

**DEPARTMENT OF DEFENSE AUTHORIZATION FOR  
APPROPRIATIONS FOR FISCAL YEAR 2022 AND  
THE FUTURE YEARS DEFENSE PROGRAM**

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**HEARINGS**

BEFORE THE

**COMMITTEE ON ARMED SERVICES  
UNITED STATES SENATE**

ONE HUNDRED SEVENTEENTH CONGRESS

FIRST SESSION

ON

**S. 2792**

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2022 FOR MILITARY  
ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CON-  
STRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF  
ENERGY, TO PRESCRIBE MILITARY PERSONNEL STRENGTHS FOR  
SUCH FISCAL YEAR, AND FOR OTHER PURPOSES.

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**PART 7**

**STRATEGIC FORCES**

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MAY 12, 19; JUNE 9, 2021



DEPARTMENT OF DEFENSE AUTHORIZATION REQUEST FOR FISCAL YEAR 2022 AND THE FUTURE YEARS DEFENSE PROGRAM—Part 7  
STRATEGIC FORCES

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# **DEPARTMENT OF DEFENSE AUTHORIZATION REQUEST FOR FISCAL YEAR 2022 AND THE FUTURE YEARS DEFENSE PROGRAM**

**WEDNESDAY, MAY 12, 2021**

UNITED STATES SENATE,  
SUBCOMMITTEE ON STRATEGIC FORCES,  
COMMITTEE ON ARMED SERVICES,  
*Washington, DC.*

## **NUCLEAR FORCES POSTURE**

The Committee met, pursuant to notice, at 4:33 p.m. in room SR-232A, Russell Senate Office Building, Senator Angus King (Chairman of the Subcommittee) presiding.

Committee Members present: King, Warren, Manchin, Rosen, Kelly, Fischer, Cotton, Rounds, Sullivan, Cramer, and Tuberville.

### **OPENING STATEMENT OF SENATOR ANGUS KING**

Senator KING. This is a hearing of the Department of Defense budget posture for nuclear forces in review of the Defense Authorization Request for Fiscal Year 2022 and Future Years Defense Program. First I want to thank our witnesses for appearing at today's hearing.

The Department of Defense's efforts to maintain a safe, reliable, and effective nuclear deterrent are at the basis of all of our defense strategies. Let me also thank Ranking Member Fischer for her work with me on the Strategic Forces Subcommittee. Two weeks ago, Senator Fischer and I visited Minot Air Force Base and the U.S. Strategic Command. Together we saw the two land legs of our strategic triad, the Minuteman III and the B-52 heavy bomber. We both went down in the silo, on the Minuteman III silos, and I have to say, as an Easterner I have never seen a place so flat in my life. Your dog could run away in Minot, North Dakota, and it would take 3 days before you would lose sight of it.

Both of these arms of our triad are increasingly showing signs of age—we saw that ourselves—for a nuclear deterrent mission that constitute what former Secretary Ash Carter refers to as “the bedrock of every mission of the Department of Defense.” At Strategic Command we received an in-depth brief on the planning and use of nuclear weapons and the development of those weapons by our near peers.

As the Department continues the task of modernizing the triad, I hope at today's hearing we can help the Subcommittee to understand the key risks, given that this effort will span multiple admin-

istrations and serve well into the 2070s. I note that we often focus on cost, which is clearly important, but perhaps the bigger policy issues to consider are whether the triad we are modernizing today will continue to effectively deter our adversaries, as their capabilities, characteristics, and intentions evolve in the future. These non-monetary risks pose existential threats to our Nation and should serve as our North Star, to ensure we continue the bipartisan approach we have maintained on this singularly important topic.

Let me conclude by thanking General Ray for his 36 years of service to our Nation. I understand you will relinquish command of the Air Force Global Strike Command and retire this summer. I wish you the best in your future endeavors.

After Senator Fischer's opening statement, each witnesses will have 5 minutes, and then we will alternate among our Members for question rounds of 5 minutes each.

Senator Fischer?

#### **OPENING STATEMENT OF SENATOR DEB FISCHER**

Senator FISCHER. Thank you, Chairman King, and welcome to all of our witnesses today. I appreciate you being here with us.

This is a budget request hearing, and so I want to associate myself with the concern expressed by many in Congress that we are in the second week of May, more than halfway through the fiscal year, and we still do not have a budget proposal from the administration. This limits our ability to conduct oversight, and increases the likelihood of a continuing resolution. None of us would like to see that happen. That is especially concerning because many of the programs that we will be discussing here today are replacing capabilities that will begin aging out over the next decade and are expected to be delivered just in time.

As we have been hearing for many years, there is no margin for further delay. I hope the Department is thinking ahead and preparing to request anomalies for these programs so that the fragile modernization schedule is not disrupted by a CR.

Thank you, Mr. Chairman.

Senator KING. Hopefully we can have the budget as soon as possible so that these hearings can do their job.

We have with us Ms. Leonor Tomero, Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy; Mr. Andrew Walter, Deputy Assistant Secretary of Defense for Nuclear Matters; General Timothy Ray, Commander, Air Force Global Strike Command; and Vice Admiral Johnny Wolfe, Director, Navy Strategic Systems Programs.

Ms. Tomero, you are going to lead off. Thank you.

#### **STATEMENT OF MS. LEONOR TOMERO, DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DEFENSE POLICY**

Ms. TOMERO. Thank you, Chairman. Chairman King, Ranking Member Fischer, and distinguished Members of the Committee, thank you for the opportunity to testify today. May I request permission to submit my written statement for the record and provide brief opening remarks.

Senator KING. Without objection.

Ms. TOMERO. Thank you. Let me begin with the threat. The United States faces a complex global security environment where strategic competitors are expanding and modernizing their nuclear capabilities to achieve strategic advantage. China, Russia, Iran, and North Korea have all demonstrated the capability and intent to advance their interests. China is rapidly becoming more capable and assertive, and its nuclear modernization is concerning. China's comprehensive modernization of its conventional and nuclear capabilities are adding new dual-capable systems that threaten the United States and its allies and partners.

Moreover, we are confronted with multifaceted deterrence challenges across domains, which add increased escalation risks, all making deterrence more challenging.

The Department is beginning a set of strategic reviews that will include U.S. nuclear posture and policy. This process will be informed by security and fiscal environment. It will align and be closely integrated with the U.S. National Defense Strategy. The Department began the NDS review on May 3rd, and plans to deliver it to Congress by January of 2022.

As reflected in a recent speech 10 days ago at INDOPACOM, and in a recent Washington Post op-ed, Secretary Austin's priority has been to focus on integrated deterrence to address threats and opportunities to strengthen deterrence across conventional, cyber, space, hybrid, and nuclear domains. We are contributing to that work.

With regard to deterrence policy, as Secretary Austin also stated, nuclear deterrence is the Department's highest priority mission. Our nuclear forces remain essential to ensure that no adversary believes it can ever employ nuclear weapons for any reason, under any circumstances, against the United States or our allies and partners without risking devastating consequences.

We plan to begin a specific review of our nuclear posture and policy soon and will process with its analysis this summer and fall. In the coming months, in line with the Interim National Security Strategic Guidance and the goal of reducing the existential threats posed by nuclear weapons, we will also explore what steps can be taken to reduce the role of nuclear weapons in our National Security Strategy, while continuing to ensure our strategic deterrent remains safe, secure, and effective, and that our extended deterrence commitments to our allies remain strong. Our upcoming strategic reviews will play a critical role in this effort.

We must sustain and modernize the nuclear triad to maintain credible deterrence in the face of 21st Century threats. The President's fiscal year 2022 discretion request supports the ongoing nuclear modernization programs while ensuring that these efforts are sustainable. Our reviews will assess the U.S. nuclear modernization programs to ensure that they deliver on time and are aligned with policy.

Importantly, the reviews will include a renewed focus on strategic stability, including risk reduction and arms control. President Biden has already demonstrated his commitment to re-establishing U.S. credibility and leadership on arms control by extending the New START Treaty for 5 years, which provides stability, predict-

ability, and transparency and maintains its verification measures. We must look to build on this foundation.

We are harnessing our greatest strategic advantage, our network of allies and partners, both globally and regionally. We will engage and consult with our allies to ensure robust extended deterrence and credible assurances. Extended deterrence remains a critical element of our regional and strategic stability.

Mr. Chairman, let me conclude by thanking the Subcommittee for its previous support for nuclear deterrence and the opportunity to testify, and I look forward to your questions. Thank you.

[The prepared statement of Ms. Leonor Tomero follows:]

#### PREPARED STATEMENT BY LEONOR TOMERO

##### INTRODUCTION

Chairman King, Ranking Member Fischer, and distinguished Members of the Committee, thank you for the opportunity to testify on the Department's nuclear weapons policy, strategy, and capabilities in support of the Defense Authorization Request for Fiscal Year 2022.

As Secretary Austin has stated, nuclear deterrence is the Department's highest priority mission. Our nuclear forces provide the bedrock of our national defense, and remain essential to ensure no adversary believes it can ever employ nuclear weapons for any reason, under any circumstances against the United States or our allies and partners without risking devastating consequences. The Department will continue to maintain and field safe, secure, survivable, and effective nuclear forces to deter adversaries and to respond if deterrence fails. As Deputy Secretary of Defense Hicks has stated, "Maintaining a credible nuclear deterrent is critical to our Nation's defense."

Today, the United States faces a complex global security environment, in which the critical challenges to our prosperity and security include strategic competition with an increasingly militarily capable China and Russia, increasingly dangerous regional powers, and accelerating technological changes with potentially strategic effects. In this competitive global environment, the risk of interstate conflict may rise because of advances in technology and new frontiers for conflict with a variety of actors—all making deterrence more challenging.

China, Russia, Iran, and North Korea have all demonstrated the capability and intent to advance their interests at the expense of the United States, its allies, and their regional neighbors. China has rapidly become more capable and assertive, and its military modernization, including of nuclear forces, is increasingly concerning. Russia's comprehensive conventional and nuclear modernization programs are adding new systems that threaten the United States and its allies and partners.

We are confronted with multi-faceted deterrence challenges including cyber, space and nuclear domains, and increased escalation risks. In a security environment where assertive strategic competitors are expanding and modernizing their nuclear capabilities to achieve strategic and potentially escalatory effects, we must maintain credible strategic deterrence against adversaries and protect the American people and our allies and partners.

##### THE NUCLEAR THREAT

###### *China*

China is continuing its rapid expansion and platform diversification of its nuclear arsenal. In this decade, China intends to at least double the size of its nuclear stockpile and will soon field a nuclear triad. The 2021 Threat Assessment Report from the United States Intelligence Community notes that "China is building a larger and increasingly capable nuclear missile force that is more survivable, more diverse, and on higher alert than in the past, including nuclear missile systems designed to manage regional escalation and ensure an intercontinental second-strike capability."

China is examining how lower-yield nuclear weapons and air-launched ballistic missiles fit into its expanding nuclear arsenal—an arsenal that includes a mix of strategic-range systems capable of striking the United States as well as theater-range forces capable of threatening U.S. allies and partners as well as U.S. bases, and forces in the region. China is fielding a new generation of mobile missiles, with multiple independently targetable reentry vehicles (MIRVs) and penetration aids to overcome perceived missile defense capabilities. China has also developed a new

road-mobile strategic intercontinental ballistic missile (ICBM) and is planning to arm its ballistic missile submarine with new submarine-launched ballistic missiles (SLBMs). Like Russia, China is also committed to the development of hypersonic strike systems, including nuclear-armed missiles.

In addition to its land-and sea-based components, China has announced development of a new nuclear-capable strategic bomber designed for stealth. China has also deployed a nuclear-capable precision-guided DF-26 intermediate-range ballistic missile capable of attacking land and naval targets. Although China maintains its “No First Use” policy publicly there is some doubt as to whether it intends on abiding by it, and China’s new nuclear weapons provide it with coercive options in a crisis or conflict.

#### *Russia*

According to the 2021 Annual Threat Assessment, Russia will remain the largest and most capable nuclear rival to the United States for the foreseeable future as it expands and modernizes its nuclear weapons capabilities and increases capabilities of its strategic and non-strategic weapons.

Russia’s comprehensive nuclear modernization program not only includes replacement of legacy systems, but includes fielding new, so-called “novel” nuclear systems. To date, Russia has recapitalized more than 80 percent of its strategic nuclear forces, including an array of modernization efforts and novel weapons programs. Some of Russia’s stated drivers of its modernization for its newer systems include perceptions of United States missile defense and Western conventional superiority.

Russia has also modernized and improved the capabilities of its theater and tactical nuclear forces. It has 1,000–2,000 non-strategic nuclear weapons of more than a dozen types. Moreover, according to the Defense Intelligence Agency, the number of Russia’s non-strategic nuclear weapons is expected to grow significantly over the next decade and the number of which are not limited by any arms control agreement.

According to the 2021 Annual Threat Assessment, Russia “believes such systems offer options to deter adversaries, control the escalation of potential hostilities, and counter United States and allied force near its border.” Although Russia may claim these weapons are defensive in nature to address conventional imbalances with the United States and its allies, this nuclear arsenal provides Russia with a multitude of options to coerce or threaten the NATO alliance and our Asian allies and partners. These options include the employment of limited nuclear first use in a regional context where Russia maintains the right to use such weapons in response to an existential threat.

#### *North Korea*

North Korea continues its unlawful production of nuclear weapons and ballistic missile capabilities in direct violation of United Nations Security Council resolutions. North Korea’s nuclear capabilities constitute a significant and evolving threat to our allies and its tested ICBMs are designed to strike anywhere within the continental United States.

Between 2006 and 2017, North Korea conducted six progressively sophisticated nuclear explosive tests and three ICBM flight tests that demonstrate its ability to reach the United States Homeland. It continues to produce fissile material for nuclear weapons. Most recently, in January 2021, North Korea unveiled a new type of submarine-launched ballistic missile, which it declared to be “the world’s most powerful weapon.”

North Korea’s continued development and deployment of nuclear weapons threatens its neighbors and the United States.

#### *Iran*

Iran continues to destabilize regional stability, pursue advanced military capabilities and technologies, and threaten United States allies and partners. Iran has developed and fielded a substantial arsenal of ballistic and cruise missiles that can strike targets throughout the region up to 2,000 kilometers. According to the Defense Intelligence Agency, Iran continues to deploy an increasing number of more accurate and lethal theater ballistic missiles, as well as pursue technical capabilities that could enable it to produce an ICBM if it chooses to do so.

The Joint Comprehensive Plan of Action (JCPOA) effectively blocked Iran’s potential pathways to a nuclear weapon and enabled robust international monitoring of all aspects of Iran’s nuclear fuel cycle. Under the arrangement, Iran committed to dismantle much of its nuclear program, including significantly curtailing uranium enrichment activities and cutting its stockpile of low-enriched uranium by 98 percent, and opened its nuclear program to the most comprehensive and intrusive verification regime ever negotiated.

Iran is not currently undertaking the key nuclear weapons-development activities needed to produce a nuclear device, according to the Intelligence Community. However, since the United States exited the JCPOA in May 2018, Iran has taken steps to expand its nuclear activities in excess of the JCPOA's limits and now is much closer to the fissile material required for a nuclear weapon than it was prior to taking these steps. Iran is also advancing its research and development on other capabilities of concern, such as the production of uranium metal, and is now doing so without the full benefit of the intrusive verification and monitoring measures that were in place when Iran was complying with its commitments under the deal. The Department supports the Administration's strategy of pursuing principled diplomacy to again constrain Iran's nuclear capabilities. The President has been clear about returning to compliance with the JCPOA if Iran resumes full and strict compliance with its commitments under the deal.

In addition, Iran's development of more capable ballistic missiles makes it critical that the United States closely monitor developments in Iran to ensure our ability to deter its destabilizing and aggressive behavior.

#### DETERRENCE POLICY

As the 2021 Interim National Security Strategic Guidance states, "we will address the existential threat posed by nuclear weapons" and the United States "will take steps to reduce the role of nuclear weapons in our national security strategy, while ensuring our strategic deterrent remains safe, secure, and effective and that our extended deterrence commitments to our allies remain strong and credible."

In keeping with past practice for incoming administrations, the Department is beginning a set of strategic reviews that will include U.S. nuclear posture and policy. This process will be informed by the 21st Century security and fiscal environment. The reviews will align with the U.S. national defense strategy and will include an integrated approach to deterrence, across several domains—conventional, cyber, space, and nuclear—to strengthen U.S. national security and our extended deterrence commitments. They will consider and assess U.S. strategy, posture, and policy adjustments, and consider program execution risk—all with a goal of maintaining a safe, secure, and effective strategic deterrent, ensuring strategic stability, and reducing risks of mistake and miscalculation in crisis and conflict.

#### *Reducing the Role of Nuclear Weapons*

As the Interim National Security Strategic Guidance notes, the proliferation of nuclear weapons poses profound and existential dangers which cannot be effectively addressed with the United States on the sidelines. In the coming months, we will begin to explore those steps that can be taken to reduce the role of nuclear weapons in our national security strategy, while continuing to ensure our strategic deterrent remains safe, secure and effective and our extended deterrence commitments to our allies remain strong. Our upcoming strategic reviews will play a critical role in laying the groundwork for this effort by allowing us to examine areas where we can make progress toward this goal.

#### *Ensuring a Safe, Secure, and Effective Strategic Deterrent through Nuclear Modernization*

As Secretary Austin testified, we must sustain and modernize the nuclear triad to maintain credible deterrence in the face of 21st Century threats. This Committee is well aware of the age of our nuclear systems and DOD's challenge in sustaining them as we simultaneously proceed with modernizing U.S. nuclear forces after decades of deferred recapitalization. As Secretary Austin has stated, "U.S. nuclear weapons have been extended far beyond their original service lives, and the tipping point, where we must simultaneously overhaul these forces, is now here." Although the Administration is reviewing the U.S. nuclear posture, the President's fiscal year 2022 discretionary request supports ongoing nuclear modernization programs while ensuring that these efforts are sustainable. Secretary Austin has further noted that the Department will ensure that "our modernization program is being executed in the most cost effective and judicious manner."

Effective deterrence requires a robust and credible nuclear command, control and communication (NC3) system that ensures the President has the ability to direct U.S. nuclear forces at all times, even under the most challenging circumstances. As the Department replaces an aging NC3 and considers future architectures, NC3 will continue to be a top priority.

The United States is making significant investments in modernization of nuclear delivery platforms. The Department has embarked on several on-going concurrent programs, many of which plan to deliver by 2030, to replace aging systems including: the *Columbia*-class ballistic missile nuclear submarines (SSBNs); modernization



of the associated D5 missile and new reentry vehicles; the replacement and modernization of land-based ICBMs (Ground Based Strategic Deterrent; GBSD); a nuclear long-range stand-off (LRSO) cruise missile; a modern bomber (B-21); and nuclear capable fighters (F-35).

The U.S. stockpile strategy must continue to evolve to enable the United States to field a modern deterrent fit for 21st Century challenges. The Department of Energy's National Nuclear Security Administration (NNSA) life-extension, modifications, and nuclear weapons programs are designed to address DOD military requirements. Today's dynamic security environment requires a mix of weapon attributes, and weapons modernization and sustainment programs—all of which must be backed up by world-class personnel and a resilient infrastructure. The United States has adopted a stockpile strategy that will ensure our nuclear weapons remain safe, secure, and effective against current and future threats. The imperative behind this strategy is to meet current and future military requirements with higher confidence and without explosive nuclear testing.

Our review of U.S. nuclear strategy and posture will assess the U.S. nuclear modernization programs to ensure that they deliver on time and are aligned with policy and requirements.

#### *Renewed Focus on Strategic Stability, Risk Reduction, and Arms Control*

The 2021 Interim Strategic National Security Guidance stated that “we will endeavor to head off costly arms races and re-establish our credibility as a leader in arms control.” President Biden has already demonstrated his commitment to re-establishing U.S. credibility and leadership on arms control by extending the New Strategic Arms Reduction Treaty (New START) for five years. The New START Treaty extension provides stability and predictability in addition to retaining limits on Russian systems that pose an existential military threat to the United States.

It ensures legally binding constraints on a substantial portion of Russia's nuclear warheads, with an upper limit of 1,550 nuclear warheads on deployed ICBMs, on deployed SLBMs, and counted for deployed heavy bombers equipped for nuclear armaments (each such heavy bomber is counted as one warhead toward this limit). The Treaty also limits both deployed and non-deployed heavy bombers and launchers of ICBMs and SLBMs, and it keeps in place an important verification system, to ensure that Russia remains in compliance with its treaty obligations.

As we pass the 11th anniversary of the signing of the New START Treaty in April 2010, we must look to build on its foundation. The scope of Chinese and Russian nuclear modernization and expansion makes the task of seeking progress on further arms control, nuclear security, and risk reduction measures all the more necessary. In addition, the increasing potential for conduct in the cyber, space, and information domains to have strategic effects (with consequent escalatory risk) underscores the importance of meaningful dialogue with Russia and China on the range of emerging military technological developments that could threaten strategic and regional stability. Presidents Biden and Putin have already agreed to hold strategic stability discussions. Similarly, we will work to engage China with the goal of having it accept its responsibility as a nuclear-armed, technologically advanced power, which includes increased transparency and progress on nuclear risk reduction. The Department will support efforts to negotiate agreements and arrangements that make the United States and its allies and partners more safe and secure.

#### COMMITMENT TO ALLIES AND PARTNERS

As strategic competitors continue to invest in efforts to challenge the United States, we are harnessing our greatest strategic advantage—our network of allies and partners—both globally and regionally to deter aggression from China and Russia, and to contend with persistent threats from North Korea and Iran.

The extended deterrence assurances we provide to our allies and partners are a critical element of regional and strategic stability. No country should doubt the strength of our extended deterrence commitments or the strength of the U.S. and allied and partner capabilities to deter, and, if necessary, respond should deterrence fail.

#### NATO

In his January 26, 2021 call with NATO Secretary General Jens Stoltenberg, President Biden emphasized the importance of shared values, consultation, and capabilities to strengthen deterrence. With regard to nuclear deterrence specifically, NATO Allies reiterated in the London Declaration in December 2019, that “as long as nuclear weapons exist, NATO will remain a nuclear Alliance” and that “we are fully committed to the preservation and strengthening of effective arms control, disarmament, and non-proliferation, taking into account the prevailing security envi-

ronment.” The fundamental purpose of NATO’s nuclear capabilities is to preserve peace, prevent coercion, and deter aggression. The United States continues to make available its strategic nuclear forces for the defense of NATO, and they remain the supreme guarantee of the security of NATO Allies. The independent strategic nuclear forces of the UK and France have a deterrent role of their own and contribute significantly to the overall security of the Alliance. The forward deployment of U.S. nuclear weapons in NATO countries and the capabilities and infrastructure provided by Allies concerned also support NATO’s nuclear deterrence and defense posture, and provide a political and military link between Europe and North America.

#### *United Kingdom*

Our support to the UK and its Continuous-At-Sea-Deterrent contributes to NATO’s defense and has underwritten our collective peace and security from nuclear threats since the signing of the bilateral Mutual Defense Agreement in 1958. We maintain regular dialogue through Biannual Staff Talks and other technical engagements. The UK uses United States Trident missiles, equipped with UK warheads, onboard its *Vanguard*-class SSBNs; and the new United States *Columbia*-class and UK *Dreadnought*-class SSBNs will share a common ballistic missile compartment. The UK will also utilize United States technology through the W93 program to support its parallel replacement warhead program. The UK’s nuclear forces are a key contribution to NATO’s nuclear deterrent posture.

#### *France*

The independent strategic nuclear forces of France also contribute significantly to the overall security of the NATO Alliance. The United States maintains a formal dialogue with France through Annual Staff Talks to facilitate understanding of each other’s threat perceptions and on other issues related to nuclear security.

#### *The Republic of Korea, Japan, and Australia*

In Asia, our formal relationships with important allies such as the Republic of Korea and Japan are critical to regional security and stability and provide a critical deterrent to North Korean and Chinese threats. We have long-standing extended deterrence dialogues with the Republic of Korea (ROK) through the Deterrence Strategy Committee (DSC) of the Korea-United States Integrated Defense Dialogue and with Japan through the Extended Deterrence Dialogue (EDD). Through regular bilateral meetings, site-visits, and table-top exercises, both the EDD and DSC have helped us to develop a common Alliance understanding of deterrence principles, and to test application of those principles to scenarios we may face in the Indo-Pacific region. We also have meaningful consultation with Australia through the Strategic Policy Dialogue (SPD). The evolving nature of the SPD continues to be a venue that deepens our understanding of allied concerns on strategic and nuclear threats in the region. Moreover, we continue to use all of these venues to regularly assure our allies of the continued importance of U.S. extended deterrence commitments as a crucial part of our collective national security.

#### CONCLUSION

Mr. Chairman, let me conclude by stating that as the Department plans to begin its strategic reviews, enhancing deterrence and addressing strategic threats remain the highest priority. As long as nuclear threats exist and in an increasingly complex and threatening security environment, the United States must have a modern nuclear deterrent that is safe, secure, and credible to keep America and its allies and partners safe. We will continue to address the existential threat posed by nuclear weapons, strengthen strategic stability, pursue efforts to reduce nuclear risks and engage with our allies.

Thank you and I look forward to your questions.

Senator KING. Thank you. Mr. Walter.

#### **STATEMENT OF MR. ANDREW WALTER, DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR MATTERS**

Mr. WALTER. Chairman King, Ranking Member Fischer, Members of the Subcommittee, thank you for the opportunity to join my colleagues to testify before you today regarding matters related to the U.S. nuclear enterprise.

With the understanding that the administration is embarking on the review of nuclear policies and posture that Secretary Austin

discussed during his confirmation hearing, and my colleague just mentioned, I will provide a few framing comments on the strategic environment and current program of record from my perspective in my responsibilities for certain programmatic and technical matters in the Department.

While the U.S. nuclear deterrent is and will remain safe, secure, effective, and credible, the strategic threat environment in which it must do so has worsened considerably over the past decade. China, in particular, is pursuing and fielding major quantitative and qualitative improvements to its nuclear capabilities that significantly change the strategic threat they pose to the United States and our allies and partners.

For its part, Russia is completing its longstanding plan to modernize its legacy nuclear forces, and is aggressively pursuing new, advanced nuclear capabilities. Both China and Russia are also actively pursuing advancements in ballistic missile defense and air defense systems.

At the same time, the systems and infrastructure that comprise the United States' nuclear deterrent were largely built during the Cold War and are increasingly difficult to sustain. As Secretary Austin has said, "Although effective today, U.S. nuclear deterrence systems remain dependent on aging systems that have been extended far beyond their original service lives, and the tipping point where we must simultaneously overhaul these forces is now here."

These combined developments are resulting in long-lasting challenges that require the United States to focus and maintain long-term attention and resources on ensuring we have a modern and credible nuclear deterrent. To be clear, this focus must be on the entire U.S. nuclear deterrent. This includes not just the nuclear weapons and their delivery systems but also the nuclear command, control, and communications system, the supporting infrastructure across both the Department of Energy and the Department of Defense, and the people in both Departments who are the true backbone of the Nation's deterrent.

As we do this, we must be mindful that our current timelines for nuclear modernization programs are 10 to 20 years from concept to capability, and the capabilities produced will be in the field for 3, 4, even 5 decades. While both Departments continue to seek opportunities to shorten delivery time frames and find efficiencies, we know that programmatic decisions made today have repercussions that last for decades. This is why the nuclear enterprise always seeks to anticipate future threat environments and, more importantly, to create flexibility and resiliency across the nuclear deterrent.

The four largest acquisition efforts in the Department of Defense's current nuclear modernization program—the *Columbia*-class submarine, the B-21 bomber, the ground-based strategic deterrent, and the long-range standoff cruise missile—were all started 5 to 10 years ago. We are beginning to see these programs come to fruition, and all are currently on track.

But the successful execution of these programs, and complementary programs in the National Nuclear Security Administration, requires enduring commitment over long timelines. As President Biden's 2010 nuclear posture review stated, "An effective strategy

must be sustained over time with support from a long succession of U.S. administrations and Congresses.” This sustained national commitment will ensure that no adversary ever believes it can carry out a strategic attack on the United States or our allies for any reason, under any circumstances, without risking devastating consequences.

This Committee is a central stakeholder in that commitment. I thank you for the Committee’s longstanding and continued bipartisan support, as you mentioned, Mr. Chairman, for our nuclear deterrent mission and for the men and women, both in and out of uniform, across the nuclear enterprise.

On behalf of these national security professionals, as they continue to work to ensure the U.S. nuclear deterrent continues to keep the peace for generations to come, thank you. I look forward to your questions.

[The prepared statement of Mr. Andrew T. Walter follows:]

PREPARED STATEMENT BY MR. ANDREW T. WALTER

Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for the opportunity to testify before you today regarding matters relating to the U.S. nuclear enterprise. I am pleased to join my colleagues to discuss what five successive Secretaries of Defense have called the Department of Defense’s (DOD) highest priority mission: ensuring that the United States has a safe, secure, effective, and credible nuclear deterrent—now and in the future.

As we continue to persevere through the COVID-19 pandemic and the long-term modernization of our nuclear enterprise, we want to assure you that U.S. nuclear forces remain ready and capable. Our nuclear deterrent underwrites every U.S. military operation across the world and is the foundation and backstop of our national defense. It has preserved peace and stability by deterring aggression against the United States and our allies for over 70 years and has received strong support from Congress and multiple Administrations throughout those decades. Furthermore, assuring allies and partners depends on their confidence in the credibility of our extended nuclear deterrent capabilities and commitments.

As the Deputy Assistant Secretary of Defense for Nuclear Matters (DASD(NM)), I am responsible for directing and overseeing a wide variety of activities that underpin and advance DOD’s nuclear related missions. We lead and participate in activities across the nuclear enterprise: from executing the statutory responsibilities of the Nuclear Weapons Council; to coordinating stockpile management activities between DOD and our partners at the Department of Energy’s (DOE) National Nuclear Security Administration (NNSA); to overseeing policies and actions that ensure the security and safety of our nuclear weapons, as well as prevent and respond to nuclear weapon incidents and accidents; to working closely with allies on nuclear issues. We succeed in our mission when our partners and stakeholders across the nuclear enterprise succeed in the execution of their own missions—our role in many activities is to serve as the focal point of coordination, and our goal is to ensure the enterprise as a whole is aligned in what needs to be done to support this highest priority mission.

The most vital piece of that mission is the modernization of the U.S. nuclear enterprise. Although decades-long sustainment efforts have allowed us to maintain a viable nuclear deterrent based on weapons and forces fielded many decades ago, sustainment alone cannot ensure that these capabilities continue to deter into the future—especially as threats continue to exist and evolve. Nearly all the systems that compose the current nuclear deterrent—our weapons; delivery systems; Nuclear Command, Control, and Communications (NC3) systems; and supporting infrastructure and facilities—were built during the Cold War and are facing sustainment challenges that require modernization to ensure a viable deterrent. Ultimately, we know that programmatic risks in nuclear acquisition and sustainment programs, if realized, flow back to U.S. Strategic Command and put in danger its ability to meet deterrence and assurance objectives laid out by the President and the Secretary of Defense. To prevent this, the Department is carefully examining and taking action on both risks and opportunities as we transition from our current, legacy nuclear forces to their modern replacements.

Carrying out the Nation's nuclear deterrence mission is a responsibility shared by DOD and our partners at NNSA. Similar to DOD, NNSA is addressing challenges as United States nuclear warheads and their key production infrastructure continue to age well beyond their original design lives while challenges posed by China, Russia, North Korea, and Iran continue to grow. Due to the long post-Cold War pause in nuclear weapons acquisition programs, we no longer have many of the production capabilities that built our current nuclear arsenal. Key nuclear facilities in NNSA's production enterprise date to the late-1940s or 1950s—51 percent of this infrastructure is rated as being in no better than poor condition. NNSA is developing and executing plans to address these longstanding challenges by building modern replacement facilities, but we know that if NNSA production infrastructure investment is not prioritized the Cold War-era stockpile cannot be maintained or modernized before it ages out.

Core to this critical partnership between DOD and NNSA is the Nuclear Weapons Council (NWC), a coordinating body established by Congress to facilitate the alignment of requirements and to establish priorities as the two Departments fulfill their shared responsibility for providing the Nation's nuclear deterrent. The NWC convenes monthly to maintain alignment of efforts between DOD and NNSA on the vision, strategy, and execution of nuclear programs. The NWC's current structure and processes enable regular, senior-level attention and proactive decisions on capabilities and capacities needed to maintain and modernize an effective nuclear weapons stockpile that meets the requirements of an increasingly challenging international security environment. The NWC fully supports NNSA's efforts to establish a responsive and resilient nuclear security enterprise to meet U.S. deterrence and assurance needs. A responsive enterprise also ensures that NNSA can attract and retain a world-class workforce capable of responding to the dynamic and uncertain security environment we face.

The President's Fiscal Year 2022 Budget ensures a strong, credible nuclear deterrent for the security of the Nation and our allies. While the Administration is conducting a review of nuclear policy and posture, the President's Fiscal Year 2022 Budget supports ongoing nuclear activities and programs while ensuring that these efforts are sustainable. Within the Office of the Under Secretary for Acquisition and Sustainment, we are mindful that we must ensure our legacy nuclear programs remain safe, secure, and effective up to the day they are replaced and retired. We must not lose sight of the need to sustain these aging capabilities even as we fund and prioritize delivering their modern replacements on schedule. As such, all nuclear programs remain on track. To continue to meet military requirements and better mitigate future risks, tracking sustainment and modernization programs across both DOD and NNSA—and their interdependencies—will continue to be a top priority.

As the Committee requested, although I will refer you to my colleagues from the Services for specifics, I'd like to provide a brief status update on several major modernization programs. I provide this update with the recognition that the Administration has expressed its intent to take steps to reduce the role of nuclear weapons in our national security strategy, while ensuring our strategic deterrent remains safe, secure, and effective and that our extended deterrence commitments to our allies remain strong and credible. As the Administration conducts this review of nuclear policy and posture over the coming months, I provide the following status on the Department's major nuclear modernization programs of record.

The Ground Based Strategic Deterrent (GBSD) program is intended to deliver the next generation Intercontinental Ballistic Missile (ICBM) weapon system to support the nuclear deterrent. The objective of the GBSD program is to deliver a low technical risk, total system replacement of Minuteman III to address sustainment challenges, close capability gaps, and ensure the U.S. maintains an effective land-based nuclear deterrent through 2075. The development of a modern ICBM system seeks to reduce the total cost of ownership over sustaining the legacy Minuteman III by increasing system reliability and adopting specific design features focused on increasing maintainability. In addition, the implementation of a modular open system architecture, coupled with the Air Force's plan to own the technical baseline, greatly enhances the ability of the weapon system to adapt to future threats and sustainment modifications. The Air Force has assessed that there is no margin to delay development and fielding of GBSD; its legacy counterpart, the Minuteman III is 40 years beyond its designed life expectancy and will begin experiencing attrition and age-related component degradation resulting in the number of available ICBMs falling below military requirement levels in the late 2020s. Additionally, Minuteman III is becoming increasingly difficult and expensive to sustain, and will not meet military effectiveness requirements in the 2030s as adversary threats advance. The

GBSD program is currently in the Engineering and Manufacturing Development (EMD) phase with Milestone C planned for fiscal year 2026.

The Long Range Standoff Weapon (LRSO) will replace the early-1980's AGM-86B Air Launched Cruise Missile (ALCM) with a missile capable of penetrating advanced air defenses long into the future. LRSO will maintain the viability of the B-52 in the nuclear triad and support the long-term effectiveness of the bomber leg, while imposing costs on our adversaries by greatly complicating their air defense strategies. LRSO also represents the first simultaneous integrated nuclear weapons program that the DOD and NNSA have executed since the 1980s. This means that the DOD-provided LRSO cruise missile and the NNSA-provided W80-4 refurbished warhead are being developed as an integrated system.

The B-21 will support the Nuclear Triad with a visible and flexible deterrent capability, and provide operational flexibility across a wide range of military objectives in fulfillment of national objectives. The B-21 Raider provides the ability to penetrate modern adversary air defenses and will replace aging B-1 and B-2 bombers and complement modernized B-52 bombers. The Air Force plans to procure a minimum of 100 B-21 Raider aircraft in support of its full range of nuclear and conventional missions. The first two test aircraft are currently being manufactured and the first flight for the B-21 is estimated for 2022.

The *Columbia*-class ballistic missile submarine (SSBN) is the U.S. Navy's number one acquisition priority. *Columbia* will replace the nearly 40-year-old *Ohio*-class SSBNs. SSBNs are critical, stabilizing, and efficient elements of U.S. nuclear deterrence and assurance and are the most survivable leg of the triad. Twelve *Columbia*-class SSBNs are required to meet strategic nuclear deterrence requirements. The *Columbia* is being designed to have a longer service life, better operational availability, and better survivability than their predecessors.

Not only will *Columbia* provide the United States with 21st Century capability, it will do so at a responsible cost. Full ship construction is planned to begin in fiscal year 2024 with a first strategic patrol in fiscal year 2031. The Navy has started a weapon system modernization program (D5 Life Extension 2 (D5LE2)) to support the *Columbia*-class deterrent for its full service life. *Columbia*-class SSBNs and the D5LE2 program will provide a credible and survivable at-sea deterrent while facing a future dynamic threat environment. Additionally, the Navy and NNSA have initiated the W93/Mk7 program to meet U.S. strategic deterrence modernization needs. The program is also vital for continuing the longstanding United States commitment to support the United Kingdom's Continuous at Sea Deterrent. The W93/Mk7 provides the opportunity for aligning our independent programs and collaborating, within the constraints of existing treaties and agreements, to allow both countries to responsibly address challenges within their legacy nuclear forces.

Finally, the United States requires a robust NC3 system. The modernization of our NC3 systems will address 21st Century threats and ensure the President has the ability to command control U.S. Forces at all times, even under the most extreme circumstances.

Our nuclear modernization efforts—including delivery systems, warheads, infrastructure, and NC3—will take decades to complete but are critical to our Nation's security. These efforts will help ensure that no adversary ever believes it can carry out a strategic attack on the United States or our allies for any reason, under any circumstances, without risking devastating consequences. I thank this Committee for its longstanding, bipartisan support for our nuclear deterrent mission and for the men and women—both in and out of uniform—across the nuclear enterprise. I look forward to your questions.

Senator KING. Thank you, Mr. Walter. General Ray.

**STATEMENT OF GENERAL TIMOTHY M. RAY, USAF,  
COMMANDER, AIR FORCE GLOBAL STRIKE COMMAND**

General RAY. Good afternoon Chairman King, Ranking Member Fischer, distinguished Members of the Subcommittee. Thank you for inviting me to appear before you today and represent the men and women of Air Force Global Strike Command.

After nearly 3 years as the Commander of Air Force Global Strike Command, and as the Joint Force Air Component Commander, which is the operational air commander to U.S. Strategic Command, I have had a front row seat in the opening stages of the long-term strategic competition unfolding around us. During this

time, it has become abundantly clear we must bring about significant transition in how we do our job—how we lead, how we think, how we operate, and especially how we develop our combat capabilities, both legacy and future systems.

As we transition from two decades of counterterrorism operations to the long-term strategic competition, we face potential adversaries with increasingly more capable and abundant military technologies, matched with their own determined regional and global ambitions. Air Force Global Strike Command and Air Force's Strategic Air have a central role in delivering what the Nation needs—a safe, secure, reliable, effective, affordable long-range precision strike force, both nuclear and conventional. As the only force of its kind, this force is not only for the American people but for our allies.

Part of presenting the long-range precision strike force needed is fostering the right climate and culture for the best of America's sons and daughters. Our airmen are the linchpin of the force our Nation needs most, and as we modernize we must also prioritize the development of the right leaders with the ability to lead any airman from any walk of life, to build the unity and the trust our units need to prevail in any challenge.

While our adversaries focus on the division of our American public, we must labor to instill in all of our teammates the dignity, respect, diversity inclusion that are critical to the paths of unity and trust. Without it, we miss out on the tremendous talent from every corner of our country, the innovation and the boldness we need.

American public's trust in the nuclear forces as safe, secure, reliable is a non-negotiable requirement, and must remain a bedrock of how we operate. What must change, however, is the manner in which we train, prepare, sustain, and modernize. The Air Force nuclear arsenal must evolve beyond a collection of aging programs, and must be grounded in relevant operational concepts and modern capability development techniques. This results in affordable acquisition programs and it improves sustainment practices and dynamic training underwritten by robust and survivable nuclear command and control.

Transitions are difficult, but we have a unique opportunity to partner with Congress, the combatant commanders, the Office of the Secretary of Defense to advance affordable and innovative solutions supporting the long-range precision strike mission. The effort we undertake will ensure our intercontinental ballistic missile and bomber forces are ready and adaptable for the challenges of the 21st Century.

Lastly, I want to thank you for your continued support. I cannot articulate enough how credible the on-time funding is to restoring readiness. Predictable, reliable, and flexible budgets, with the right authorities to drive the competition, are critical to our future success.

Chairman King and distinguished Subcommittee Members, I want to thank you for your dedication to our great Nation, to your very thoughtful approach to these very difficult challenges, and certainly for the opportunity to appear before the Committee. I look forward to your questions.

[The prepared statement of General Timothy M. Ray follows:]

PREPARED STATEMENT BY GENERAL TIMOTHY M. RAY

INTRODUCTION

First and foremost, I want to thank the Committee for the opportunity to appear before you and testify on behalf of the 33,700 men and women of Air Force Global Strike Command (AFGSC) that I am privileged to lead. I would also like to take the opportunity to thank the men and women of AFGSC for their successful work in leading and taking care of each other during a time of national crisis. Even in the toughest of times, this command continues to develop the world's most respected and feared long-range strike force, ready to respond anytime and anywhere to ensure the success of the Department of Defense's highest priority mission.

AFGSC plays a central role in delivering a safe, secure, reliable, effective, and affordable long-range nuclear and conventional precision strike force. This is made possible every day because of the amazing people in our command and the phenomenal relationships within the enterprise. After nearly two decades in the counter-terrorism fight, the global context continues to shift. The 2018 National Defense Strategy (NDS) and President Biden's Interim National Security Strategic Guidance acknowledge the reemergence of long-term, strategic competition as a central challenge to our Nation's prosperity and security. We are facing an increasing number of nuclear threats from near-peer competitors, as well as new challenges to our legacy weapon systems, leveraged by modern capabilities. We recognize the importance of restoring margin ahead of our competition by developing the right leaders and the right processes to prepare, sustain, and modernize our nuclear weapon systems. Our Nation's legacy bombers and Intercontinental Ballistic Missiles (ICBMs) are not aging gracefully. We are behind on modernization with no margin in the schedule. There are no allied bomber forces or ICBM forces, and the only production line for the B-21 is in its infancy. Our command is committed to delivering improved weapon systems as efficiently and affordably as possible by pursuing mature technologies, stabilizing requirements, and owning the technical baseline of our weapons systems; a formula that has proven successful in our acquisition efforts thus far.

Building on our proud heritage, we stand on the shoulders of giants. AFGSC continues this great legacy as we construct the long-range precision strike force our Nation needs. In order to create the lethal, competitive force we need in the future, our nuclear enterprise must be driven by innovative leadership underpinned by a dedication to quality of life for our airmen and families. We owe it to America's sons and daughters to train and equip them with the absolute best we can provide. Furthermore, we must ensure these Airmen are part of a larger effort, linking them to their organizations and to their local communities. As we seek to achieve excellence in all our endeavors, we invite Congressional input to advance affordable, cost-effective, and innovative solutions, which ensure our strategic deterrent capabilities meet the challenges of the 21st Century.

*Our People—Developing Strong Leaders & Communities through Transition*

*Over the past year and through the most challenging of times, AFGSC has made significant progress in leading transition and improving the quality of life for our airmen. Through the COVID-19 pandemic our team has risen to the challenge and adapted our battle rhythm, implementing the necessary measures to ensure the safety and wellbeing of our airmen and families during times of uncertainty.*

COVID-19 MANAGEMENT

AFGSC's nuclear mission is the cornerstone of our Nation's defense and the defense of our allies around the world. As the command responsible for two legs of the nuclear triad, we are ready to execute the mission under all circumstances and at any time. Every challenge presents an opportunity and the men and women of AFGSC continually rise to the occasion, displaying exemplary leadership, resilience, and problem-solving prowess in the most challenging situations. Our long-range strike bombers and ICBMs continue to operate and achieve what is needed, when it is needed. With the emergence of COVID-19, we employed the necessary precautions to include the isolation of crews and other mission essential personnel. Missile wings took proactive measures early on to preserve combat capability and guarantee combatant command requirements could be met for the duration of the pandemic. We also took preventative measures to preserve the capacity of our bomber forces and to minimize the potential impact to mission readiness. In fact, our com-



bat mission readiness rates among our bomber aircrews is at its highest in the history of the command.

Recognizing the need for a “whole of community” approach to COVID-19, AFGSC leadership closely monitors the effect of COVID-19 on the AFGSC community, to include clinics, schools, and child care centers. We also work with medical professionals to monitor the health of our airmen, to assess the impacts on the healthcare network’s capacity, and to ensure implementation of preventative measures while continuing efforts to vaccinate our forces. Along with protecting our medical teams and contingency planning, our priorities are focused on sustained 5 to 7-day ICBM alerts, maintaining E-4B National Airborne Operations Center (NAOC) capabilities, coverage of our operational commitments, bomber modernization, and Nuclear Command, Control, and Communication (NC3) sustainment. Looking ahead, we will leverage lessons learned to ensure we employ the best practices for a post-COVID command.

#### STRATEGIC NARRATIVE & CONTEXT

Our 2018 NDS and President Biden’s Interim National Security Strategic Guidance acknowledge the complex global security environment and the reemergence of long-term strategic competition with China and Russia as a central challenge to United States prosperity and security. We must now consider multi-polarity with potentially dangerous adversaries like North Korea, Iran, and extremist organizations. As we think broadly about our current global situation and transition to the future, there are new considerations we must continue to explore, to include how we better equip our airmen and develop our leaders to prepare for the future fight. This strategic shift in our defensive posture requires us to focus on three critical areas within our mission:

- Improving *quality of life* for our airmen and families through a culture of community, authentic leadership, innovation, and cross-functional collaboration will ensure our competitive advantage, will maintain adaptability through transition, and will ensure retention of our most important assets—our people. Retention of this talent is an imperative.
- *Sustainment* of our long-range precision strike capabilities and building margin in the force is critical to our role in the NDS. Congressional support will also ensure our budget is driven by strategy and facilitates our ability to execute the critical long-range strike mission.
- Overcoming adversarial challenges in a competitive environment will require sustained *modernization* and improvement, leveraged by enterprise relationships and empirically-driven data that ensures readiness for the future fight.

Future challenges dictate we be bold in our considerations and rethink how we build leaders in an all-volunteer force – retention and development of our talent is our competitive advantage. AFGSC leadership will continue its commitment to retaining talent and improving the quality of life for our airmen and families.

#### QUALITY OF LIFE

*The importance of this can’t be stressed enough. The men and women of AFGSC have proven time and time again that they are up for any challenge and dedicated to the nuclear mission, but to keep them successful we must invest in their futures and that of their families every single day. We owe it to America’s Sons and Daughters to support them to the level they support our Country.*

#### FACILITIES

We continue improving the quality of life for our airmen and our families at each of our wings. With strong advocacy from base leadership, the Air Force secured additional funding for *CY20 Operating and Capital Replacement and Repair* to address the most significant structural issues in our base housing communities. In addition, AFGSC’s role in the Air Force-led Child Care Capacity Initiative continues to show great results; a critical component in the everyday lives of many of our airmen. AFGSC has also improved quality of life for our ICBM force through improved internet connection at our missile alert facilities (MAFs). This past year, our team increased Wi-Fi capability by 1000 percent for our nearly 630 ICBM personnel to ensure optimal communication while serving in remote alert locations.

#### HEALTH & WELLNESS

Women comprise 23 percent of AFGSC. Therefore, we stood up lactation rooms for nursing mothers at each of our units and continue to create the spaces necessary to meet this crucial need for many of our families. In March 2020, we purchased resources to outfit each of our launch control facilities (LCCs) with dedicated lactation areas. Additionally, over the past year we collaborated with the Air Force Sur-

geon General and the Defense Health Agency (DHA) to improve policy on Nuclear Enterprise Medical, Behavioral, and Mental Health practices. In fiscal year 2021, Minot and Whiteman AFBs will add an additional 110 health care professionals to increase accessibility to care, a critical component to suicide prevention, for our airmen and families.

AFGSC remains focused on our commitment to help airmen and their family members thrive professionally and personally in order to ensure optimal readiness and steadfast mission execution. We are encouraged by the progress we have made in improving certain quality of life aspects for our people, but we acknowledge this is an ongoing effort and we still have more to do.

*SUSTAINMENT—Building Margin in Our Capabilities for the Future Fight*

*With improved prioritization within the Air Force Budget, conditions have greatly improved for building margin in our current forces. As the Air Component to United States Strategic Command (USSTRATCOM), we maintain a holistic view of readiness as an ecosystem, encompassing operations, maintenance, equipment, training, weapons, test, and security.*

EIGHTH AIR FORCE

Eighth Air Force (8 AF), located at Barksdale Air Force Base, Louisiana, is responsible for the B-1B, B-2A, B-52H bombers and the E-4B National Airborne Operations Center (NAOC). Our bombers provide decision makers the ability to demonstrate resolve to our adversaries through generation, dispersal, deployment, and if directed, employment. While heavy bombers equipped for nuclear armaments are constrained by the limits set out in the New START treaty, the overall size of the bomber force is driven by the significant contribution to conventional campaigns, now more of a concern in this era of strategic competition.

Based on NDS objectives as ordered by the Secretary of Defense, we have transitioned to the Dynamic Force Employment (DFE) model to help balance readiness and long-range strike capability. Our forces continue to operate globally in alignment with the NDS as Bomber Task Forces (BTFs), executing DFE missions in order to remain operationally unpredictable and strategically predictable. The Air Force has conducted continuous combat operations with 46 percent fewer aircraft than we had in 1991 while supporting continuous rotations in the United States Central Command (USCENTCOM) and United States Indo-Pacific Command (USINDOPACOM). In addition, 8AF bombers have also provided episodic support to United States Africa Command (USAFRICOM), United States European Command (USEUCOM), and United States Southern Command (USSOUTHCOM) areas of responsibility (AORs). During this period, the demand for bombers increased resulting in a growing toll on airmen and readiness of the aircraft and equipment. Currently, AFGSC provides bomber forces to the combatant commanders through the Global Force Management process and BTF operations orders (OPORDs). These opportunities enhance our support to our allies and display our resolve to potential adversaries. We will continue to leverage BTF missions from CONUS in order to meet NDS requirements while building readiness and flexibility for our personnel.

The core of AFGSC assurance and deterrence is our unwavering commitment to USSTRATCOM and our nuclear mission. While the effects of an extremely high operational tempo have reverberated throughout the bomber fleet, AFGSC continues to balance global force posturing with our nuclear mission, ensuring readiness and the health of our fleet.

*B-1B LANCER*

The B-1 remains a critical component of long-range strike as we transition to the B-21. Based at Dyess AFB, Texas and Ellsworth AFB, South Dakota, the B-1 is the most versatile, conventional-only, multi-mission weapon system and carries the largest payload of guided and unguided weapons of all three bombers. Multiple wartime deployments, high operations tempo, and harsh environmental exposure have proven the aircraft's combat effectiveness, but have taken a toll on aircraft availability. The B-1 has flown beyond its certified designed service life without full-scale fatigue testing to extend it. We must preserve the remaining structural life to maximize aircraft availability as we transition to the 2-bomber fleet (B-52 and B-21) of the future.

The B-1 was built as a low-level penetrator and was engineered for flight profiles different than the close air support profiles flown in support of USCENTCOM. The stand-off weapons currently employed by the B-1 today include the Joint Air-to-Surface Standoff Missile (JASSM), the Joint Air-to-Surface Standoff Missile-Extended Range (JASSM-ER) and is the only Air Force delivery platform of the Long-Range Anti-Ship Missile (LRASM). This long-range precision strike capability plays a crit-

ical role for the B-1 in assuring our allies and deterring potential adversaries now and into the future.

Seventeen years of steady deployments characterized by repeated max-weight takeoffs, heavy-weight landings, and heavy-weight areal operations in the close air support role has stressed the B-1 beyond its designed structural limits. Consequently, this resulted in the need for increased structural inspections and repairs and an unwavering commitment by the B-1 community to successfully restoring fleet health and operational capability over the past year. Innovative maintenance practices such as Condition Based Maintenance Plus (CBM+) sustainment processes will help the Air Force achieve the service life goal for the B-1. This predictive approach to identifying aircraft subsystem degradation has minimized scheduled down time for the B-1 fleet. By concurrently making deferred repairs and by changing near end-of-life components, unscheduled breaks can be avoided, resulting in improved aircraft availability. Furthermore, in fiscal year 2020, AFGSC stood up a dedicated depot-level structural inspection and repair line at the Oklahoma City Air Logistics Complex to assure the highest standard of aviation safety.

Another way we have preserved structural integrity of the B-1 is through the termination of low altitude-high speed (LAHS) flight profiles. Over time, LAHS maneuvers have over-stressed the Forward Intermediate Fuselage (FIF) causing significant fatigue damage and shortening the remaining structural life of the aircraft. Terminating LAHS flight operations reduces this stress, delays the need for certain structural repairs, aids in the preservation of service life, and extends B-1 operations as a bridge to B-21 employment. In shaping this decision, we conferred with all Joint Force Air Component Commanders (JFACCs) and determined LAHS operations were no longer a priority for the B-1. However, we maintain the ability to return to this flight profile if and when it is needed.

B-1 upgrades and improvements are planned to ensure relevance, lethality, and survivability, making it a viable platform until retirement. Avionics and weapons upgrades are critical. The Integrated Battle Station includes the repair infrastructure of the upgraded Central Integrated Test System, Fully Integrated Data Link, Vertical Situation Display, and flight simulator upgrades. These capabilities provide aircrew with a more flexible, integrated cockpit and achieved full operational capability in September of fiscal year 2020. In addition, mandatory upgrades to Radio Cryptographic Equipment, Identification Friend or Foe, and Link-16 will ensure the B-1 remains assimilated with the Joint force.

In 2019, the 412th Test Wing at Edwards AFB, California, along with AFGSC and industry partners, held an expanded carriage demonstration to showcase the feasibility of increasing B-1 weapons capacity and integrating future advanced weapons. External Carriage and Long Bay options were successfully tested in CY20 and proved the modifications would increase the bomber's magazine capacity for munitions and add larger, heavier munitions, such as hypersonic weapons. Increased weapon carriage allows for fewer overall sorties, reduces air refueling requirements and flying hour costs, while increasing aircraft availability for follow-on missions. Additionally, these expanded carriage options will gap on our maintenance and aircrew shortfall by requiring fewer combat sorties to get the same effect. Current estimates to enable initial expanded carriage on the B-1 is 160 million dollars.

Sustainment and limited B-1 modernization remains on the critical path as we transition to the B-21. We are carefully balancing structural repairs and fleet health with needed combat capability while we continue the retirement of 17 structurally challenged B-1s in fiscal year 2021. Retiring 17 B-1s in fiscal year 2021 frees an estimated 1.2 billion dollars in operations, maintenance, sustainment, and modernization costs, allowing the Air Force to concentrate resources on the remaining force, set the right conditions for B-21 transition, and invest in other NDS required capabilities. These efforts build margin by striking a balance between sustainable B-1 improvements while working toward a more manageable fleet.

Lastly, reducing 17 B-1s in fiscal year 2021 will not result in the closure of any squadrons nor cut any maintenance manpower. We intend to sustain readiness through limited aircrew reassignments, improve the maintainer-to-aircraft ratio in the near-term, and posture sufficient maintenance personnel for initial B-21 retraining in the long-term. This divestiture plan will shape the B-1 fleet so it remains healthy and effective, provides margin across the bomber transition, and incurs cost savings to reach the future B-21 force faster.

#### *B-2 SPIRIT*

For 30 years, the B-2 has served as the Nation's only stealth bomber capable of penetrating air defenses anywhere in the world. Based at Whiteman AFB, Missouri, the B-2 holds targets at risk with a variety of nuclear and conventional weapons that no other platform can execute while providing 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 strikes 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 must ensure the B-2's ability to penetrate enemy defenses until the fielding of the B-21 bomber. Moreover, the B-2 is being upgraded to carry the JASSM-ER and the B61-12 nuclear gravity weapon. These upgrades are critical to ensuring the bomber leg of the nuclear triad remains a viable and relevant warfighting capability.

Small fleet dynamics continue to challenge our sustainment efforts primarily due to vanishing vendors and the diminishing supply chain. There is an ongoing effort 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 critical drivers for B-21 requirements.

#### *B-52 STRATOFORTRESS*

The B-52 may be the most universally recognized symbol of American airpower. Based at Minot AFB, North Dakota and Barksdale AFB, Louisiana, the B-52 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. Therefore, it is paramount we continue to invest resources into this aircraft. The modernization and sustainment of the B-52 should not be based on how long it has been in service, but rather, based on its capacity to remain in service. AFGSC is looking at B-52 modernization holistically in order to optimize, prioritize, and deliver affordable, on-time modernization.

Modernization programs will be prioritized and integrated in an effort to make deliberate decisions on timing for concurrent programs. Integration of the existing programs with smart and efficient development and test schedules is critical to deliver affordable, lethal combat capability. Current modernization programs include the B-52 Radar Modernization Program has entered execution in the pre-Milestone B phase. The Air Force is also funding an effort to integrate and deploy replacement B-52 engines. A successful commercial engine replacement will realize significant savings in fuel and extend the aircraft's range while improving reliability and sustainment. Additionally, B-52 training simulators require integration of various programs such as Combat Network Communications Technology (CONNECT), Internal Weapons Bay Upgrade (IWBU), data link capabilities, air refueling, and information technology refresh. Supporting the revitalization of these critical training tools will create high fidelity training environments in-line with Air Force priorities such as Pilot Training Next, and directly increase the readiness of B-52 crews in support of nuclear and conventional missions.

Another initiative is the 1760 IWBU, which increases B-52 smart weapons capacity by 67 percent and adds JASSM and JASSM-ER capability. There are also 75 B-52s that have been converted to the new CONNECT configuration completed in fiscal year 2019. CONNECT 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. CONNECT is also integrated with the Advanced Targeting Pod to provide Digitally Aided Close Air Support; a robust enhancement available to combatant commanders today. Communications remain the cornerstone of our long-range strike capability as the ability to re-task or retarget bombers while in route to the battlespace is a powerful force multiplier. The addition of Link-16 and Joint Range Extension Applications Protocol-ALPHA (JREAP-A) has enhanced the B-52's operational picture allowing it to integrate with the Joint force from beyond line-of-site ranges in real-time.

Multiple B-52 test activities are expected to begin in fiscal year 2023. The B-52 enterprise, in coordination with the 412 Test Wing, conducted an in-depth capacity analysis to determine the most efficient method to test B-52 modifications while tailoring aircraft available to Combatant Commanders. Modifying aircraft in a common production flow manner (multiple modifications during a single modification window) will allow the most cost efficient and timely option to get these critical capabilities tested and field.

#### *E-4B National Airborne Operations Center (NAOC)*

The E-4 is a key component of the National Military Command System for the President, the Secretary of Defense and the Joint Chiefs of Staff. Based at Offutt

AFB, Nebraska, the E-4 provides a highly survivable command, control and communications center to direct U.S. forces, execute emergency war orders, and coordinate actions by civil authorities. The E-4 operates throughout all phases of the threat spectrum and retains the ability to respond to national emergencies despite the destruction of ground communication centers. In addition, the E-4 provides overseas travel support for the Secretary of Defense and his staff to ensure Title 10 command and control connectivity.

The E-4 fleet undergoes continuous modifications and modernization at home station. The small fleet dynamics make it challenging to maintain combat readiness while supporting operational test and evaluation (OT&E) requirements. The operational units accomplish OT&E with no additional manpower that necessitates a delicate balance between operational missions, quality of life considerations, and modernization and sustainment efforts. The DOD must recapitalize this critical capability with a more robust and sustainable platform.

#### TWENTIETH AIR FORCE (20 AF)

Twentieth Air Force (20AF), headquartered at F.E. Warren AFB, Wyoming, is responsible for the Minuteman III (MMIII) ICBM, the UH-1N and MH-139 helicopters, the Kirtland Underground Munitions Maintenance and Storage Complex at Kirtland AFB, New Mexico, and the ICBM Flight Test Squadron at Vandenberg AFB, California. The 450 dispersed and hardened Launch Facilities (LFs), are controlled, maintained, defended, and supported by AFGSC airmen each and every day, providing the bulk of our day-to-day nuclear alert force. The ICBM forces presented to USSTRATCOM preserve strategic stability by providing the Nation a credible and responsive nuclear option in a contested environment. The responsiveness of these weapons present adversaries a near insurmountable obstacle should they consider a disarming attack on the United States. AFGSC's ICBM forces remain compliant with all U.S. obligations under the New START treaty.

#### *MINUTEMAN III INTERCONTINENTAL BALLISTIC MISSILE (ICBM)*

AFGSC is committed to the sustainment of MMIII ICBM, its NC3 systems, and its support equipment until replaced by the Ground Based Strategic Deterrent (GBSD). To sustain the existing fleet of large missile maintenance vehicles, the Transporter Erector Program (TERP) and the Payload Transporter Replacement (PTR) remain a priority. This support equipment is critical to the eventual MMIII deposture and the transition to GBSD. In the meantime, MMIII Launch Control Centers (LCCs) will be equipped with modernized communications systems to improve reliability and replace technologically obsolete systems. The LCC block upgrade, expected to deploy in 2021, is a modification effort that replaces multiple LCC components to include modern data storage, a weapon system console printer, and oxygen regeneration units. A significant security upgrade to the remote visual assessment capability at our LFs will also increase situational awareness and security. This program began deploying in fiscal year 2020.

Minuteman III weapon system effectiveness is a function of key performance parameters: accuracy, availability, reliability and survivability. A comprehensive, scientifically rigorous test and evaluation program, driven by DOD requirements, continually assesses the system against each performance parameter's threshold and drives sustainment efforts to maintain compliance. Nevertheless, indefinite sustainment is impractical, unaffordable, and ineffective due to age-related deterioration, the evolution of the industrial base, and the expanding technical capabilities of our adversaries.

To further improve the nuclear capability of our ICBM force, the ICBM Programmed Depot Maintenance program began in fiscal year 2016, but only offers 80 percent coverage due to parts availability. The program places operational LFs and LCCs on an 8-year depot-level maintenance cycle that increases ICBM effectiveness by ensuring sustainment is executed in an engineering-based, systematic manner. Successful prototyping of the program was accomplished in fiscal year 2016 and from fiscal year 2016 to fiscal year 2018, 100 LFs and 15 LCCs went through the first maintenance cycle with an additional 57 LFs and 6 LCCs in fiscal year 2020. This program is key to ensuring MMIII viability through the GBSD transition.

#### *UH-1N HELICOPTER*

The Air Force's UH-1N helicopter supports several critical missions: security of our ICBM fields, transport missions in the National Capitol Region, Fifth Air Forces (Japan), and critical Continuity of Operations missions. Additionally, the UH-1N fleet supports Air Force survival training with helicopter and hoist familiarity, vectoring training, and rescue operations. They also participate in the Defense Support

of Civil Authorities program with units across the country and are frequently called upon to conduct search and rescue activities for missing or injured civilians.

AFGSC developed a comprehensive sustainment plan for the UH-1N while transitioning to the MH-139. The UH-1N will continue to operate in AFGSC through the mid-fiscal year 2020s and within the USAF until the mid-fiscal year 2030s. AFGSC is responsible for the life-cycle of all UH-1Ns in the USAF and some modernization will be necessary for the aircraft to remain effective. Currently, all future modifications will be completed in early fiscal year 2020s and will only apply to a limited number of UH-1Ns selected for longer life spans. This modernization strategy will ensure mission effectiveness until platform retirement while remaining fiscally responsible.

The planned acquisition of 80 total MH-139 helicopters to replace the aging UH-1N fleet will be a significant shift in acquisitions and missile field security capabilities. With an estimated cost avoidance of \$1.7 billion, the selection of a modified civilian helicopter using the current generation of technology will bring a significant increase in payload, speed, and endurance, ensuring compliance with all DOD and USSTRATCOM security requirements.

#### NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS (NC3)

As the NC3 lead for the Air Force, AFGSC supports CDRUSSTRATCOM's priorities of sustaining current NC3 systems and replacing legacy systems with next generation NC3 technology to ensure NC3 capabilities to the President and our Nation's warfighters.

Sustaining current NC3 systems includes developing maintenance performance indicators to track the reliability of communications systems and to predict maintenance actions and spare parts needs. Unfortunately, many components suffer from diminishing manufacturing sources and material shortages across the NC3 enterprise; such as the decades-old Miniature Receive Terminal (MRT) on the B-52. The B-52 MRT receives Emergency Action Messages (EAMs) over Very Low Frequency (VLF). Given the importance of the MRT, and considering its high rate of failure, AFGSC sought out a commercial vendor capable of manufacturing unique band-pass filters required to sustain MRT receivers. Now, there are enough band-pass filters in supply to sustain the aging system until replaced.

Continuing its sixth decade as the backbone of the Nation's bomber fleet, the B-52 was funded in fiscal year 2020 for installation of a VLF receiver that leverages the technology recently installed on the B-2 fleet and provides NC3 receive-only capability. To further modernize VLF capability across multiple platforms, we are moving forward with development of a Common VLF Receiver (CVR) capable of using emerging waveforms for improved EAM reception. We envision employing this receiver on both airborne and ground-based weapons systems. The Space Force develops, and the Air Force integrates, the Family of Advanced Beyond line-of-sight Terminals (FAB-T) and the Force Element Terminal (FET), which will enable the B-52 access to the Advanced Extremely High Frequency (AEHF) satellite network. AEHF will also be integrated into the ICBM's LCCs, further enhancing NC3 redundancy in the force. At this time, we are assessing options to leverage other programs' investments in AEHF technology to enable rapid fielding across bombers and supporting tanker aircraft.

Communications upgrades to the E-4 National Airborne Operations Center (NAOC) will ensure a reliable, airborne NC3 platform for senior leaders. The Low Frequency Transmit System (LFTS) replaces the existing dual trailing wire antenna and reduces aircraft weight by almost a ton. The Survivable Super High Frequency (SHF) system provides reliable and sustainable voice and data capability in scintillated and jammed operational environments. Tactical UHF radios will be upgraded to Mobile User Objective System (MUOS) capability to meet CJCS requirements. Finally, the FAB-T Command Post Terminal (CPT) is being installed on the E-4B fleet and will enable Presidential National Voice Conferencing (PNVC) that replaces legacy MILSTAR capability and provides connectivity to the AEHF satellite network.

As the E-4 is modernized, the Nation must look ahead to replacing the aging aircraft within the National Military Command System. The joint-service NAOC, Executive Airlift (EA), Airborne Command Post (ABNCP), and Take Charge and Move Out TACAMO (NEAT) Analysis of Alternatives (AoA) is completed and the results received a Sufficiency Review from the Office of Secretary of Defense Cost Assessment and Program Evaluation (OSD CAPE) in November 2020. The AoA evaluated whether mission realignments could improve the operational value of the airborne layer and examined potential synergies in acquiring a common platform. The AoA results, endorsed by the Joint Requirements Oversight Council (JROC), determined

a common platform for the twelve missions performed by the three aircraft was not feasible, mission realignment was not recommended, and the Air Force should begin the E-4 replacement program known as the Survivable Airborne Operations Center (SAOC). The SAOC program is postured to pave the way forward to achieve a FOC in early-mid 2030's. Additionally, after researching potential changes to Doctrine, Organization, Training, materiel, Leadership and Education, Personnel, Facilities and Policy (DOTmLPF-P), we will transition to experimenting and prototyping in order to drive technological solutions to enable a more effective NC3 system. This effort is dedicated to integrating future NC3 into Joint All-Domain Command and Control (JADC2) utilizing technologies embedded in the Advanced Battle Management System (ABMS).

Planning efforts to develop the next generation of NC3 systems, 30 years from now, have started. In order to better manage the transition from legacy systems to the NC3 weapon system of the future, AFGSC directed a significant change in the way we steer our NC3 modernization efforts. A brand new NC3 Concept of Force Development will explore and demonstrate how and where the modernization capabilities will enable the Joint All-Domain Command and Control (JADC2) battlespace of the future. Air Force NC3 experts are analyzing the threats and risks inherent in our current NC3 systems and recommending mitigating actions to achieve assured nuclear communications for the future.

#### SECURITY

Security is one of the most fundamental competencies the Nation demands of the military. Ensuring security is more than just placing Defenders at our gates. It is about the safety of our nuclear arsenal to include preparing for hostile unmanned aerial systems, cyber-attacks, and other potential threats across multiple domains. Warfighting domains continue to expand, challenging the Nation's collective understanding and application of warfare, national defense, and theories of victory. Emerging and existing cross-domain threats hold AFGSC nuclear and conventional power projection platforms and our bases at risk. AFGSC continues to cultivate innovative teams to determine the best ways to secure our installations and assets.

##### *"FIGHT THE BASE" CONCEPT*

Over the past year, applying the Fight the Base concept has allowed us to realize AFGSC's vision of ensuring the uninterrupted production of long-range strike from its installations when sanctuary is not guaranteed. Moreover, AFGSC has made significant strides in the counter-unmanned aircraft systems (C-UAS) security initiative. This includes improved detection capabilities near critical resources and the fielding of necessary capabilities such as fixed-site, mobile vehicle-borne, handheld, and portable C-UAS systems. These capabilities provide a necessary added layer of security to ensure continued weapons systems safety and operability. The command also initiated a friendly forces blue-unmanned aircraft systems (B-UAS) pilot program. Originally intended for use in testing against our defenses, these B-UAS will also be used to enhance battlespace awareness and assist in meeting emerging threats. C-UAS is a rapidly developing technology and will require an ongoing evolution to utilize this capability and defend against the threat.

##### *2020 SECURITY FORCES ENTERPRISE PLAN*

In line with AF initiatives to reconstitute the health of our security forces, AFGSC remains focused on establishing requirements, updating policy, and advocating and programing for necessary resources in order to restore full spectrum readiness and retain our tactical advantage. Over the past year, AFGSC worked to reinvigorate our Security Forces culture, specifically taking deliberate steps to improve recruitment, equipment, continuum of learning, career development, and policy. Our efforts successfully implemented 15 officer and 500 enlisted funded Security Forces positions annually. These efforts also enabled the assessment and approval of female body armor, the accelerated fielding of the M18 and M4A1 weapon systems, and the creation of a new Defender training curriculum. Lastly, the implementation of the new Security Force Development Tours at nuclear units have increased overall manning to 100 percent and have contributed to the decrease in the number of disciplinary issues within certain units.

These are a few examples of how AFGSC is taking Security Forces training and operations in a more relevant, realistic direction. These efforts continue to ensure the robust integration of existing and developing technologies to provide cost effective and robust battle space awareness to AFGSC defense forces.

### MODERNIZATION—Maintaining the Competitive Edge

*The rapid rate of technology advancement requires us to maintain the competitive edge through smart acquisitions, strong industry relationships, and owning the technical baseline. Led by cross-functional teams, modular and adaptable systems with established digital engineering has proven foundational in our efforts to modernizing our forces and ensuring the critical capabilities required to meet future challenges of the Great Power Competition.*

#### THE BOMBER ROADMAP

The 2018 National Defense Strategy and the updated Defense Planning Guide predicated the need to update the 2017 bomber vector. AFGSC updated the plan to reflect current conditions, ensure continued support to operational plans (OPLANs), and facilitate the transition from the current 3-bomber fleet to a 2-bomber fleet of 175 B-52Hs and B-21s.

In the analysis of how we best transition to the two-bomber fleet of 175—aside from a successful B-21 program—we determined there are two interrelated critical elements; effective and on-time B-52 modifications and sustainment of a sufficient number of B-1 and B-2 bombers until an adequate number of B-21s are available.

#### B-21 RAIDER

The Nation needs at least 100 B-21 Raiders to support the nuclear triad, deter aggression, fight and win in a contested environment, and replace our aging B-1 and B-2 bombers, and in my best military judgement many more B-21s could be used to mitigate risks. The B-21 will form the backbone of the bomber force in both conventional and nuclear roles for the decades to come, providing an unmatched ability to penetrate future air defenses and support joint military operations using long-range strike capabilities, large and mixed payloads, and survivability. The B-21 Raider will also outpace future threats and provide combatant commanders with operational flexibility. Its open systems architecture will enable rapid, innovative and affordable technology insertion as threats evolve.

The Air Force is preparing to base the B-21 at three existing bomber bases. In March 2019, following a deliberate process that sought to minimize mission impact, maximize facility reuse, minimize cost, and reduce overhead, the Air Force announced Ellsworth AFB, South Dakota, Whiteman AFB, Missouri, and Dyess AFB, Texas as preferred locations for B-21 Main Operating Bases. The selection of the preferred basing locations leveraged the strengths of each base to optimize the B-21 beddown strategy while simultaneously meeting warfighter demands for bomber airpower. The final basing decision for the first location is expected in 2021, following compliance with the National Environmental Policy Act (NEPA) and other regulatory and planning processes.

Enacted fiscal year 2021 funding of \$2.8 billion maintains our ability to deliver initial capabilities in the mid-2020s and assures the Air Force commitment to an Average Per Unit Cost (for 100 aircraft) of \$550M. The program is a national security imperative and ensures the Air Force can provide both the conventional and nuclear capabilities the National Defense Strategy demands.

#### Long Range Stand-Off Missile (LRSO)

The LRSO is the replacement for the aging Air Launched Cruise Missile (ALCM). The ALCM is currently 29 years past its design service life and has significant capability gaps that will only worsen through the next decade. The LRSO will be a reliable, flexible, long-range, and survivable weapon system that complements the nuclear Triad. LRSO will also ensure the bomber force (B-52 and B-21) can continue to hold high value targets at risk in an evolving threat environment.

LRSO was designed with a focus on reliability and manufacturing as foundational tenets of the acquisition strategy. This strategy sets the LRSO apart from previous cruise missile programs that focused on achieving reliability after Initial Operational Capability (IOC). The structure of the LRSO program drove industry competition through preliminary design review (PDR) and acted as a forcing function which encouraged industry behavior to yield desired results.

LRSO has completed the Technology Maturation and Risk Reduction (TMRR) phase and is on track for Milestone B. This Milestone will begin LRSO's engineering and manufacturing development phase. To date the contractor's use of digital engineering has resulted in a pioneering first use of factory produced missiles for testing purposes. Consequently, the program is on schedule, and properly staffed. Flight test events have begun and the first powered flight is scheduled for Aug 2021 to support warhead Baseline Design Review. Following a successful engineering manufacturing and development phase, production should begin in 2026.



Enacted fiscal year 2021 funding ensures future LRSO development and enables the schedule to meet a planned IOC of 2030 while ensuring the Air Force commitment to an Average Procurement Unit Cost (APUC) of \$4.9 million per LRSO (1020 total missiles).

#### GROUND BASED STRATEGIC DETERRENT (GBSD)

To ensure continued lethality and affordability of the most responsive leg of the triad, GBSD successfully awarded a \$13 billion engineering and manufacturing development (EMD) contract last September. The EMD contract is a nine year effort with five years of development and four production options. Program analysis has revealed GBSD is the most effective strategy to mitigate capability shortfalls, enhance future warfighting effectiveness, replace aging infrastructure, and is designed to stand alert for multiple decades. A focus on developing a competitive edge is evident in the leveraging of Model Based System Engineering (MBSE) where there is an estimated potential to save several billion dollars of acquisition and lifecycle costs that are difficult to accurately model due to the uniqueness of our approach. This is possible due to MBSE's decreased design cycle timelines ensuring and fully realizing design modifications subsequent impacts without the need for traditional prototypes or extensive paperwork reviews.

Furthermore, the key acquisition tenet of modular design reduces the need for specialized or comprehensive system overhauls throughout the 50-year operational lifecycle. The value proposition of this program is unprecedented – the Air Force will save money on maintenance, operations, and personnel. Physical access and modularity of the designs makes GBSD simpler and provides more affordable sustainment than any of its predecessors. The security requirements will change dramatically; there will be fewer convoys on the roads, fewer open launcher configurations, and fewer defenders needed to guard the site during maintenance. Additionally, there is collaboration with the Department of Energy's National Nuclear Security Administration (NNSA) and the W78 warhead replacement program, the W87-1. As of this calendar year, that program is in development. The replacement warhead will use the MK21 aeroshell and will deploy on GBSD after fiscal year 2030.

Continued Congressional support will mitigate risk for the transition from MMIII to GBSD. Maintaining GBSD schedule momentum and reducing schedule risk is critical to avoiding capability shortfalls to warfighter requirements during transition.

#### MH-139 GREY WOLF

AFGSC is the lead command for the Air Force's newest helicopter fleet, the MH-139. The MH-139's revolutionary predictive maintenance database, logistics, and parts distribution are taking the Air Force into a new era using civilian processes and technology to enhance military weapon systems. The MH-139A is a multi-mission helicopter tasked with nuclear security at our ICBM bases, transportation of our Nation's leaders within the National Capitol Region and Fifth Air Force (Japan), and rescue and training support at the USAF Survival School.

In order to continue supporting critical national missions and fully comply with DOD and USSTRATCOM requirements, the Air Force is committed to replacing the UH-1N fleet, as the legacy platform falls short of missile field operational needs; notably speed, range, endurance, payload, and survivability. The acquisition of 80 MH-139 helicopters to replace the aging UH-1N fleet is a significant shift in both acquisitions and missile field security capabilities, and is needed to help modernize our force.

The timely fielding of this platform will enable the Air Force to meet nuclear security requirements and fully support missions in the national capital region.

#### WEAPONS GENERATION FACILITIES (WGF)

Our Weapon Storage Areas (WSA) are no longer considered just storage facilities. Renamed Weapons Generation Facilities (WGFs), these dedicated areas support rapid generation of nuclear aircraft and routine maintenance operations for the ground-based and air legs of the nuclear triad while significantly improving security. WGFs facilitate the growth of new technology and bombers, while also sustaining our current fleet. Deliberate recapitalization of weapons storage capacity via the WGF construction program is critical to ensuring the safety, security, and effectiveness of strategic capabilities in the future.

In 2019, AFGSC organized a cross-functional team to re-examine the design plans and identify more affordable options. The team identified options that allowed for the recapitalization of existing facilities where possible and were able to identify and challenge outdated or irrelevant processes and operating instructions. As a re-

sult, we were able to bring down the cost of new facilities from 599 million to 228 million dollars while improving the necessary security requirements. We were able to accomplish this only because our external partners went through the process with us and had buy-in. The result is a fiscally responsible but modern and secure facility for the country's nuclear weapons.

Two ICBM wings are planned to receive modernized WGFs. Bomber WGFs are needed to accommodate mission growth and improve current capacity, and with the right number, will provide national leadership more strategic decision space. WGFs at B-21 bases will enable nuclear capability in the future, while the WGF at Barksdale ensures B-52s remain viable and competitive. Of note, because WGFs only ever contain non-deployed nuclear warheads, and not heavy bombers or ICBMs, they do not meet the "facilities" definitions under the New START treaty (NST), and are not subject to declaration or inspection under the treaty. Therefore, the standup of WGFs at ICBM and bomber bases will not impact NST implementation.

In May of 2019, F.E. Warren Air Force Base in Wyoming broke ground on the first WGF. In August 2019, AFGSC briefed the Acting Secretary of the Air Force and received approval on the way ahead for bomber WGFs, subject to budgetary decisions within the Air Force, Department of Defense, and the Office of Management and Budget.

B-21 WGF construction will be timed to coincide with projected B-21 acquisition and fielding timelines, but location and funding decisions are not yet final. Locations that do not have existing facilities capable of recapitalization, the design characteristics have been scaled back for more affordable construction. A more detailed update will be available after a final decision is made on the plan for bomber WGFs.

#### CONCLUSION

AFGSC remains committed to affordable modernization and sustainment of our Nation's nuclear triad and conventional weapon systems, and the development of our airmen to lead in the long-term strategic competition ahead of us. As the world's most lethal, respected, and feared long-range strike professionals, we are dedicated to improving near-term readiness. Predictable, reliable, and flexible budgets, leveraged with the right authorities, have proven successful in sustaining and modernizing our long-range strike force while ensuring proper mission focus within the NDS.

We have reoriented, reinvented, and reimagined our organization in order to build expanded capacity down to our operational wings as we innovate in the space that remains. Inspired by our Striker heritage, and driven by the speed of relevance, authentic leadership and cross-functional collaboration remains at the heart of our efforts as we build the nuclear force our Nation needs. In light of the COVID-19 pandemic, we are thankful for the support we have received from our senior military, community, and civic leaders in prioritizing the health and wellbeing of the great airmen of AFGSC.

Our defense Committees understand the significance of maintaining our competitive edge as we face the threats that great power competition presents to our national interests. We are grateful for the opportunity to partner with Congress, our combatant commanders, and the Office of the Secretary of Defense to move forward with affordable, cost-effective, and innovative solutions to ensure our ICBM, bomber, and NC2 capabilities are ready for 21st Century challenges. We are thankful for the continued support and advocacy from Congress and I look forward to updating the Committee on our progress.

Senator KING. Thank you, General. When I got home from the trip my wife said, "What most impressed you? Was it the missiles or the bombers?" I said, "No. It was the people." The young men and women that we met in Minot were exceptional people, and when I say young, I mean, early 20s, with enormous responsibility. But I hope you will take that back. Senator Fischer, I am sure you agree. That was the highlight of the trip, I think, for me, so please convey that.

I know we have airmen. How about all those females. Are they still airmen? What is the—

General RAY. Yes, sir. They are airmen.

Senator KING. All right. I just wanted to be sure.

General RAY. Female airmen, and just as tough as the rest of them.

Senator KING. I got that impression. Thank you.

Admiral Wolfe, please. Thank you.

**STATEMENT OF VICE ADMIRAL JOHNNY R. WOLFE, JR., USN,  
DIRECTOR, NAVY STRATEGIC SYSTEMS PROGRAMS**

Vice Admiral WOLFE. Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for the opportunity to testify on the Department of the Navy's budget priorities for nuclear forces. I would like to thank this Subcommittee for its continued support of the Navy's nuclear deterrent mission, and I respectfully request my written statement be submitted for the record.

Senator KING. Without objection.

Vice Admiral WOLFE. As you heard from Admiral Richard last month, nuclear deterrence underwrites every U.S. military operation and capability on the globe, and serves as the backdrop for both our national defense and the defense of our allies. That Nation's nuclear triad of intercontinental ballistic missiles, strategic bombers, and ballistic missile submarines serves as the bedrock of our ability to deter major power conflict, assure our allies and partners achieve U.S. objectives should deterrence fail, and hedge against an uncertain future.

The Navy has provided unwavering and singular mission-focused support to the sea-based leg of the triad for over six decades. We must maintain today's deterrent while modernizing for the future. This falls into four concurrent lines of effort for the Navy.

First, we must maintain the current D5LE missile inventory and provide the necessarily operational support to sustain *Ohio*-class submarines through their service lives. This is being accomplished through an update to all of our sub systems. All of our life-extension efforts remain on track, and our current program will support the deployment of all existing warheads. We must also recapitalize or strategic weapons facilities to continue to support and sustain SSBN operations that enable our continuous at-sea presence.

Second, we must continue to work with our partners at PEO *Columbia* to assure that the transition between *Ohio*-class and *Columbia*-class submarines stays on schedule. For SSP, this requires a seamless transition of the current D5LE weapons system and missile inventory onto the new *Columbia*-class. During this time of transition, we will ensure that the Navy's portion of the nuclear triad remains credible by introducing the W93/Mark 7 to rebalance the stockpile of W76 and W88s and meet STRATCOM requirements.

Third, it is imperative that we start the work on a future missile and corresponding weapons system now. This next generation of the current D5LE missile, a missile in service since 1989 and boasting a remarkable history of 182 successful flight tests, is called D5LE2. D5LE2 will yield multiple benefits in missile performance to include extending its service life. D5LE2 is required to completely outload the *Columbia*-class SSBNs and ensure that Trident remains credible in the face of a dynamic threat environment. A D5LE2 missile must be developed, tested, and produced with the

lead time sufficient to deploy on *Columbia*-class hull number 9 no later than fiscal year 2039. It will then be backfitted for the first eight hulls of the class.

Lastly, one of the greatest advantages the United States has is its alliances and partnerships. As the U.S. Project Officer for the Polaris Sales Agreement, I will continue to support the UK's sovereign deterrent for today's *Vanguard*-class submarines and their successor, the *Dreadnought*-class.

For decades, United States policy has recognized that the independent British nuclear deterrent adds to global security. Under the 1958 Mutual Defense Agreement and the 1982 Polaris Sales Agreement, the United States has provided assistance and material, consistent with international law, to the UK deterrent program. Without this assistance, the cost and schedule risks to maintain the UK's independent deterrent would rise significantly, thus creating additional challenges for the UK in sustaining its nuclear contribution to NATO alongside the United States.

None of these four lines of effort are possible without an investment in our people, our infrastructure, and our industrial base. Military, civilian, government, and contractor, the men and women of SSP are working hard to deliver a safe, secure, and effective strategic weapons system today that will serve us well into the latter half of this century. They remain my number one priority in order to ensure continued program success.

Nuclear modernization will take time to complete, so work towards these ends must start now, and it cannot be delayed. It is only through your continued support that the Department's top modernization priorities can be achieved.

As the 14th director, it is my highest honor to represent the men and women of SSP, comprising approximately 1,700 sailors, 1,000 marines, 300 coast guardsman, over 1,300 civilians, and over 2,000 contractor personnel. It is my most critical goal to ensure that they are poised to execute the mission with the same level of success, passion, and rigor, both today and tomorrow, as they have since our program inception in 1955.

Thank you for the opportunity to testify today on behalf of the men and women who make deterrence of major power conflict their life's work. I look forward to your questions.

[The prepared statement of Vice Admiral Johnny Wolfe follows:]

#### PREPARED STATEMENT BY VICE ADMIRAL JOHNNY WOLFE

##### INTRODUCTION

Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for this opportunity to discuss the sustainment and recapitalization of the sea-based leg of the nuclear triad. It is an honor to testify before you today representing the Navy's Strategic Systems Programs (SSP) and the contributions the Navy provides to our national and global security.

The Nation's nuclear triad of intercontinental ballistic missiles, heavy bombers, and ballistic missile submarines (SSBNs) equipped with submarine-launched ballistic missiles (SLBM) is essential to the very foundation of our Nation's security and survival. The nuclear triad is the bedrock of our ability to deter aggression, to assure our allies and partners, to achieve U.S. objectives should deterrence fail, and to hedge against an uncertain future. While we are actively working to modernize our forces, U.S. modernization efforts lag behind those of our adversaries. As our Sea-Services leadership noted in December 2020's *Advantage at Sea*, "China's and Russia's aggressive naval growth and modernization are eroding United States mili-

tary advantages. Unchecked, these trends will leave the Naval Service unprepared to ensure our advantage at sea and protect national interests within the next decade.”

President Biden’s Interim National Security Guidance reminds us that “[w]e must contend with the reality that the distribution of power across the world is changing, creating new threats. In today’s threat environment, strategic deterrence is foundational to our national defense. Every Operational Plan across the Department begins with the assumption that strategic deterrence will hold. A safe, secure and effective nuclear force remains the most credible combination of capabilities to deter strategic attack and execute our national strategy. We must stay the course with nuclear and conventional force recapitalization commitments to ensure the Joint Force can operate when, where, and as required to defend our national interests. China, in particular, has rapidly become more assertive. It is the only competitor potentially capable of combining its economic diplomatic, military and technological power to mount a sustained challenge to a stable and open international system. Russia remains determined to enhance its global influence and play a disruptive role on the world stage. Both Beijing and Moscow have invested heavily in efforts meant to check United States strengths and prevent us from defending our interests and allies prioritize China as our number one pacing challenge and develop the right operational concepts, capabilities, and plans to bolster deterrence and maintain our competitive advantage.” Indeed, Great Power Competition has returned—and with it the need to recapitalize each essential and complementary component of the nuclear triad. This new framework demands we be ready for any threat, in any domain, at any time. Potential adversaries are exploiting seams below the level of armed conflict in an attempt to gain strategic advantage. We must account for the possibility of a conflict leading to conditions which could very rapidly drive an adversary to consider nuclear use as their least bad option. Given these conditions, I encourage you to draw one conclusion:

Our Nation’s nuclear modernization initiatives must be fully funded.

The Navy provides the most survivable leg of the nuclear triad with the interdependent *Ohio*-class SSBNs and the Trident II D5 Strategic Weapon System (SWS), which comprises both flight and shipboard systems. SSBNs are responsible for more than 70 percent of the Nation’s operationally deployed nuclear warheads that are subject to the New START Treaty. As the Chief of Naval Operations stated in his 2021 NAVPLAN, “[o]ur ballistic missile submarines provide an assured response to any strategic nuclear attack on the United States. *Ohio*-class boats are nearing the end of four decades of service and must be replaced, making *Columbia*-class program our top acquisition priority.” Furthermore, “[p]rojecting power and influence from the seas is vital to deterring aggression and resolving crises on acceptable terms. Our power projection capabilities alongside our strategic deterrent provide the surest guarantee of security for America and our allies”—this starts with deterring a nuclear attack against our Nation with our ballistic missile submarines.

Concurrent with the delivery of the *Columbia*-class is the need to develop the next generation of Trident II D5 SWS that will ensure the credibility of the sea-based strategic deterrent for the life of the *Columbia*-class. SSP’s core mission comprises two fundamental lines of effort: the safety and security of our Nation’s strategic assets entrusted to the Navy; and the design, development, production, and sustainment of the Navy’s SWS. We strive to maintain a culture of excellence, underpinned by rigorous self-assessment, to achieve the highest standards of unrelentingly on our tremendous responsibility for the custody and accountability of our Nation’s nuclear assets. The men and women of SSP, our sailors, our marines, our Navy masters at arms, our coast guardsmen, and our industry partners remain dedicated to supporting the strategic deterrence mission, to responding to the emerging needs of our warfighter, and to protecting and safeguarding our Nation’s assets with which we are entrusted. We certainly could not do this without the support from this Committee.

The men and women of SSP and their predecessors have provided unwavering and mission-focused support to develop, sustain, and secure the sea-based leg of the triad for over 65 years. However, SSP’s critical modernization bow wave is no longer part of the future—it is today. We are heading down a path from which we cannot turn away. Our workforce must evolve from years of sustainment efforts to the dual responsibilities of sustainment and development. Our industrial base has eroded under years of sustainment with minimal focus on future technologies. Investment in critical workforce skills, the industrial base, and complex technologies unique to strategic systems is essential to the Navy’s ability to sustain not only today’s sea-based strategic deterrent but to respond to emerging warfighter needs with cost-effective, creative, and timely solutions through the life of the *Columbia*-class SSBN.

As the fourteenth Director, it is my highest honor to serve as the program manager, technical authority, safety and security lead, regulatory lead, and Polaris Sales Agreement Project Officer for the Navy's nuclear weapons program. Most importantly, I am honored to represent the men and women of SSP, comprising approximately 1,500 sailors, 1,000 marines, 300 coast guardsmen, 1,400 civilians, and thousands of contractor personnel. It is my most critical goal to ensure they are poised to execute the mission with the same level of success, passion, and rigor both today and tomorrow as they have since our program's inception in 1955.

#### SWS SUSTAINMENT ON *OHIO*-CLASS SSBN AND PROCUREMENT FOR *COLUMBIA*-CLASS SSBN

Today's fragile relationship between sustainment of legacy systems and their replacements remains omnipresent in the calculus of effectively deterring adversaries. As previously stated, the Navy's highest priority acquisition program is the *Columbia*-class submarine, which replaces 2020s, and the *Columbia*-class must be ready to begin patrols no later than October 2030. Recapitalizing our SSBNs is a significant investment that only happens every other generation, making it critically important that we do it right and on time. Delays to the Navy's SSBN modernization plan are not an option. The continued assurance of our sea-based strategic deterrent requires not only a next class of ballistic missile submarines, but equally critical, a credible SWS—to include not just the weapon system itself, but the infrastructure and the people as well. The Navy is taking the necessary steps to ensure that the next generation deterrent is designed, built, delivered, and tested on time and provides flexibility and adaptability in the dynamic threat environment that ADM Richard mentioned before this Committee at an affordable cost.

To lower development costs and leverage the proven reliability of the Trident II D5 SWS, the *Columbia*-class SSBN will enter service with the same functionality and performance of the currently deployed Trident II (D5) SWS including the life extended Trident II D5 missile, which resides on today's *Ohio*-class submarines. Maintaining a common SWS during the transition between existing and successor submarine platforms allows the Navy to leverage a mature material and knowledge enterprise, thus reducing programmatic costs and risks. Life-extended missiles will be shared with both the *Ohio* and *Columbia*-class submarines in the United States and with the UK *Vanguard*-class and *Dreadnought*-class submarines into the 2040s.

Another major initiative to reduce risk associated with the overhaul of the sea-based strategic deterrent is the SSP Shipboard Modernization Program, which manages obsolescence and modernizes SWS shipboard systems through the use of open architecture design and commercial off-the-shelf hardware and software wherever feasible. The Shipboard Modernization Program refreshes shipboard electronics hardware and upgrades software, which will extend service life, enable more efficient and affordable future maintenance of the SWS, all while ensuring we continue to provide the highest level of nuclear weapons safety, security, and performance for the deployed SSBNs in order to meet U.S. Strategic Command (USSTRATCOM) requirements. The in-progress incremental upgrades to the SWS shipboard systems resident on the *Ohio*-class are also linchpins to the timely delivery of the *Columbia*-class SSBNs. Modernization of the model-based engineering design practices in order to effectively respond to today's ever changing environment. The Navy's strategy of addressing obsolescence while simultaneously providing warfighter capability highlights the unique complexity of sustainment and modernization of our Nation's nuclear deterrent.

#### TRIDENT II D5 LIFE EXTENSION AND LIFE EXTENSION 2

The Trident II D5 SWS capability 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 demand for service life from today's high-performing systems has resulted in a missile life extension effort to match the *Ohio*-class submarine service life and, in concert with the Shipboard Modernization Program for shipboard systems, to serve as the initial SWS for the *Columbia*-class SSBN. The D5 Life Extension (D5LE) will ensure an effective and credible SWS on both the *Ohio*-class and *Columbia*-class SSBNs into the 2040s. Our initial life extension of missile and guidance flight hardware components was 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 D5LE program is executing on schedule to continue to meet deterrence requirements and will complete deployment by fiscal year 2024.

As the Navy carefully manages the approach to end of life of our *Ohio*-class SSBNs, we must address the viability of the SWS throughout the life of the *Colum-*

bia-class SSBNs. Twelve *Columbia*-class SSBNs will replace today's 14 *Ohio* SSBNs and beginning in fiscal year 2030 D5LE missiles will support initial load-outs on *Columbia* (Hulls 1–8). Production of additional D5LE missile is not practical due to unavailable technologies and lack of an industrial base. The Trident II D5 Life Extension 2 (D5LE2) program is required to modernize and replace D5LE to support later *Columbia*-class missile inventory starting in fiscal year 2039 (targeting *Columbia* Hull 9 and will backfit Hulls 1–8 during their Extended Refit Period) to continue to meet USSTRATCOM requirements. D5LE2 will ensure the weapon system maintains demonstrated performance and remains survivable while facing a dynamic threat environment until *Columbia* end of life. D5LE2 is a hybrid of pull-through cost-effective technology (e.g. solid architecture). D5LE2 is structured to maintain today's unmatched reliability and demonstrated performance, while unlocking untapped system potential to efficiently respond to emerging needs and to maintain a credible deterrent throughout the life of the *Columbia*-class.

In fiscal year 2020 and continuing in fiscal year 2021, SSP began system architecture studies to evaluate solutions to problems associated with emerging threats, supportability, and adaptability required to address challenges in an uncertain future. Additionally, these studies focused on missile and guidance technology to determine the effective composition of redesign, remanufacture, and pull-through of highly reliable components. This ensures longer lead unique SLBM subsystems are mature in fiscal year 2028 and fiscal year 2029 to then be able to support large facility proofing and flight testing off a manned platform in the mid-2030s and Low Rate Initial Production (LRIP) in fiscal year 2034.

Unlike SLBM programs of the past, D5LE2 does not have the benefit of a healthy industrial base that comes from maintaining continuous development. These early efforts will be critical to reconstituting the SLBM industrial base to restart production on critical components whose production lines were shut down over the last decade. In short, full support of D5LE2 today is vital to achieving 2039 Initial Fleet Introduction (IFI) and to embarking on a path that maintains an SLBM deterrent capability through the service life of the *Columbia*-class SSBN.

#### WARHEAD AND REENTRY BODY ACTIVITIES AND NPR SUPPLEMENTAL CAPABILITIES

The Navy also works in partnership with the Department of Energy's National Nuclear Security Administration (NNSA) to refurbish our existing reentry systems and development of new reentry systems in response to USSTRATCOM requirements. The Trident II (D5) missile is capable of carrying two types of warhead families, the W76 and the W88, and the W93 warhead will be designed for use on both the D5LE and D5LE2 missiles. In 2019, NNSA completed the W76–1 Life Extension Program, marking the U.S. stockpile's first full-scale warhead refurbishment program. The Navy is now working on modernizing integrated aeroshells that house these warheads through the Mk4B program with the inclusion of a Shape Stable Nose Tip, which reduces reentry variability and improves performance margins.

The W88 warhead continues to undergo its refurbishment program on a revised timeline based on capacitor component issues that did not meet reliability requirements. The Navy and NNSA coordinated on tightly coupled schedules for the fleet, the nuclear enterprise weapons complex, and production of affected non-nuclear components to propose an 18-month delay to the original schedule that was approved by the Nuclear Weapons Council (NWC). The program remains on track for reaching a First Production Unit in July 2021. I am confident that our teams will work together to manage the delay, as we have historically addressed refurbishment challenges with a mission-focused attitude and rigor. The Navy will prioritize meeting our warfighters' requirements and minimizing disruption to the operational fleet to ensure that the sea-based leg of the triad continues to fulfill its deterrence mission. However, this program setback is indicative of the pervasive and overwhelming risk carried within the nuclear enterprise as refurbishment programs face capacity, historical funding, and schedule challenges.

In 2021, the Navy entered Phase 1 of the joint DOD–DOE Nuclear Weapons Lifecycle Process with NNSA for the W93/Mk7. This effort will address evolving ballistic missile warhead modernization requirements; improve operational effectiveness for USSTRATCOM; and mitigate technical, operational, and programmatic risk in the sea-based leg of the nuclear triad while simultaneously reinvigorating the atrophied industrial base and modernizing a Cold War era stockpile. W93/Mk7 will provide flexibility and adaptability to meet future warfighter needs. With the near simultaneous age out of the deployed stockpile in the 2040s, the W93/Mk7 will help address production concerns in the weapons complex and ensure a continuous at sea deterrent for the sea-based leg of the nuclear triad. Fiscal year 2021 initial investment supports the reinvigoration of critical, niche national skillsets and capabilities

uniquely associated with harsh reentry environments, and therefore, is applicable to both the Navy and Air Force future needs. Even with the addition of the W93 to the stockpile, we will not increase the deployed stockpile. The Navy will work in close coordination with the Department of Defense, NNSA, the NWC, and the Congress as this effort matures, but we cannot continue to life extend our leftover Cold War era weapons and systems and successfully carry out our national strategy.

Finally, SSP will continue to support the Navy's Fiscal Year 2021 Analysis of Alternatives (AoA) for the 2018 NPR-directed nuclear-armed Sea Launched Cruise Missile (SLCM-N). The initial study for this AoA has been submitted to the DOD's Office of Cost Assessment and Program deterrence.

#### INDUSTRIAL BASE AND INFRASTRUCTURE

The Nation requires a fully modernized nuclear force and supporting infrastructure to execute our national strategy. Our modernization needs cannot succeed without investing in the research and development (R&D), critical skills, and facilities needed to produce, sustain, and certify our nuclear systems. Ensuring robust defense and aerospace industrial base capabilities—such as radiation-hardened electronics, strategic inertial instrumentation, and solid rocket motors—remains an important priority in conjunction with R&D investment. SSP has placed particular emphasis on the solid rocket motor industry and its sub-tier suppliers and appreciates the support of the Congress to allow for the continuous production of these vital components. Essential to the nuclear deterrent, is a national aeroshell production capability. The Navy has not delivered an integrated aeroshell since the 1980s and needs to reinvigorate a production capability that only resides in a small cadre of highly skilled experts in an exceptionally niche industry. Aeroshell investment supports the Navy but will also be cost-effectively leveraged by our colleagues in the Air Force—and also our strategic partners in the United Kingdom as they pursue their independent reentry program endeavors. Finally, R&D investment is critical to today's nuclear modernization needs to ensure that we advance necessary technology ahead of design needs and to train our workforce during the early years of development. If the Nation does not continue to address these concerns, no amount of money will be able to adequately mitigate the risks associated with key stockpile and infrastructure losses for as many as 5 to 10 years.

From an infrastructure perspective, our program is entering unprecedented times. Existing facilities are reaching their 30-year recapitalization windows while we simultaneously face weapons systems modernization periods in order to meet future requirements. Investing in facility sustainment and modernization is required for cradle-to-grave operations. Appropriate Military Construction (MILCON) and Facility Sustainment, Restoration, and Modernization (FSRM) resourcing is critical to the Navy maintaining a credible deterrence to include providing more than 70 percent of the Nation's operationally deployed nuclear warheads. We will make smart investments to address through-put constraints and build in surge capacity to address process missiles and outfit the SSBNs. Maintaining and sustaining facilities is critical to meeting USSTRATCOM and Fleet mission requirements. Our Nation, and the Navy, will continue to prioritize and resource the sustainment and modernization of its nuclear infrastructure enterprise to provide an effective and flexible deterrent now and into the future.

As the Navy executes the modernization and replacement of the SSBN and associated SLBM leg of the nuclear triad, DOD and NNSA's infrastructure must be prepared to respond in tandem to the evolving needs of the Nation. Of most importance, we must have an effective, resilient, and responsive plutonium pit production capability. This capability can address age-related risks, support planned refurbishments, as well as prepare for future uncertainty. Additionally, tritium, lithium, and uranium, and high explosives and energetics, among other strategic materials, are vital to ensuring the Navy can continue to meet its strategic deterrent requirements. Efforts to sustain and modernize deterrent forces must continue. Our strategic forces underpin every military operation around the world, and we cannot afford to delay given the increasing threats facing our Nation.

#### WORKFORCE

History reminds us that the swift, successful creation and execution of the Fleet Ballistic Missile program in the 1950s was truly a result of national commitment, congressional support, and cadre of hand-selected scientists, engineers, and inspirational leaders. Though process will always underpin our efforts, our dedicated predecessors—civilians, military, and industry partners alike—responded to the national need with focused determination and drove this program with a vision. People are as fundamental to our nuclear deterrent as the SWS itself. Today, SSP and its in-



dustry partners are focused on inspiring, growing, and retaining a generation of workforce that did not live through the darkest days of the Cold War. Connecting a new workforce to this fundamental global security mission remains an important task shared among the entire nuclear enterprise. A capable, credible, and affordable strategic deterrent for our Nation for the next 60 years requires not only technical, policy, management, and financial acumen—it requires passion and a commitment to making this our life's work.

Truly, 2020 was an unprecedented year. I would like to take this opportunity to highlight some of the outstanding work the SSP team has done to continue to execute on our mission despite the uncertain environment:

SSP took an aggressive COVID-19 Testing and Vaccination posture for our Security Force commensurate with Tier 1 units to ensure their availability and to maintain the Nuclear Weapons Security Standard (NWSS). Additionally, we developed contingency plans to reinforce our security teams in order to mitigate COVID19 impacts. To date, we have not had to implement any of the contingency plans. We worked with nuclear policy leadership for the Secretary of Defense and Chief of Naval Operations staff to provide relief to some of the administrative training and PRP requirements in order to allow the force to remain focused on maintaining the NWSS and minimize interactions required across the force. We worked with our Marine Corps counterparts to adjust our Concept of Operations to maximize social distancing and minimize transmission by addressing guard rotations, reduction of security posts where possible based on operational requirements (ex. reduction of entry / exit lanes and associated guards commensurate with reduction of operations and personnel due to COVID (more people teleworking, less people have to enter area)), barracks berthing assignments, cleaning cycles, Personal Protective Equipment requirements, and aggressive contact tracing that minimized interaction between individual cohorts. Finally, we maximized the use of virtual inspections or using personnel already at that geographic location with the appropriate subject matter expertise in order to minimize external vectors that could negatively impact the security force. The combination of common sense measures and innovative tactics have enabled SSP to continue to deliver results despite the pandemic, and I am confident we will emerge from these tragic and unprecedented events stronger and more resilient than we were a year ago.

#### POLARIS SALES AGREEMENT: SUPPORT TO THE UK

Development of the future SWS not only addresses known United States risks, it also supports the UK's critical need to recapitalize its deterrent. This is essential to our NATO partners' overall defense posture. Under the auspices of the Polaris Sales Agreement and the Mutual Defense Agreement, the paths and tools are in place to ensure each nation's sovereign needs are met. A critical component of the *Columbia*-class Program is the development of a Common Missile Compartment (CMC) with the United Kingdom. Today, the United States Navy shares the Trident II (D5) SWS with the UK aboard its *Vanguard*-class of ballistic missile submarines, through the Polaris Sales Agreement (PSA). Similar to the United States Navy, the UK's Royal Navy is recapitalizing its four aging *Vanguard*-class SSBNs with the *Dreadnought*-class SSBN. The CMC will support today's Trident II D5 SWS that will be deployed as the initial loadout on both *Columbia* and the UK *Dreadnought*-class SSBNs. Our partnership with the UK also supports production of these two new classes of SSBNs in both United States and UK build yards. Ensuring that the *Columbia*-class program remains on schedule supports not only our Nation's operational requirements, but also the ability of the UK, one of our most important allies, to maintain its Continuous at-Sea Deterrent. For decades United States policy has recognized that the independent British nuclear deterrent adds to joint efforts to deter aggression and attack against NATO and thereby positively contributes to global stability. Under the 1958 Mutual Defense Agreement and the 1962 Polaris Sales Agreement, the United States has provided assistance and material, consistent with international law, to the UK deterrent program. Without this assistance, the cost to the UK associated with maintaining its independent deterrent would rise significantly and would certainly have a negative impact on the UK's ability to maintain conventional and intelligence capabilities which the United States and NATO rely on to deter aggression and attack.

#### CONCLUSION

In keeping with the Administration's Interim National Security Guidance, the United States must renew its enduring advantages so that we can meet today's challenges from a position of strength. Our Nation's sea-based strategic deterrent has been a critical component of our national security since the 1950s and must con-

tinue to assure our allies and partners and to deter potential adversaries well into the future. SSP ensures a safe, secure, effective, flexible, and tailorable strategic deterrent, with a steadfast focus on the proper stewardship, custody, and accountability of the nuclear assets entrusted to the Navy. Sustaining and modernizing the sea-based strategic deterrent capability is a vital national security requirement. 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 nuclear triad and the vital role it plays in our national and global security.

Senator KING. Thank you, Admiral. We will now proceed to 5-minute question rounds, and let me begin.

Ms. Tomero, you caused a disturbance in the force by an interview with a Japanese newspaper, where you referred to the modernization programs as “costly,” but I note that you went on to say, “Nuclear deterrence continues to remain the number one priority for the Department of Defense.” Do you want to expand on that, because as you know it raised some furor.

Ms. TOMERO. Senator, thank you. Chairman, thank you for the question and the opportunity to clarify that interview. The interview with a Japanese newspaper was heavily editorialized. My comments and remarks during the interview were about the upcoming reviews, the importance of extended deterrence, and the issues that would be looked at as part of these review, including looking broadly at nuclear modernization, at our declaratory policy, and again, the intent was to assure our allies, and particularly Japan in this instance, that we would consult with them and that extended deterrence remains strong.

I am happy to provide the transcript of the interview that more accurately reflects what my remarks were, and during the interview I did not talk about reductions or express concern about cost. It was as an answer to a question about the \$1.2 trillion nuclear modernization. My answer was some of these programs are very expensive, as a statement of fact, not as a concern.

Senator KING. I think it would be helpful to supply the transcript. None of us are familiar with the phenomenon of giving an interview and not having it come out exactly as we thought. We never heard of that before.

Ms. TOMERO. I would be happy to, and again, to reiterate, nuclear modernization of the triad will be one of our top priorities.

[The information referred to follows:]

Ms. TOMERO. I am enclosing a copy of the transcript of my interview with the Japanese newspaper, Asahi Shimbun. As I testified, the interview with the Japanese newspaper was heavily editorialized. My comments and remarks during the interview were about the Department’s strategic reviews, the importance of extended deterrence, and the issues that would be looked at as part of these reviews, including nuclear modernization and U.S. declaratory policy. The intent was to assure our allies, particularly Japan, that our extended deterrence commitments remain strong, that no decisions have been made yet, and that we look forward to engaging with allies on these issues. Please see Appendix A.

Senator KING. Thank you. Now, there is a statement in your prepared remarks that caught my attention, and I just wanted you to clarify it. It is in the middle of page 5. It says, “We will begin to explore those steps that can be taken to reduce the role of nuclear weapons in our National Security Strategy, while continuing to ensure our strategic deterrent remains safe.”

Those steps that can be taken to reduce the role of nuclear weapons—can you amplify on that a bit?

Ms. TOMERO. Yes, sir. So that was the direction coming out of the National Security Strategic Guidance, the Interim Guidance, that the United States would reduce the role of nuclear weapons, and so we will be looking at options to do that, and present options to be considered, and decided as appropriate. It is really in the context of the Strategic Guidance saying that we have to look at reducing the existential threat of nuclear weapons.

Senator KING. I appreciate that. Will the budget that we are about to receive show any substantial change in the priorities in terms of modernization?

Ms. TOMERO. Sir, what I can quote at this point is the discretionary budget that came over from OMB, the guidance that was submitted to the Appropriations Committee, saying that there would be support for nuclear modernization and sustaining our nuclear forces. At this point I cannot go into the details—

Senator KING. I understand.

Ms. TOMERO.—of what the fiscal year 2022 budget will cover, and I understand the delay is causing some frustration. But I am really happy to come back and brief in more detail and meet with you and your staff.

Senator KING. Thank you. We will follow up.

General Ray, I only have a minute left so we may want to come back to this. But the question is, how much longer can we life-extend the Minuteman III, and your view on the practicality of that approach as opposed to developing the ground-based strategic deterrent?

General RAY. Sir, thank you for the question. We are out of time. There are several key components that needed to be—

Senator KING. I am not out of time.

[Laughter.]

Senator KING. You mean we are out of time—I have got 27 seconds.

General RAY. Sir, I will talk as long as you want me to. But there were several decisions that would close out the gaps that we needed for the Minuteman III extension—2015, 2016 decisions needed to be made to start programs for our propulsion system rocket engines, our missile guidance sets, and for our boosters. That is now 6, 7, 8 years beyond, because we made the decision to go with GBSD through the JROC and through the analysis of alternatives and the milestone decision authorities making that decision at the OSD level. We did not go backwards. So you actually are out of time. You will buy a gap, a significant gap, in ICBM capability if you were to go backwards now, and I can come back to that, sir.

Senator KING. Thank you. I think we almost certainly will. Senator Fischer.

Senator FISCHER. Thank you. Thank you, Mr. Chairman. General Ray, I would like to follow up a little bit where Senator King was headed in talking about the analysis that we are looking at on the pursuit of the GBSD as a replacement.

The Air Force compared costs with the Minuteman and the GBSD in 2019, and again more recently. What is current estimated

cost difference between pursuing GBSD and trying to life-extend the Minuteman?

General RAY. Ma'am, thank you for the question. The bottom line up front is it is a \$38 billion difference with GBSD being the least expensive and more effective option in every category that we analyzed it on. So we were given six criteria, classified criteria. No version of the Minuteman III ever, in that discussion, satisfactorily met those in an affordable fashion. GBSD did, and the cost of the Minuteman III life extension continues to go up. It was \$5 billion difference back in 2016, \$20 billion difference—

Senator FISCHER. We would still end up with something that does not do the job for us in the future.

General RAY. Exactly, ma'am, and so GBSD is going in the right direction, doing everything we want it to do—more affordable, meets all my criteria that I need. The Minuteman III becomes increasingly more difficult to sustain. I can provide more details about what that means.

Senator FISCHER. We are looking at program costs that you just spoke about. Are there additional costs that are not included there?

General RAY. Ma'am, I think when we give the numbers I believe it does include the de-mil of the Minuteman III, which is one of those costs that we need to account for.

Senator FISCHER. Okay. One of the big drivers of the difference in cost between the GBSD and the Minuteman are the sustainment costs. Is that correct?

General RAY. Yes, ma'am. I was just at the depot last week, at Hill, talking to the team, simply on the propulsion system and not the rest. We have about 330 parts that we do not have a source for, that we are trying to get. We are going to get—probably 40 to 50 percent we will never get a bid from industry to go fill those parts.

Senator FISCHER. I thought it was really helpful for myself and Senator King where we saw the level of effort that is required to maintain the facility. When you do maintenance you need to deploy a security team around them because the warhead is potentially exposed. Is that correct?

General RAY. Yes, ma'am.

Senator FISCHER. Can you explain how with the GBSD that would be different, and what it will mean for sustainment costs?

General RAY. Yes, ma'am. Because the Minuteman III was built as a single system, every time you need to work on anything below the warhead you have to unstack it, which means you expose the warhead. With the GBSD, the way it is being constructed, we expect two-thirds reduction in the number of times we expose the weapon, and two-thirds reduction in the number of convoys. Moreover, we think that 95 percent of the work that we would do would require less than 6 hours with only a handful of people, compared to most of the jobs are 10, 12, 14, and do require a heavier security footprint.

Senator FISCHER. That definitely will reduce risk because there is less exposure of the warhead, for one thing, right?

General RAY. Emphatically.

Senator FISCHER. You reduce the number of times that people are there, so the demands on your personnel, that they are accessing the missile. Is that correct?

General RAY. Yes, ma'am. We will be able to reduce the number of people that we have to commit to this mission.

Senator FISCHER. Okay. I was just at a Commerce Committee markup today on a bill looking at threats from China, from a research viewpoint, basically. As the Global Strike Commander, when you look at the acceleration that the Chinese are doing with their nuclear program, with their modernization, and their growth, what does that mean to you, in your position?

General RAY. Ma'am, we are in the air component commander to U.S. Strategic Command. It means I have a much more difficult job balancing all the requirements. It absolutely underscores the need to have a modernized triad. So the GBSB has got to be how I answer a growing number of threats. You heard some of my teammates here talk about growing capabilities with ballistic missile defense. Certainly that trend is going to continue. As I bring on cruise missiles, it has to be able to survive. So it is a fundamentally different set of problems that I need to operate in, and there is no margin that remains in any of the current systems that will let me carry a couple of decades out.

Now I do believe the beauty of all the systems that we are fielding is that they are built to be in this game for a long period of time. We have a modular design, open mission systems, digitally engineered, so in recent discussions we have been able to explain to a lot of those who are very savvy in the acquisition world how we will absolutely change the game to keep these systems modernized and relevant. There is no margin remaining in the Minuteman III or in the current systems that we have. Thank you.

Senator FISCHER. Thank you, General. Thank you, Mr. Chairman.

Senator KING. Senator Warren, via Webex.

Senator WARREN. Last month, DOD announced that it is moving forward with the development of the next-generation Interceptor, a new weapon system which is going to be added to the current generation of ground-based interceptors. The Cost Assessment and Program Evaluation Office estimates that the United States will spend a total of \$18 billion on 31 interceptors. That is almost half a billion dollars for one, just one, of these missiles, and that price goes up when you consider that 10 of the 31 missiles will only be test units.

The Northern Command has already warned this Committee that North Korea could overwhelm our missile defense system within the next few years, so it is not at all clear to me that spending billions of dollars on additional interceptors is the right call.

Ms. Tomero, given NORTHCOM's concerns, do you believe that spending \$18 billion on just 21 interceptors that may be overwhelmed in a few years is a responsible way to spend taxpayer dollars?

Ms. TOMERO. Senator Warren, thank you for the question. The administration recently awarded two contracts for these interceptors, and it for the development phase of the interceptor. So there

are several critical decision juncture that will happen along the way that will inform the way forward.

Senator WARREN. I appreciate that, but that is not the question I am asking. I am just asking whether or not we ought to be spending that much money for 21 interceptors, that we are already being warned will be overwhelmed.

Ms. TOMERO. The intent, Senator, is to provide an effective, limited missile defense capability against threats from rogue states, and so the intent is to improve that capability—

Senator WARREN. I guess the question I am asking is whether or not we think this is effective.

Look, I understand that your job here is to make the case for these weapons, but it is also unclear NGI will represent any significant upgrade to our system of defense against intercontinental ballistic missile threats. Joshua Pollock, a senior research associate at the Middlebury Institute of International Studies said, and I want to quote him here, “This is a staggering expenditure for such a modest capability,” end quote.

Now I understand that \$18 billion is a drop in the bucket when it comes to DOD’s budget, but that is more than what the government spends fighting the opioid crisis that killed nearly 100,000 people last year. I am also worried that the price tag could go up, just like we have seen with previous missile defense programs. So let me ask, is it possible that the price tag for NGI could further increase as DOD moves along in its development?

Ms. TOMERO. Senator, we will closely track this. I guess there is always a possibility that costs might increase. What we are planning to do is provide the incentives, especially starting with two awards, which is unusual for the Missile Defense Agency to have competition and including have incentives on having the most efficient system that we are able to have providing value and providing incentives on cost. We have that competition and we will be able to make that determination in fiscal year 2024 time frame.

Senator WARREN. Well, and you started this by saying costs might go up, because that is exactly what has happened in the past. The redesigned Kill Vehicle program was meant to upgrade our existing missile defenses before it was cancelled in 2019, after more than a decade of development. The program’s cost more than tripled through the development phase. But the Government Accountability Office found that DOD repeatedly ignored warnings of major issues with the project.

So let me just ask, this is kind of a simple yes or no. Would you agree that more transparent, more methodical, more rigorous acquisition practices could drive the cost of these interceptors and other projects down, rather than keeping them absurdly expensive?

Ms. TOMERO. Senator, we certainly support the incentives and have an approach that we believe will drive competition and will maximize the opportunities to deliver an effective system that delivers on time and on cost.

Senator WARREN. Well, I will just point out that the GAO has repeatedly warned about the continued use of high-risk acquisition practices that use short development timelines to justify spending outrageous amounts of money.

Look, I think spending nearly half a billion dollars on a single missile, that is barely an upgrade on the existing system, is absurd. This is just another example of irresponsible and out-of-control defense spending that wastes taxpayer dollars. We should be prioritizing smart investments in capabilities that actually advance our national security and not spending billions of dollars on what are, at best, marginal improvements.

Thank you, Mr. Chairman. I yield back my time.

Senator KING. Thank you, Senator. Now Senator Cotton.

Senator COTTON. Thank you, Mr. Chairman.

General Ray, you testified in response to Senator Fischer's question that China is significantly accelerating its nuclear modernization. Is that correct?

General RAY. Yes, sir.

Senator COTTON. Does China just tell us the pace at which it is accelerating that modernization? Does it throw open its research labs and its military bases to let us know how it is accelerating?

General RAY. Sir, they do not.

Senator COTTON. Okay. So we get that from intelligence assessments.

General RAY. Affirmative.

Senator COTTON. Do you think it is more likely, in retrospect, when you back in 5 or 10 years, that those intelligence assessments will have overestimated the pace at which China is expanding and the volume of weapons they are producing, or that we underestimated, and China was actually moving faster and getting more weapons systems in place that we currently believe?

General RAY. Senator Cotton, thank you for that question. I believe that I can only talk about the last probably 3 or 4 years, and I will tell you we underestimated the pace.

Senator COTTON. That has been the common pattern of such assessments in the nuclear age, going back 75 years, correct, that we usually undershoot the mark of what our adversaries are trying to do?

General RAY. Sir, that could be true going that far back. I know that with a good arms control agreement that is verifiable and enforceable you have access or the ability to see where the Russians are going is much more understandable. We have no such agreement with the Chinese.

Senator COTTON. All right. Thank you, General Ray.

Ms. Tomero, so we have heard from General Ray that the People's Liberation Army is undertaking this massive nuclear buildup. Do you believe that is the result of any U.S. missile defense deployments?

Ms. TOMERO. Senator, I think there are several drivers for China's nuclear modernization. I would be happy to come talk to you about it in a classified setting.

Senator COTTON. So you believe that China may be responding to United States missile defense deployments?

Ms. TOMERO. Again, I think it is important to understand the drivers for China's nuclear modernization program. We want to make sure that we have got effective nuclear deterrence against China, and that we clearly communicate that we have deterrent capabilities against China. Part of that is understanding what drives

their modernization programs, and again, I am happy to come talk about it in a classified setting.

Senator COTTON. Ms. Tomero, I have been on this Committee and the Intelligence Committee now for 8 years. I have never seen a single product that suggests that China is responding to United States missile defense deployments. So could you or the Joint Staff please provide me, by document number, sometime in the next 2 weeks, any product that suggests that may be the case?

Ms. TOMERO. Sir, we will definitely provide you products that show—

[The information referred to follows:]

Ms. TOMERO. China's plan to expand and modernize its nuclear arsenal is a serious threat to the United States and its allies and partners. As I testified, there are several drivers for China's nuclear modernization and China's rapid expansion of its nuclear arsenal. Last year, DoD estimated that China had a nuclear warhead stockpile in the low-200s and projected that it would at least double over the next decade. Since then, China has accelerated its nuclear expansion and will almost certainly exceed the intelligence community's previous projection. It is important to identify the drivers of our adversary's nuclear modernization programs in order to understand how we can most effectively enhance nuclear deterrence and prevent a dangerous and costly arms race.

U.S. missile defense is likely one of many factors that contribute to our adversaries' perceived force requirements. Our adversaries are driven by their perceptions of their national interests and strategic objectives, what is required to protect and achieve those, and a view of the security environment that includes many other threats beyond U.S. missile defense.

China's nuclear strategy has long centered on the ability to provide an assured counterstrike against adversary's nuclear attack—which requires a sufficient portion of its nuclear force be able to survive such a strike. China's efforts to expand and diversify its nuclear arsenal are broadly aimed at improving the survivability, responsiveness, and effectiveness of its nuclear force while also providing China's leaders with additional strategic options. The 2020 Department of Defense Military and Security Developments Involving the People's Republic of China states that: "The PRC's nuclear weapons policy prioritizes the maintenance of a nuclear force able to survive a first strike and respond with sufficient strength to inflict unacceptable damage on an enemy .... In addition, China insists its new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are intended to ensure the viability of its strategic nuclear forces in the face of continued advances in U.S. and, to a lesser extent, Russian strategic ISR, precision strike, and missile defense capabilities."

U.S. homeland defenses are designed against a limited rogue state threat, not against the nuclear arsenals of Russia or China, and we rely on strategic nuclear deterrence to address the larger and more sophisticated nuclear threats of China and Russia. The size and sophistication of Russian and Chinese strategic systems could easily overwhelm the capacity of U.S. missile defenses.

Section 1692 of the National Defense Authorization Act for Fiscal Year 2020 required a federally funded research development center to prepare a study on other states' reactions to U.S. homeland defenses. This report was delivered to Congress in January 2021 (see attached). The report found concern over U.S. homeland missile defenses is one of many factors, and that neither U.S. missile defenses nor Russian and Chinese modernization have altered the strategic balance as of the completion of the report.

Furthermore, Russia and China are also further developing missile defense systems. That said, we must remain cognizant of the perceptions of our missile defenses moving forward and ensure that their future development does not negatively impact strategic stability.

We expect that the set of strategic reviews will account for adversary nuclear forces and doctrine, the effects across the cyber, space, and information domains, linking to conventional deterrence, and any needed posture and policy adjustments.

The LLNL Study (LLNL-TR-817610) is on file at the Senate Armed Services for viewing.

Senator COTTON. Thank you, and in a classified setting. I understand.



Ms. Tomero, should the United States adopt a no-first-use policy?

Ms. TOMERO. Sir, thank you for that question. The declaratory policy will be looked at as part of these reviews. We will do it in consultation with the rest of the Department, with the military, with the interagency. We will plan to start consultation with allies more broadly on extended deterrence, and so we will look at the pros and cons of our current policy, potentially of alternatives, but at the end of the day, this is the prerogative of the President.

Senator COTTON. I am glad that we are going to consult with a lot of people. So you are open—you believe that it is at least an open possibility we should adopt a no-first-use policy? I am asking for your view. You are a key member of what is going to be a nuclear posture review. Do you believe we should adopt a no-first-use policy?

Ms. TOMERO. Thank you for your question. My role is to inform options and inform a decision, and it is not about my personal view. Again, this is going to be looked at across the Department and across the interagency.

Senator COTTON. Well, I am not asking your personal view in the sense of like your taste about the matter. I am asking your considered policy judgment, having worked on these issues, for, I think, a couple of decades now. Do you think the United States should adopt a no-first-use policy?

Ms. TOMERO. At this point, Senator, before we have even begun specific reviews, we are not going to foreclose options. We are going to look at what our current declaratory policy is, evaluate risks and benefits, and I would be happy to come discuss considerations and, of course, decisions made once the review is concluded.

Senator COTTON. What about a sole-purpose policy?

Ms. TOMERO. Again, that relates to declaratory policy and what changes might or might not be made.

Senator COTTON. My time has expired. Thank you. I have to say, I am now troubled by the direction of this nuclear posture review.

Senator KING. Thank you, Senator Cotton. Senator Manchin on Webex.

Senator MANCHIN. Thank you, Mr. Chairman. This will be to Mr. Walter and Ms. Tomero. Recently my office met with Northrop Grumman's Chief Information Officer to discuss the measures that are being put into place to develop a secure nuclear command and control and communications, an NC3 system, with the modernization of the ground-based strategic deterrent, as we are all beginning to realize just how vulnerable we are from the cyber domain. I am concerned with the cybersecurity, the entirety of our current and eventually modernized nuclear enterprise. 0

So my question would be, what goals has the Department set internally with our private industry partners to ensure that the NC3 systems remain as secure as possible?

Ms. TOMERO. Senator, I agree that NC3 and having a robust NC3 underpins most of our nuclear deterrent. I would respectfully defer that question to my colleague, Andrew Walter, since it is an acquisition question. Thank you.

Senator MANCHIN. Well, I will have a second part. Maybe you can answer one part of this. I am sure the Department has been considering instituting a zero trust concept for our nuclear net-

work. Can you discuss what that will actually look like for the cybersecurity professionals that are monitoring these systems and what resources will be available for them to verify every single user?

Ms. TOMERO. Sir——

Mr. WALTER. Thank you, Senator. The Department takes the cybersecurity of the nuclear deterrent force extraordinarily seriously. Our legacy forces remain and are secure, often based on just how old they are and not connected to external systems.

As we look towards the modern systems, such as the ground-based strategic deterrent and other systems, cybersecurity is a paramount priority and requirement within the system, and providing the GBSD program office and Northrop Grumman sufficient resources to ensure that it remains so throughout its life of 30, 40 years, potentially.

I would like to ask General Ray to chime in on the specifics for the system.

General RAY. Yes, sir. Thank you for the question and the opportunity to comment. Sir, what we have done as the air component to Global Strike, to Strategic Command, as the team that builds this, is we have documented what we believe, at a very high level of classification what the roadmap should be. Cybersecurity is one of the critical pieces when we designed the GBSD, when we looked at that. Cyber operators are part of this conversation, and I could tell you, watching the software development approach that we are taking is the leading edge capability. I have seen first-hand the Kubernetes containerized software approach. We have had the red team multiple times try to break into the developmental software, and they cannot.

Sir, we see this as a central issue and it will be part of how we deal with encryption, how we deal with AI and quantum and all those things going forward. Over.

Senator MANCHIN. Thank you, General. To both of you, again, in the past this Subcommittee has heard about needing improvements in our satellite system, such as the advanced extremely high frequency satellites in orbit and production. These efforts are related to, and often tied directly to, the Missile Defense Agency, and now the Space Development Agency as our nuclear defense and employment are tied together. Some have been critical of this move as it could be interpreted as a duplication of effort and reductive to the need of interoperability within our forces.

So given that you come from the different services and both require access to our satellite network, do you feel there is a united effort between the Missile Defense Agency and the Space Development Agency to ensure that seamless access is being maintained across the DOD enterprise? Both of you. Either one who wants to start on that one can say.

Mr. WALTER. Sir, thank you for the question. Between the Missile Defense Agency and the Space Development Agency there are often regular conversations regarding the requirements needed in the satellite constellation. I would have to take for the record the specifics for what those consultations are and how we are ensuring there is no duplication of effort, but that is a priority across the ac-

quisition system, to ensure that we are acquiring the right capabilities without duplicating in different program silos.

Senator MANCHIN. General?

General RAY. Sir, at this time the team's application of AHF is not directly impacted by that particular relationship. So I am grateful to say that we have what we needed in terms of this for the here and the now.

Senator MANCHIN. So it is working.

General RAY. Sir, from where I am sitting at this time, yes, sir, it is.

Senator MANCHIN. That is good to hear. Thank you both. I yield my time, Mr. Chairman.

Senator KING. Thank you, Senator. Senator Rounds.

Senator ROUNDS. Thank you, Mr. Chairman. First, let me begin by just saying thank you to all of you for your service to our country and your continued dedication.

I am just curious. General Ray, let me just begin with you. I think I understood you correctly but I want to confirm this. With regard to the GBSD and the cost comparison between moving forward with the GBSD versus a service life extension on the Minuteman III, there would actually be cost savings by moving forward with the GBSD as opposed to the Minuteman III? Is that correct?

General RAY. Yes, sir, it is.

Senator ROUNDS. How much did you say that was?

General RAY. Sir, the current figure here in 2021 is \$38 billion.

Senator ROUNDS. That is \$38 billion—

General RAY. Billion. Yes, sir.

Senator ROUNDS.—estimated at this time, in 2021 dollars.

General RAY. Through the life of 2075, and I believe it is fair to offer that parameter.

Senator ROUNDS. Very good. Thank you.

Admiral Wolfe, there has been a discussion about whether or not we need all three portions of the triad to continue on. There has been a debate out there. Some people say you only need two out of the three. I would beg to disagree with that, but I think it would be fair to hear from you and from General Ray, at least a concurrence as to how these three pieces fit together and what it means to adversaries who look at us, recognizing if you had two versus three.

Could you share, just briefly, the reason why we need three in the triad?

Vice Admiral WOLFE. Yes, sir. Thanks for the question, Senator. So I would tell you I absolutely agree, all three legs of the triad are critical to the deterrent mission that this Nation needs. I will let General Ray talk about to the value of the intercontinental ballistic missiles and the bombers. But from a submarine perspective, right, we are assured second strike, I would tell you that if one of the other two legs went away, that makes the Navy's mission even more critical. It puts more demand on the submarine force. It puts more strain.

I would also tell you that as we—and General Ray and I were talking about this before this hearing—because we are trying to do this very smartly, we leverage what we are doing in this very small, critical, industrial base, when we talk about critical elec-

tronics that are radiation hard, and we talk about niche capabilities that just are not required anywhere else. When that goes away, with one leg, I would submit to you not only does it increase our risk with the industrial base, it is going to cause our costs to go up. I would say that STRATCOM would have a much, much more difficult mission as well, to make sure that the deterrence from the adversaries' eyes remain strong.

Senator ROUNDS. This is all about deterrence, isn't it?

Vice Admiral WOLFE. Yes, sir. It is absolutely all about deterrence. It is not about what we think it is about, what our adversary thinks, and what they think is acceptable.

Senator ROUNDS. Thank you. General Ray?

General RAY. Yes, sir. I agree with my colleague about the inter-related benefits, the survivable dimension, the flexible responsive piece, certainly the flexible visible piece of the bomber and, of course, the responsive dimension of the ICBM. It does present a great deal of challenges for our would-be adversaries.

But as the air component commander to Strategic Command, as we think through these scenarios and these options, having a range of options that let us give the national leadership the tailored approach to this problem, the fewer resources you have, the more challenging it becomes.

Senator ROUNDS. Definitely about deterrence, though.

General RAY. Absolutely, sir. It is about a competitive dimension in this very strategic environment.

Senator ROUNDS. It is not a secret the challenges that we have are not just one country. Right now they are basically two major near-peer competitors, and a third and a fourth that are rogue. Is it fair to say that China and Russia are both considered to be near-peer competitors, that we basically have to have deterrence in place for today?

General RAY. Sir, I think there was a lot of thinking about the Chinese a few years ago, that they would have a minimalist deterrent approach, basically a counter-value approach. Everything I have seen from their warhead production, the diversity of the delivery systems, and how they are deploying things, they are no longer playing that game. They are playing a counter-force game, to hold our resources at risk, and their accelerated pace is very disturbing.

Senator ROUNDS. If we stop from one, is there a possibility that as you wargame this, to be able to show appropriate deterrence you have to be in a position to respond to one or two adversaries, at or about the same time. Fair enough to say? Just a quick yes or no. I am accurate in that?

General RAY. Yes, sir, it is, and because I have ICBMs to offer as options, I can be more tailored in my approach to provide the very limited number of bombers to the theaters that they might help.

Senator ROUNDS. Mr. Chairman, I am out of time but I have to follow up with one question, if I could, please.

Ms. Tomero, you have a role to play in determining treaty determinations and negotiations in the future. Would it be fair to say that as we look at deterrence here it is critical that we recognize the need to look at deterrence with the possibility of defending

against not one but two adversaries at the same time, in order to provide appropriate deterrence?

Ms. TOMERO. Yes. That is the first piece of what the review will begin to look at, is the threats, and, of course, as I mentioned, we are very concerned about the Chinese, increasing threat from China, and the novel systems and [inaudible] systems from Russia, and so those will underpin the reviews.

Senator ROUNDS. That would be included in your recognizing that as you discussed, treaties and the need for the full deterrence that both of these two officers have shared today, and you are in agreement with them?

Ms. TOMERO. Absolutely.

Senator ROUNDS. Thank you. Thank you, Mr. Chairman.

Senator KING. Senator Rosen, via Webex.

Senator ROSEN. Well, thank you, Chairman King and Ranking Member Fischer for holding this very important hearing, and to our witnesses for your work and service and for being with us today. I would really like to just focus in on nuclear testing, waste disposal, our nuclear stockpile, some of those issues.

Ms. Tomero, as you know, in 1993, Congress created the Stockpile Stewardship Program. It is a science-based program to ensure the mission-critical readiness and reliability of our Nation's nuclear stockpile. Congress tasked NNSA with ensuring, and I quote, "that the nuclear weapons stockpile is safe, secure, and reliable, without the use of underground nuclear weapons testing," end quote.

The subcritical and physics experiments conducted at the Nevada National Security site, the only facility in the Nation where subcritical experiments can be executed, combined with advances in nuclear modeling reduced the need for explosive testing while ensuring the safety and effectiveness of the United States nuclear stockpile.

Last year, after it was suggested by the prior administration that they were considering resuming explosive nuclear testing, Senator Cortez Masto and I introduced legislation requiring congressional approval before any future explosive nuclear tests could take place. Nevadans, let me tell you, do not want to return to a time when explosive nuclear testing put the health and safety of our residents in jeopardy, and the states around us.

Ms. Tomero, as you well know from working with former Nevada Senator Harry Reid, former Congresswoman Shelley Berkley, and from working on the House Armed Services Committee when I served on it, Nevada also does not want to become the Nation's nuclear dumping ground for nuclear waste, including defense nuclear waste.

So, Ms. Tomero, could you discuss the potential consequences of resuming explosive nuclear testing at the site, and could you include, if you might, potential environmental impacts and, of course, the potential strategic implications, please?

Ms. TOMERO. Thank you, Senator. It is the objective of this administration to support the continued moratorium for nuclear testing as a policy position, and my understanding is we have the nuclear lab directors look at the need for testing and look at what would be required to sustain reliable, effective, and safe nuclear stockpile every year. But for the details on whether we would have

to resume nuclear testing for technical reasons, I would refer that to my colleague, Andrew Walter.

Mr. WALTER. Thank you, ma'am. I think the Stockpile Stewardship Program you mentioned is one of the great success stories of the last 30 years in the nuclear enterprise. The Stockpile Stewardship Program has invested in the workforce at NNSA, the scientists and engineers and technicians, as well as the key capabilities needed to certify the stockpile's safety and reliability, in the absence of nuclear explosive testing.

During the Cold War, nuclear explosive testing was used to do that. We have invested in the means to do that without explosive testing, and the lab directors continue to certify that currently nuclear explosive testing is not needed.

I think for Nevada, one of the key capabilities the National Nuclear Security Administration is investing in today is the enhanced capabilities for subcritical experiments in U1a, and this is a critical capability where the lab directors at NNSA will use to gather the data they need from subcritical experiments to continue to certify the stockpile and ensure the designs we use in the future remain safe and reliable.

So I think ECSE, in the Nevada Test Site, the Nevada National Security Site, is just incredibly important to maintaining that unbroken record since the 1990s of not doing nuclear explosive testing.

Senator ROSEN. Thank you. I appreciate that. I would like to quickly just ask my final question here. Ms. Tomero, do you share the concerns of the former Secretaries of the Air Force that transporting tons of nuclear waste, including defense nuclear waste, around or through Nevada test sites, through probably over 300 congressional districts across this Nation, through the Nevada Test Site, through the Training Range, which is the crown jewel of the Air Force, to Yucca Mountain, would be detrimental to our strategic testing, training, and military readiness? I can just take a yes or no answer, a quick answer. My time is up, please.

Ms. TOMERO. Senator, I understand the concerns that—I would be happy to get you an answer for the record as it goes beyond the lanes of my policy job jar.

[The information referred to follows:]

Ms. TOMERO. As I testified, I understand your concerns and the importance of considering and addressing the safety requirements and risks of transporting nuclear waste across the country; however, my office does not have responsibility for this issue. Instead, let me refer you to our colleagues at the U.S. Air Force and the Department of Energy to provide you additional information about the impacts to strategic testing, training, and military readiness of transporting nuclear waste around or through Nevada test sites.

Senator ROSEN. Thank you. I appreciate that. My time is up.

Senator KING. Thank you, Senator Rosen. Senator Cramer.

Senator CRAMER. Thank you, Mr. Chairman. I might just say, every time I go to Minot I am impressed with those same young men and women, and they do get younger every time. But one of the things that impresses me the most is that even the Southerners never complain about the weather in Minot, and that takes incredible discipline.

Anyway, I want to dig in a little more to the deterrence policy issue that the chairman brought up in terms of clarifying your

statement, and I noted you are quoting the Interim Strategic Policy in a couple of places, relating to what I think is a goal to reduce, or it seems to be a goal to reduce our nuclear deterrence. I want to ask you, Ms. Tomero, I mean, how much risk are we willing to accept to reduce our nuclear deterrence? The word "reduce" is used a couple of times.

Ms. TOMERO. Let me clarify. Having a strong nuclear deterrence is one of our highest priorities, and so we will continue to maintain strong and reliable nuclear deterrence, which has been the cornerstone of our national security.

Senator CRAMER. I just get concerned when the word "reduce" is used several times in your testimony, and it seems to conflict. So I hope we can get it clarified on the right side of things.

I guess you would then testify that you don't think the deterrent is too great now for the global threats that we face?

Ms. TOMERO. Again, I think we need to maintain strong nuclear deterrence, as we have for decades.

Senator CRAMER. Okay. Let me back up a little bit. Maybe, General Ray, you could answer this. If we were to, say, go from 400 to 300, for example, ICBMs, just as an example, because that gets talked about, would we need to shore up some other conventional system, or how would we fill a gap if there was a reduction of some type?

General RAY. Sir, thank you for the question. When I think about how I would answer—how much is enough I think is one of those questions—I remind myself of the series of policy questions that underwrite everything. The first one is, of course, are you a counter-value or a counter-force construct? I think because of our capabilities or precision the number of threats that hold us at risk, that we would prioritize those as the thing to deal with. Obviously the enemy systems begin to shape that.

The second I ask is, no first use, launch under warning, launch under attack, and how we go down that path, and where we are, I think, is fitting for what we are dealing with. If the policy changes then there are ramifications, and then what we do with New START, does that really answer all of our problems in the strategic environment or is it a pragmatic take that we put a very sensible fence around the things that we can control and contain or work.

We should celebrate, as a Nation, that when we put arms control alongside very credible modernization, and put a credible deterrent on the table, we have removed thousands of weapons and we have become a better planet for that.

So when I just walk through these policy questions, the next one, of course, is extended deterrence, which has a very clear counter-proliferation dimension. I would turn and go, what is your policy, and then what is the threat I am up against, and how I would line those up. I think there is the discipline that we all have to keep in light of what we are dealing with, and particularly with the Chinese growth.

You know, if I had to deal with the threats, I am sure Admiral Richard would ask for me to think through the sources. The idea of putting bombers back on alert is something that we practice but we do not sustain, because we have been fortunate enough to live

in an environment, up to now, to where we can afford to not have them on alert but have them in a ready status. It takes me a certain number of classified hours to go back, sir. I do not have the bomber crews. I do not have the tankers. I do not have the bombers that go and meet all the combatant commands. There is no allied bomber force. This is it, and so how we would address that from the air component side, you would have to make sure that Strategic Command had those other resources to meet the targeting guidance.

Senator CRAMER. Well, thanks for all that, and that is a great explanation because I do worry, as I look at what seems to be some direction, at least. Ms. Tomero, I understand that you do not want to take things off the table in the middle of a discussion, and I can appreciate that. But there are certain things that have been studied pretty well, you know, to its limit, and one of them being the viability of Minuteman III and the GBSD. I think it was Senator Cotton that went through, starting with 14, or maybe it was you, General Ray, started with 14 and all the way through all the administrations, going back to that, the Milestone A decision, Milestone B decision, all those things that reviewed that. I just wonder, is there any reason to believe that any additional reviews would do anything to overturn the mountain of evidence that supports the conclusion that has already been drawn?

Ms. TOMERO. Sir, let me just start by saying that there is very strong support for modernization of the triad, as Secretary Austin testified before Congress, as Deputy Secretary Hicks testified. So that will be a high priority for our review, is to ensure that we continue to modernize the triad. Of course, we will look at how the programs are doing, what the program risks are, to make sure that we have the capabilities we need, when we need them.

Senator CRAMER. Thank you. Thank you, Mr. Chairman.

Senator KING. Thank you, Senator. Senator Tuberville.

Senator TUBERVILLE. Thank you, Mr. Chairman. Thank you very much for all of your service. General Ray, thank you. Getting ready to retire. You know, I tried that after 40 years of coaching, and after about a year my wife said, "You either get a job or we are going to get a divorce," so get ready for that.

[Laughter.]

Senator TUBERVILLE. But thank you. You know, last year or so I have been watching our hypersonic missiles being developed, a lot of parts and product in Alabama. Mr. Walter, how do you think the DOD program is responding or planning to respond to the development of hypersonic weapons?

Mr. WALTER. Sir, hypersonics is a bit out of my lane, as the DASD for Nuclear Matters. I would offer Vice Admiral Wolfe has had more responsibilities in that area.

Senator TUBERVILLE. Good.

Vice Admiral WOLFE. Yes, sir. When you asked that question, is that in relationship to our development or what the adversary is developing?

Senator TUBERVILLE. Our development.

Vice Admiral WOLFE. Our development. Yes, sir. So in my non-nuclear hat I am responsible for our Conventional Prompt Strike Program, which is the hypersonic program with the Army that we



are ready to deploy. I would tell you that we are focused on getting the Army's capability first, in fiscal year 2023. We will follow that by Navy capability. I think you have heard the CNO talk about our first priority is getting to the new DDG-1000. I think these weapons give our combatant commanders a lot of capability that we do not have today.

So the Department continues to push forward on these programs. As a matter of fact, we were just over on the other side of the Hill this afternoon, talking about all the hypersonics programs. So the Department is committed and moving forward with development of all those weapons.

Senator TUBERVILLE. Thank you. General Ray, as the Global Strike Commander, what does the notable acceleration of Chinese nuclear modernization and growth mean to you in that position?

General RAY. Sir, if I had to take something that kept me up at night, this is it. It is a breathtaking pace that they are keeping. The diversity and what I see is after watching the Russians for many years they are playing a very Chinese game, a very hybrid game, a very appropriate game for where they are and where they want to achieve their goals, you know, how they use hypersonics, dual-use systems, their advances in the command and control area. I have to be very careful about the classification, but if you have not been briefed, you know, at the right level of classification we would be glad to help do that.

I will go back to a little bit of Admiral Wolfe's question. The Air Force is working, as well, in hypersonics, the ARRW, and ultimately the HACM, which is the air-breathing cruise missile. We are hoping to have our tests off the B-52 here by the end of the month.

Senator TUBERVILLE. Thank you.

Ms. Tomero, the Biden administration has shared that, where possible, they will pursue new arms control agreements. How would this impact reduction agreements with Russia and the START Treaty, set to end in 2026?

Ms. TOMERO. Sir, as you know the START Treaty will last for another 5 years, and provides legally binding constraints, verifiable constraints on Russia's deployed strategic weapons. But we look forward to building on the extension, and, of course, having a follow-on arms control that further address the systems that are not covered by New START, and, of course, covering systems beyond New START's expiration.

Senator TUBERVILLE. Thank you. Thank you, Mr. Chairman.

Senator KING. I think we have a vote beginning, but I think we have more time. If it is a 10-minute vote that means we have about a half hour.

[Laughter.]

Senator KING. If you were ever given 10 minutes to live, you should say, "I would like it to be during a 10-9 minute vote in the Senate." [laughter]

So quick question. Admiral Wolfe, there were real problems with the welds in the missile silos for the new *Columbia*. Has that been corrected? Are we back on track? Did we lose schedule?

Vice Admiral WOLFE. Yes, sir. So you are correct. We did have issues with the welds on the missile tubes early on. What PEO Co-

*lumbia* has done is they have gotten to the root cause of that. They have it under control. We did lose some schedule margin. I would say that we did not lose schedule in the overall delivery of the *Columbia*, the first of class. PEO *Columbia* continues to monitor that and continues to watch as all of the vendors are producing these missile tubes and making sure that we are meeting not just what we need for the *Columbia*-class but also those same missile tubes are being delivered to the UK for the *Dreadnought*-class as well, and we have revised the schedule and we are tracking to that schedule.

Senator KING. Thank you. General Ray, we have been talking all day about deterrence, and deterrence rests upon two things—credibility and will. Would it undermine our deterrent posture to not modernize, particularly for the missile systems which are now going on 50, 60 years old? In other words, would not modernizing itself send a signal that would not be good in terms of our ability to deter our adversaries?

General RAY. Sir, I think that is exactly the case. I think our adversaries know exactly what we can and cannot do, and they are busy preparing counters to those. To not respond to that or let that be the status quo would be very detrimental to our deterrent, or basically our capability.

Senator KING. It just seemed to me that would be a signal. We are not modernizing and therefore the credibility of the deterrent diminishes.

Let's see. Mr. Walter, we have talked about NC3, and Senator Manchin mentioned it. I really think instead of talking about the triad we ought to be talking about the quad, because without NC3, nothing else works, and if that is a vulnerability, I am sure you have read, all the books about World War III start with a cyberattack, and so it has got to be absolutely bulletproof, and I guess cyber-proof.

Mr. Walter, reassure me.

Mr. WALTER. Yes, sir. If I could take it a step farther, when we speak about the nuclear deterrent we tend to speak about five key components. As I mentioned in my opening statement, there is the weapons, there is the delivery systems, and that is what most people think about. But the nuclear command and control system, the NC3 system, underpins all of that, and allows the President to exercise the options available.

Senator KING. If we have learned anything in the last year it is that our systems are vulnerable, even Defense Department systems.

Mr. WALTER. Many of our legacy, current systems in the NC3 world, were also developed and deployed during the Cold War. So they remain safe, secure, they remain effective, but as we look to modernize them, the services spend an awful lot of time with the oversight on ensuring they remain so in the face of cyber challenges. We may not even fully understand what cyber challenges we may face in 10 years from now.

If could just add the two other components to the five-part nuclear triad, as I said, the infrastructure that underpins all of it, including at the National Nuclear Security Administration, and their ability to produce weapons, and the industrial base on the Depart-

ment of Defense side; and then finally the workforce, the people, which you mentioned and we have all mentioned.

Senator KING. Thank you. Admiral Wolfe, I have heard the argument that we do not need the missiles because the submarines are invulnerable. They are stealthy. They cannot be found. My concern is that that may be true today but it may not be true in 5 to 10 years with the development of technology. Ten years ago, we thought our space assets were invulnerable. Now we know they are not. Comment on that, please.

Vice Admiral WOLFE. Yes, sir. So the Navy—

Senator KING. I do not expect an admiral to say, “My submarines are vulnerable,” but—

Vice Admiral WOLFE. No, sir. So what I would tell you is the Navy continuously monitors, through intelligence sources and others, what capabilities the adversary may be developing, and we stay ahead of that. We have, within the submarine force, security programs, and I would be happy to talk to you at a more classified level if you would like, about the things that we look at and the things that we monitor. As we look at new submarine development, all of that is taken into account, and we design those systems so that we can stay ahead of that.

Senator KING. I appreciate that, but it is a question of where you are putting all your eggs, and there are still technological vulnerability 5, 10 years from now. But I appreciate that you are cognizant of this risk.

Senator Sullivan.

Senator SULLIVAN. Thank you, Mr. Chairman. Thank you to our witnesses. I want to get to the questions—I know that Senator Warren was asking some questions about missile defense. I want to give you—and I am sure you are familiar with this, but homeland missile defense has had a history of being partisan. By that I mean Republicans, George W. Bush, President Trump were very supportive of it. Democrat administrations, not so much.

We worked hard, this Committee worked hard, to make it bipartisan. I had a bill, Advancing America’s Missile Defense Act of 2017, that had 20 Republican, 10 Democrat co-sponsors, and it was the big missile defense build-up. So I was surprised by Senator Warren’s questioning, particularly of you, Ms. Tomero, about, hey, maybe it is not so relevant, maybe it is not so needed. I kind of thought we had moved beyond that, but maybe history is repeating itself here. I hope not.

Secretary Austin has said, in his confirmation, that the defense of the Homeland and missile defense is a central component of DOD’s mission, the relationship between missile defense, U.S. nuclear arsenals are complementary and mutually supportive. Deputy Secretary Hicks said, “Defense of the homeland is top priority, and the Homeland missile defense system is an essential component to that mission.”

So, Ms. Tomero, is that your belief as well? I know Senator Warren said, “Well, North Korea might be able to overwhelm us.” I do not agree with that. It is a little bit fatalistic. What is your view—I think it is a strong one—on the importance of our Nation’s Homeland missile defense right now?

Ms. TOMERO. Yes, I completely agree. Homeland missile defense is a high priority.

Senator SULLIVAN. You have to turn your mic on.

Ms. TOMERO. Yes, I completely agree, and can guarantee that homeland missile defense is a high priority—

Senator SULLIVAN. Okay, so—

Ms. TOMERO.—limited homeland missile defense against threats from rogue states that continue to grow, especially from North Korea, and that will continue to be our top priority, from a policy perspective.

Senator SULLIVAN. Great. You know, we just completed—it is ready to be turned on here any day—the long-range discrimination radar system, which will be the most advanced ground-based missile discrimination radar anywhere in the world. That is in Clear Air Station Alaska, as you probably know. We have dramatically built up the missile fields.

However, as you know, we have 20 silos that are now empty. That does not make sense. How quickly can we get missiles, and the kill vehicles on top of those, into those silos at Fort Greely right now that are empty? I think that should be a priority of the Department. Is that a priority, and how quickly can we do that? Do you agree with me, that does not make any sense, 20 empty silos?

Ms. TOMERO. I am aware that we are increasing and improving our missile defense capability, and adding those 20 silos is part of the improvement.

Senator SULLIVAN. The silos are done. The silos are ready. The silos just do not have missiles.

Ms. TOMERO. Right, and so we are investing in a new interceptor, as you mentioned, and so looking at ways to continue to have a strong homeland missile defense and ways to improve will be something we look at as part of the missile defense review. But in terms of how fast and the capability I would defer you to the Missile Defense Agency to provide more details on the acquisition piece.

Senator SULLIVAN. Okay. Mr. Chairman, this is a big issue, I think, for the country.

Senator KING. I believe we are having a hearing just on that subject in several weeks, on missile defense.

Senator SULLIVAN. Great. Well, with that I yield my time back. Thank you.

[Laughter.]

Senator KING. But as usual, you were effective in stating your case.

The vote has started, but I stole a second round, but if any of my colleagues would like to ask follow-up questions. Senator Fischer?

Senator FISCHER. I am going to focus on nuclear, although we do appreciate Senator Sullivan's passion for missile defense, because it is an extremely important part of our national security, so thank you, Senator.

Ms. Tomero, it is my understanding that your office has asked CAPE to do an analysis on the Minuteman III life extension. Is that correct?

Ms. TOMERO. We have not.

Senator FISCHER. Oh, you have not?

Ms. TOMERO. No. We have been working with CAPE to look at what past studies have been done on extending Minuteman III, on the cost-effectiveness on looking at GBSD. But no new studies are on the way. I expect that we will continue to work with CAPE throughout the review.

Senator FISCHER. So you have been in discussions with CAPE on analysis, though, on the review. Right?

Ms. TOMERO. We have, but no new analysis has been tasked, and as I come up to speed in the Department in my new role is understanding what past reviews had been done to inform the way forward.

Senator FISCHER. Have you coordinated with STRATCOM at all on that, or the Air Force Global Strike Command, or Mr. Walter's office in getting up to speed on it?

Ms. TOMERO. I expect that they have access to the past reviews, as my office would have. But going forward, certainly we will coordinate closely with the Joint Staff, with Strategic Command, with the components of Strategic Command as well, and so I actually was just accompanying Secretary Austin on his trip to Strategic Command. He was there the day after your visit, and so close engagement with Strategic Command will be a priority.

Senator FISCHER. Okay. Yeah, I would hope you would reach out to them, especially as you are preparing for a nuclear posture review.

Ms. TOMERO. Yeah. In fact, I stayed behind after the Secretary's trip for 2 days of meetings and briefings at Strategic Command, and I look forward to continuing our close engagement.

Senator FISCHER. As you are working your way into that, will you be able to brief our staffs so that we are kind of up to date on where you are headed? A lot of times we get the book, and that is it. But it would be really valuable if we could have information along the way, and not just from your office but also with the different agencies that you are working with on it, the combatant commands. That would be very helpful if you would do that.

Ms. TOMERO. Yeah, I look forward to engaging with you and your staff over the summer, and I am also happy to, even before we start, to listen to what your interests would be and what you would like to see, as well.

Senator FISCHER. Okay. Thank you. When we are talking about treaties and New START, and we had the extension with New START, do you think there would ever be a time in dealing with the Russians, since that is who the treaty is with, not the Chinese, do you think there would ever be a time that the United States would have a proposal for unilateral reductions?

Ms. TOMERO. I am not aware of any proposals for unilateral reductions.

Senator FISCHER. Okay. Thank you, and one point I would like to ask General Ray, when we visited with you up in Minot, and you mentioned it in passing here, and I think it is such an extremely important point. When we talk about the triad and the importance of the triad to our national security, I think we missed that connection that in many ways we only have a dyad, because of the bombers being on alert. How would you answer that?

General RAY. Ma'am, what I would say is that you have a triad. It is in varying degrees of posture, based on the current world threat that we have, that I would say is becoming more dangerous. I have the ability to rapidly bring up my bombers and put them on alert. I will say that the more weapons generation facilities I have to do that with allows me to do that late. You want to generate at the last minute, not 5 minutes too early and not 5 minutes too late. But I believe it gives a very visible and flexible opportunity, that we have not had to leverage in the current world environment. But it would become even more difficult in the future.

Senator FISCHER. Thank you. Thank you, Mr. Chairman.

Senator KING. Thank you, Senator Fischer. Senator Rounds?

Senator ROUNDS. Thank you, Mr. Chairman, and, General Ray, I would be remiss if I did not follow up with that other leg of the triad that Senator Fischer just brought up, and that is the one with regard to our bombers. We have, first of all, a fleet of B-1Bs which are not nuclear capable, because of treaty determination, to begin with. Second of all, we have the B-52, which is 70 years-plus old, and the B-2, which is limited in numbers. The weapons generations facilities are limited in number right now.

Ellsworth Air Force Base, which will be the home for the B-21, will need a weapons generation facility, which may very well mean with regarding infrastructure we will have to find the resources. I know that it is on target, but a very critical part of the discussion. An item which we sometimes just simply are taking for granted lately, and which I do not want to because we talk about those areas where we are not being successful or we are not satisfied.

But with regard to the development of the B-21, this is probably one of the most advanced weapon systems ever developed by mankind. I tell people it is a bad-ass weapon of war and peace, but it is a system which clearly, as I understand it, is on time and on target, with regard to the budget.

Would you care to confirm that, and basically give us an update on where that B-21 is at?

General RAY. Yes, sir. I was just out at Palmdale last week, on Thursday, and I had a chance to go down the line. It is on time. It is incredibly successful. Between the GBSD and the B-21, these feature all the attributes that you would want to have featured in a modern weapon system—digital engineering, modularity in their design, open mission systems, mature technology. The digital engineering on both of those is giving us an unprecedented degree of capability.

I believe when we briefed Chairman Smith a few weeks about how we are going to bring this on, with a codified methodology to rapidly bring on new techs when we had the opportunity, it meant that we were never going to change the requirements, because we had no incentive.

So the pledge I have, and, you know, when I talked to Ms. Warden at Northrop Grumman, she knows full well I am not going to change any requirements, and if the requirements remain stable, we remain on cost, we remain on time, and I think we have a tremendous ability to rapidly bring on for the B-21 new radios, new weapons, new sensors, all those things that give us velocity, but

also lets us have a very competitive sustainment game plan, and that applies to both the B-21 and the GBSD.

Senator ROUNDS. Very good. Thank you. Thank you, Mr. Chairman.

Senator KING. Senator Tuberville?

Senator TUBERVILLE. How long will it be until we have somebody from Space Command in this room, General Ray, for nuclear?

General RAY. Sir, I will be honest. I have no answer to that question. I would have to go back to the Chief of Staff of the Air Force and to the Chief of the Space Force.

Senator TUBERVILLE. Do you think it is near future? Just any guess?

General RAY. Sir, I am not going to speculate on that. I will take your question for the record.

Senator TUBERVILLE. Thank you.

Senator KING. Thank you to all of our witnesses. Thank you for your open and frank discussion today, and for the work that you are doing for the country. With that, this hearing is adjourned.

[Whereupon, at 6:03 p.m., the Subcommittee adjourned.]

## APPENDIX A

Presenters: Leonor Tomero, Deputy Assistant Secretary of Defense (Nuclear and Missile Defense); Alexandra Bell, Deputy Assistant Secretary of State (Arms Control, Verification & Compliance); Takashi Watanabe, Asahi Shimbun; Ryo Takano, Asahi Shimbun

April 12, 2021

DASD Leonor Tomero Interview with Asahi Shimbun

STAFF: Thank you so much for joining. We have the deputy assistant secretary of state for the Bureau of Arms Control, verification and compliance, Alexandra Bell, as well as Deputy Secretary of Defense for Nuclear and Missile Defense Leonor Tomero on the line.

We are joined by Takashi Watanabe and Ryo Takano from Asahi Shimbun. And I believe we've got 20 minutes this afternoon, and we -- I believe that DAS Bell has a few opening remarks to begin with, and then we go ahead and get started.

So, DAS Bell, over to you, Ma'am.

DEPUTY ASSISTANT SECRETARY OF STATE ALEXANDRA BELL: Thank you, and -- and thank you so much for this opportunity to -- to talk with you today. As Secretary Blinken said during his visit to Tokyo last month, the U.S.-Japan Alliance remains the cornerstone of peace, and security, and prosperity in the Indo-Pacific region, and it has for more than six decades. The -- the Biden administration has really placed diplomacy back at the center of our foreign policy, and the United States and Japan are -- you know, will stand side by side against common threats and increasing geopolitical competition. And we're really looking forward to working hand in hand to advance our shared interests and values.

The Biden administration is also in the process of undertaking a series of policy reviews that will shape how we approach nuclear deterrence and arms control issues, and these reviews will involve consultations with Japan, as well as our other allies and partners. But, you know, in sum, we're committed to enhancing close coordination to align security policy, deepen defense cooperation across all domains, and bolster extended deterrence by consulting alliance roles, missions, and capabilities, just a general framework for what we're thinking on these -- these issues at this point.

STAFF: Thank you so much, Ma'am. All right. We will open up the floor for questions. And just a quick reminder that this interview was on the record, so Ryo and Takashi, over to you.

Q: Thank you very much. So, my name is Takashi Watanabe. I'm a former Washington correspondent. So, first of all, could you tell us your name when each of you answer to our questions so that we can distinguish speakers.

So, my first question is last month's interim national security strategy guidance mentioned we would take steps to the new -- the role of nuclear weapons in our national security strategy. So -- so how can Biden administration help (inaudible) national security strategy reduce the role nuclear weapon?

DEPUTY ASSISTANT SECRETARY OF DEFENSE LEONOR TOMERO: Yeah, this is Leonor Tomero, Deputy Assistant Secretary of Defense for Nuclear and Missile Defense



Policy. Yeah, so thank you so much for your question, and again thank you for taking the time today to -- it's a pleasure to be speaking with you.

So, as you noted that the goal of reducing the role of nuclear weapons was part of the interim national security strategy guidance, and -- and so we'll inform how we -- how we view and -- and address nuclear weapons as part of our review. Again, this is a broad goal. We haven't made any decisions on, you know, what -- what decisions that would drive and -- and what changes, if any, would -- would come out of it, but certainly that's a -- the objective of the President is to find ways to reduce the goal of nuclear weapons, and so we look forward to examining those issues as part of our Nuclear Posture Review.

Q: I see, thank you. So, President Biden promised (inaudible) election campaign to (inaudible) the U.S. excessive expenditure on nuclear arms. So, we are wondering if Biden administration will review nuclear modernization program.

DASD TOMERO: Yeah, and -- and my expectation, right, is that -- is the Nuclear Posture Review is a broad review of nuclear deterrence strategy and posture. And so, it'll include policy -- declaratory policy. It'll address ways to increase strategic stability, reduce the risk of miscalculation, ensuring that we maintain an effective and reliable nuclear forces. And so, as part of that review, expect that we will -- we will review our nuclear modernization programs, you know, to assess whether they're on track, you know, how -- how we're doing in terms of program deliverables, schedules, and so that -- that will be part of the review.

Q: Thank you. So could you elaborate, you know, how do the review our -- of the \$1.2 trillion nuclear modernization -- you know, \$1 trillion nuclear modernization program, you know, about the triad?

DASD TOMERO: Yeah, I mean, it's -- you know, it's the -- certainly, several programs are very costly programs, but nuclear deterrence continues to remain the number one priority for the Department of Defense. And so again, you know, the goal is to ensure that we maintain safe and reliable nuclear forces, and so we will be looking at -- at nuclear modernization to ensure that we maintain nuclear forces for a credible deterrent, and that we have the capabilities we need that deliver on time and on budget.

Q: Thank you. Are you going to review or, you know, costly program like GBSD?

DASD TOMERO: You know, I -- I expect we'll review several of the nuclear programs to look at schedule and priorities as -- as we embark on -- on the review. I mean, it'll be --

DAS BELL: Yeah, and this is --

DASD TOMERO: Yeah.

DAS BELL: I'm sorry.

DASD TOMERO: Sorry. And it'll be part of -- you know, it'll also be part of what the Department looks like -- looks at in terms of determining funding priorities as we go into our budget cycle for the fiscal year 2023.

DAS BELL: Yes, this is Deputy Assistant Secretary Bell. I'll -- I'll just, you know, note that you mentioned the line from the interim strategic

guidance, and it talked about reducing the role. But, you know, immediately sort of in that same that section, is the -- the idea that the United States will ensure strategic deterrent remains safe, secure and effective, and that our extended deterrence commitments to our allies remain strong and credible. You know, it's -- it's part of the same process, but nuclear risk reduction, you know, for this country and for our allies and for the world is a priority but -- you know, so is maintaining, you know, a safe, secure and effective deterrent.

And -- and as far as your audience is concerned, the U.S. commitment to the defense of Japan is unwavering and involves the full range of U.S. capabilities, including nuclear weapons. In particular, we value the U.S.-Japan extended deterrence dialogues as a forum for frank and -- and open discussions on how the alliance can maintain and strengthen deterrence in these difficult times. So, we're actively actually working with the government of Japan to hold our next EDD. And the forum will be one through which we can consult deeply on these very issues you were asking about, U.S. nuclear policy and how we can adopt deterrence to evolving threats.

DASD TOMERO: Yeah, and I'll -- I'll add to that again the reviews have not started. We plan to -- to take a look at nuclear posture, but also missile defense -- conduct a missile defense review. So again, these reviews have not started and that we fully planned to consult with our allies, including Japan, as we begin these reviews, right, because I -- you know, as Deputy Assistant Secretary Bell mentioned, you know, maintaining and strengthening our extended deterrence assurances will be one of the key priorities as we move forward.

Q: Yeah.

DASD TOMERO: And I'll go back to your --

Q: I think (inaudible) --

DASD TOMERO: -- sorry your -- your question earlier about reducing the role of nuclear weapons, I mean, that's not a new policy goal, right? The -- the Obama administration also had that same policy goal, so it's really viewing as a -- as a continuation, I think, of democratic priorities, but again I just want to ensure that -- you know, that there's no misunderstanding that providing credible extended deterrence, including with our nuclear forces to Japan and -- and our allies will -- will remain one of the highest priorities for us.

Q: So, I think Ryo has a question.

Q: Hello, this is Ryo speaking. Thank you for the answers. And can I ask you the other way like could you give me the evaluation of the nuclear policy of the Trump administration, and like what kind of change can we expect in your upcoming NPR compared to the one from the Trump administration?

DASD TOMERO: Yeah, so this is Leonor Tomero again. You know, again every administration comes in -- since the Clinton administration, right -- has done a review of -- of its nuclear policy, so this is pretty standard practice for any new administration. And I would expect the review to provide some continuity and some change from where we've been.

I think what -- what you saw in the 2018 Nuclear Posture Review, you know, again reflected some continuity from the Obama Nuclear Posture Review in 2010, you know, focusing again on the importance of extended deterrence, on engaging allies, the importance of nuclear modernization, the importance of nuclear

command and control. But -- but I think what you've also saw was a recommendation for new capabilities in response to a perceived deterrence gap.

And so, you know, as we start this review, you know, we'll -- we will take a look at what the security environment is and -- and -- and ways to increase strategic stability, reduce the risk of miscalculation. And so those -- that posture and policy will inform the capabilities and -- and strategy.

Q: Thank you very much. So, my next question is about the declaration policy. So, I -- I'm wondering if our Biden administration is considering to declare no first-use (inaudible)?

DASD TOMERO: Yeah, well, I -- what I can tell you right is -- is what -- you know, what's been said publicly. And, of course, President Biden has engaged on these issues in the past when he was vice president in 2017, it was also part of the campaign platform, so I fully expect that declaratory policy will be reviewed and looked at as -- as part of our reviews. But again, you know, again that will be part of the analysis and the review and -- and no decision has been made yet. But -- but I -- you know, I think the sense is -- is it -- is it time and are the conditions right for changing declaratory policy?

Q: So, what is the -- the challenge, you know, like including the -- you know, allied concerns, including Japan?

DASD TOMERO: Yeah, I mean, that's -- you know, that's certainly going to be one of the top priorities is sitting down and -- and listening to what allies have to say, what their concerns are, how -- you know, what might be done to improve and make assurances more credible, and -- and maintain strong extended deterrence. And so, sitting down and -- and conducting consultations with allies, including Japan as one of our closest ally, will be one of the first orders of business.

Q: So next is the --

DAS BELL: Yeah, this is Alex -- sorry, this is Alex Bell. I -- I, you know, will just reiterate what DASD Tomero said and, you know, that this is part of an overall review process of -- of policies, really from stem to stern, related to national security and, you know, of which declaratory policy is one. But the administration has made it very clear that we're going to be talking to, listening to allies as we review all of these policies. And, you know, so the -- the discussion will, you know, be quite broad-based and, you know, we'll -- we'll go forward making sure that we're taking into account concerns and -- and concepts that allies want to discuss.

Q: I see. So next is, quickly, on the prohibition of the nuclear weapon, TPNW do came into force on January 22nd. So could you tell us Biden administration's view -- views on that? And how should we -- should we -- can you bridge the gap between NPT and TPNW, the whole NPT Review Conference this summer?

DAS BELL: Well, the United States understand and shares the desire to advance disarmament goals, and we're committed to those goals. We don't believe the treaty on the prohibition of nuclear weapons is the right way to go about that, but we understand, because we have these shared goals, we'd like to, you know, prioritize what we do agree on.

The entry into force of TPNW, you know, we don't think changes the legal obligations of states not party to the treaty, that's including the United States. And, you know, it won't have an impact on U.S. nuclear weapons policy or our extended deterrence relationships, but we would like to really focus on what are our -- our common goals are. And the -- the strengthening and support of the NPT is a -- is a top priority for the administration, and we'd like people to focus their energies on how we can do that if the RevCon goes forward in August or at -- at some future date. You know, we really want to be prioritizing, you know, the NPT, you know, given its place as -- as sort of the -- the cornerstone of arms control and nonproliferation architecture writ large. And we'd like to focus there.

Q: Okay. So -- and, you know, President Biden issued a statement on the 75 anniversary of the Hiroshima last year, so I want to bring us closer to a world without the nuclear weapons. So could you elaborate what -- could you elaborate about the concrete (inaudible)? And I'm wondering if President Biden would consider to visit Hiroshima again or another party for the first time as a U.S. president during the past time (inaudible)?

DAS BELL: As you're very aware, President Obama was able to visit Hiroshima and -- and, you know, made a, you know, quite compelling and -- and I think poignant speech that I -- I hope people, you know, will continue to read. But the State Department doesn't have any, you know, announcements to make on -- on upcoming travel plans. And -- and when it comes to the -- the President's schedule, I would -- I would have to, unfortunately, refer you to the White House for comment on that.

But, you know, as we've seen throughout President Biden's, you know, career, you know, focus on and -- and support for reducing nuclear threats has been something that -- that he's championed throughout his career. And -- and as you saw in the interim strategic guidance, clearly, you know, the point was made that -- that the United States is going to, you know -- you know, push a leadership role on arms control. And -- and -- and we'll do that, you know, in every forum possible, you know, really trying to reduce nuclear threats to the U.S., to the allies, to the world as much as we possibly can.

Q: So, we'll -- I was wondering if Biden administration is waiting to bring us closer to the world without the nuclear weapons.

DAS BELL: You know, this is actually a long-standing, you know, U.S. principle that -- that's really, you know, carried throughout the nuclear age. And, you know, the -- the -- the goal of the eventual elimination of nuclear weapons, I -- I think, has -- has carried through multiple administrations, including the previous administration.

Q: I think Ryo has a question.

Q: All right. Hi, this is Ryo speaking. Actually, the Prime Minister of Japan is visiting the White House next week. So do you have any idea whether you are discussing the threat of nuclear issue with Japan in the coming days?

DAS BELL: I -- I -- again, I, unfortunately, can't speak for the White House and -- and their plans and agenda for the President. But I -- you know, as -- as, you know, we've kind of gone over today the, you know, the U.S. commitment to the defense of Japan is unwavering. They're in -- you know, it's a subject we'll continue to engage with the Japanese government and, you know, at every level.

DASD TOMERO: Yeah, and I'd say I seek also, right, my -- my sense is that the -- the message should be clear, right, that the -- the stop and the visit to Japan was the first trip abroad for both Secretary Austin and Secretary Blinken, you know, and that reflects a very close and important alliance between the United States and Japan. And so, you know, I expect them to continue the conversation that was started during that trip and to, you know, reiterate the U.S. commitment to -- to defending Japan to prioritizing extended deterrence and -- and deepening cross-domain cooperation, including space and cyber. And again, you know, addressing emerging threats internationally and in the region.

STAFF: Apologies for the interruption, we've got time for one more question.

Q: Yeah, Okay. So -- so again, you know, our Japanese government, you know, has a concern about the -- the no first use policy or sole purpose declaration. So -- so are you -- are you planning to discuss this issue during the committee meeting?

DASD TOMERO: Again, I -- you know, I -- I don't know what the agenda is for discussions for the meeting, and so, you know, I'll leave it at that, but again reiterating, you know, the U.S. very strong commitment to the defense of Japan.

STAFF: Thank you very much. I know that our -- our speakers have a tight schedule this afternoon, but I do want to just offer the opportunity for either DASD Tomero or DAS Bell to offer any final thoughts --

STAFF: -- for today.

Q: Thank you very much. Thank you very much for your time.

DASD TOMERO: Yeah, yeah, thank you. Yeah, thank you very much for the opportunity. Appreciate it.

DAS BELL: Yeah, thank you.

-END-



**DEPARTMENT OF DEFENSE AUTHORIZATION  
REQUEST FOR FISCAL YEAR 2022 AND THE  
FUTURE YEARS DEFENSE PROGRAM**

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**WEDNESDAY, MAY 19, 2021**

UNITED STATES SENATE,  
SUBCOMMITTEE ON STRATEGIC FORCES,  
COMMITTEE ON ARMED SERVICES,  
*Washington, DC.*

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

The Committee met, pursuant to notice, at 5:06 p.m. in room SR-232A, Russell Senate Office Building, Senator Angus King (presiding) Chairman of the Subcommittee.

Committee Members present: Senators King, Rosen, Kelly, Fischer, Rounds, and Sullivan.

**OPENING STATEMENT OF SENATOR ANGUS KING**

Senator KING. I foolishly thought a 15-minute Senate vote would take 30 minutes. It actually took 50 minutes, and I apologize for that naïve assumption on my part.

This is hearing on the Department of Energy's atomic defense activities and programs in review of the Defense Authorization Request for Fiscal Year 2022. First I want to thank the witnesses for appearing at today's hearing on your defense-related programs to maintain our nuclear weapons stockpile, design the reactor to power our Navy's nuclear fleet, and clean up former Cold War defense production sites.

Dr. Verdon, you are representing the NNSA. You are undertaking the modernization of five warhead systems to meet Department of Defense requirements. This has put a tremendous strain on your production plants, and at the same time you are rebuilding the infrastructure required to handle nuclear and related materials, which, in some cases, dates to the Manhattan Project.

There are single point-of-failure risks to our deterrent. I want you to explain to the Subcommittee how you are managing these programs and their key risks.

Admiral Caldwell, you uphold a lineage dating back to Admiral Rickover to design and build power reactors for our Navy's aircraft carriers and submarine fleet, including the *Columbia*-class ballistic missile submarine whose fuel will last over 40 years, the life of the boat. Like Dr. Verdon, I would like you to explain to the Committee

the challenges you face, especially in rebuilding nuclear infrastructure to support the Navy's operational fleet.

Finally, Mr. White, you have perhaps the hardest job in the Department of Energy, which is the cleanup of former Cold War nuclear production sites. At the Hanford site in Washington State alone, you are responsible for 55 million gallons of radioactive waste and 177 underground storage tanks, some of which are leaking. I will want to know from you what the Department is doing to meet the commitments it has made to the communities in the region to clean up these sites.

Again, let me thank everyone for appearing today. After Senator Fischer's opening statement each witness will have 5 minutes for their opening statements and then we will alternate with Members present for 5-minute rounds of questions.

Senator Fischer?

#### **OPENING STATEMENT OF SENATOR DEB FISCHER**

Senator FISCHER. Thank you, Mr. Chairman, and thank you to our witnesses today.

One point that I always find interesting is that the witnesses before us today represent about 75 percent of the Department of Energy's budget, and yet the important roles the Department of Energy and the NNSA, in particular, play in supporting our nuclear enterprise is often overlooked.

But their contributions are absolutely vital. As nuclear posture reviews of the last two administrations have affirmed, a modern and responsive nuclear infrastructure is absolutely necessary to support our nuclear deterrent.

While progress has been made toward achieving this goal, significant challenges remain, and like the Department of Defense's modernization efforts, there is simply no margin for additional delay. As Admiral Richard noted earlier this year, the consequences of failing to modernize our infrastructure are immense. In his testimony, he stated, quote, "If the Nation does not continue to address these concerns, no amount of money will be able to adequately mitigate operational risks associated with key stockpile and infrastructure capability losses," end quote.

That is a powerful statement, and it reflect the Department of Energy's importance to our national security. So, gentlemen, I thank you for the vital work that you each do and for appearing before us today, and I look forward to your testimony.

Thank you, Mr. Chairman.

Senator KING. Mr. Verdon?

#### **STATEMENT OF HONORABLE CHARLES P. VERDON, ACTING ADMINISTRATOR, NATIONAL NUCLEAR SECURITY ADMINISTRATION**

Dr. VERDON. Chairman King, Ranking Member Fischer, and Members of the Subcommittee, thank you for the opportunity to testify today. On behalf of the men and women of the nuclear security enterprise I express our appreciation for this Subcommittee's strong support, bipartisan support, for NNSA's nuclear security mission, as demonstrated most recently in the fiscal year 2021 Na-



tional Defense Authorization Act and the fiscal year 2021 budget for the Department of Energy.

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

Senator KING. Without objection.

Dr. VERDON. So we meet today against the backdrop of a world marked by growing security challenges. China and Russia are modernizing their nuclear arsenal, investing significantly in resources and delivery platforms, and have made clear that nuclear weapons will be a vital element of their state craft.

At the same time, the risk for proliferation of nuclear weapons and weapons of mass destruction pose profound and existential dangers. Recognizing these global security challenges, the President's Fiscal Year 2022 Discretionary Funding Request for NNSA reflect support for the three enduring missions which Congress charged the NNSA in the year 2000: ensuring the safety, security and effectiveness of the U.S. nuclear 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 that are critical to the U.S. national security and our allies.

NNSA continues to focus on ensuring the safety, security, and military effectiveness of the U.S. nuclear stockpile. Our alignment and synchronization with the Department of Defense, coordinated through the Nuclear Weapons Council remains essential and continues to improve. The Fiscal Year 2022 Discretionary Funding Request enables NNSA to execute its warhead modernization and infrastructure modernization efforts begun under the Obama administration.

The administration is beginning its undertaking of a formal review of the efforts to modernize our nuclear deterrent to include the DOD delivery platforms, the nuclear weapons required for those platforms, and the NNSA infrastructure needed to produce and maintain those weapons. Regardless of the review's specific findings, so long as we retain a nuclear arsenal we must have the infrastructure and the science, technology, and engineering to produce and maintain the nuclear weapons stockpile.

Unfortunately, the NNSA production infrastructure has atrophied considerably, both in terms of the physical infrastructure and the capabilities needed within those facilities. Continued recapitalization is an imperative. The potential impacts to the U.S. deterrent, if not addressed, are no longer over the horizon. They have become visible.

Key also are attracting and retaining the personnel needed to continue to ensure our stockpile remains safe and effective and to operate and maintain NNSA facilities safely and securely. As NNSA mission scope increases, so does the demand for increased personnel to execute the missions to include supporting new facilities and capabilities brought online and moving to 24/7 operations at many sites across the complex.

In addition our mission to ensuring continued effectiveness of the nuclear stockpile, nonproliferation also remains an important and growing priority. NNSA's Office of Defense Nuclear Nonprolifera-

tion is critical to implementing the President's call to "lock down fissile and radiological materials around the world." The Fiscal Year 2022 Discretionary Funding Request enables NNSA's Office of Defense Nuclear Nonproliferation to continue to work worldwide with our partners to prevent states and non-state actors from developing nuclear weapons or acquiring weapons-usable nuclear or radiological materials, equipment, technology, and expertise.

With regards to our third mission of providing nuclear propulsion for the United States Navy, the Office of Naval Reactors remains at the forefront of technological development 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 warfighting capabilities. Again, the discretionary budget put forth for fiscal year 2022 supports the Office of Naval Reactors to continue their programs that are so vital to our security of our Nation and our allies.

Then finally, despite the challenges posed by the COVID-19 pandemic, I am pleased to report that NNSA did not miss a single milestone or DOD requirement during this period. This achievement is a testament to the professionalism of the NNSA's world-class workforce and the leadership of our sites and their deep commitment to our national security missions.

So I thank you again for the strong support of this Committee and the opportunity to testify before you today, and I stand ready to answer any questions you have.

[The prepared statement of The Honorable Dr. Charles P. Verdon follows:]

#### PREPARED STATEMENT BY STATEMENT OF THE HONORABLE DR. CHARLES P. VERDON

Chairman King, Ranking Member Fischer, and Members of the Subcommittee, it is an honor to appear before you, on behalf of Department of Energy's (DOE) National Nuclear Security Administration (NNSA), with my colleagues William "Ike" White and Admiral James "Frank" Caldwell. NNSA greatly appreciates the Subcommittee's bipartisan support for our nuclear security missions.

NNSA is committed to supporting the President's national security strategy. The President's Fiscal Year 2022 Discretionary Funding Request reflects the U.S. commitment to maintain a safe, secure, and effective nuclear weapons stockpile, reduce global nuclear threats, and provide the U.S. Navy's submarines and aircraft carriers with militarily effective nuclear propulsion. NNSA is on track to modernize the nuclear stockpile with our life extension and alteration programs; make substantial progress on maintaining, repairing, and recapitalizing NNSA's deteriorating infrastructure; provide policy and technical leadership to address all aspects of the nuclear threat reduction mission; and deliver nuclear propulsion that meets the U.S. Navy's operational requirements.

The U.S. nuclear deterrent is the foundation of our national defense, and its credibility serves as the ultimate insurance policy against a nuclear or large-scale conventional attack. We must contend with the reality of renewed peer competition, which is creating new threats. The world is in a moment of many global challenges. China and Russia are modernizing their nuclear arsenals, and the risk of proliferation of nuclear weapons and other weapons of mass destruction pose profound and existential dangers. In the face of these challenges, it is our most solemn obligation to protect the security of the American people. The United States must be responsive to the increasing desire for state and non-state actors to reshape the world in their favor at the expense of our Nation, allies, and partners, and at times in contravention of international norms.

#### A CHANGING THREAT ENVIRONMENT

The Fiscal Year 2022 Discretionary Funding Request enables NNSA to execute its long-standing nuclear modernization efforts begun under the Obama-Biden Admin-

istration while this Administration undertakes its formal review of efforts to modernize our nuclear deterrent, to include Department of Defense delivery platforms, the nuclear weapons required for those platforms, and the NNSA infrastructure needed to produce and maintain those weapons. This will preserve space for future policy decisions related to nuclear modernization, nuclear nonproliferation and counterterrorism, and naval reactors as the Administration adjusts to the changing international threats facing America. Russia, China, and our adversaries should make no mistake—America will do whatever is necessary to deter our enemies and provide stability in our strategic relationships with allies and partners.

The U.S. nuclear weapons stockpile is currently safe, secure, and militarily effective. However, the legacy stockpile systems are aging, and NNSA's production infrastructure has atrophied considerably. America must invest in the weapons and infrastructure modernization programs to provide the capabilities needed to ensure the deterrent's viability into the future. Future American political leaders will not have the weapons and infrastructure in place to support the nuclear arsenal unless we reestablish that capability now.

The need to modernize the nuclear weapons stockpile and recapitalize the supporting infrastructure needed to produce and maintain that stockpile has reached a tipping point. Approximately 60 percent of NNSA's facilities are more than 40 years old and more than 50 percent are in poor condition. Assessments of facilities throughout the enterprise have identified numerous single-point failures. Production capabilities allowed to lapse are needed once again and reestablishing these capabilities is both a priority and a challenge. If not appropriately addressed, the age and condition of NNSA's infrastructure will put at risk NNSA's missions, and the safety of its workforce, the public, and the environment.

With support from the Administration and Congress, NNSA is undertaking a risk-informed, complex, and time-constrained modernization and recapitalization effort. To do so, NNSA must rely on its own industrial base within its nuclear security enterprise for some critical processes and parts, in addition to using commercial industry. NNSA manages eight government-owned, contractor-operated organizations throughout the country focused on the nuclear security enterprise. This includes national security laboratories, production plants, and sites that perform the research, development, production, and dismantlement necessary to maintain and certify a safe, secure, reliable, and effective nuclear stockpile.

NNSA's unique and specialized capabilities also extend to global nonproliferation efforts. NNSA's Office of Defense Nuclear Nonproliferation (DNN) supports future arms control negotiations with well researched, tested, and evaluated technologies that strengthen confidence in verification of treaty obligations. DNN's unique capabilities are critical to America's national security and welfare, working worldwide to prevent state and non-state actors from developing nuclear weapons or acquiring weapons-usable nuclear or radiological materials, equipment, technology, and expertise.

In addition, the U.S. Nuclear Navy remains second to none, largely because Congress and the American people have strongly supported and invested in the Office of Naval Reactors, which is responsible for the U.S. Navy's nuclear propulsion work. Nuclear propulsion for the U.S. Navy's fleet of submarines and aircraft carriers is critical to the security of the U.S. and its allies, as well as the security of global sea lanes.

#### COVID-19

I am pleased to report NNSA did not miss a single major milestone or Department of Defense (DOD) requirement because of the COVID-19 pandemic. We completed our mission while ensuring the health and safety of the workforce during the global pandemic. It is a testament to the dedication of the men and women of the nuclear security enterprise that NNSA met its major deliverables and reflects our deep commitment to protecting America's national security.

NNSA accomplished this by adopting a policy of maximum telework and social distancing to safeguard the health and welfare of the workforce, while also identifying mission-critical activities that could not be performed remotely. NNSA worked with its M&O contractors to set priorities and relied on them to make decisions based on the local situation, input from health officials, and regulations to protect their workforce.

#### WEAPONS ACTIVITIES

##### *Stockpile Management*

NNSA's Office of Defense Programs, in coordination with the DOD, has supported the nuclear deterrent for almost 30 years without the need for additional nuclear

explosive testing. In fiscal year 2021, the science-based Stockpile Stewardship Program allowed the Secretaries of Energy and Defense to certify to the President for the 25th consecutive year the nuclear weapons stockpile remains safe, secure, and militarily effective. This remarkable scientific achievement is made possible through the expertise of NNSA's world-class scientists, engineers, and technicians, and prior investments made in the necessary infrastructure and tools.

The B61-12 Life Extension Program (LEP) consolidates four variants of the B61 gravity bomb and improves the safety and security of a weapon that first entered service in 1966. Currently in Phase 6.5, First Production Unit, the B61-12 LEP has achieved first production on most of its components and will achieve the system's first production unit (FPU) in the first quarter of fiscal year 2022.

The W88 Alteration (Alt) 370 supports the sea-based leg of the nuclear triad and is currently in Phase 6.5 with a system FPU date on track for the fourth quarter of fiscal year 2021. Nearly all major components have completed their respective FPUs.

The W80-4 LEP is currently in Phase 6.3, Development Engineering, in support of the U.S. Air Force Long Range Standoff (LRSO) program. fiscal year 2022 will see a planned ramp-up of production development and design activities as the program transitions to Phase 6.4, Production Engineering.

The W87-1 Modification Program will replace the aging W78-0 warhead. NNSA has planned first production in fiscal year 2030 to support fielding on the Ground-Based Strategic Deterrent ballistic missile system in the Mk21A reentry vehicle. The program will deploy new technologies that improve safety and security and improve manufacturability. Efforts in the next fiscal year will focus on completion of the Weapon Design and Cost Report, conducting an independent cost estimate, and entry into Phase 6.3.

The W93/Mk7 is a new program of record authorized by Congress in fiscal year 2021 and was established to meet DOD requirements. Starting the W93 program in fiscal year 2021 ensured coordinated development of the warhead along with the Navy's Mk7 aeroshell program. The W93 will incorporate modern technologies to improve safety, security, and flexibility to address future threats, and will be designed for ease of manufacturing, maintenance, and certification. All the key nuclear components will be based on previously tested nuclear designs and will not require underground nuclear explosive testing to certify. Fiscal year 2022 will focus on completion of Phase 1 activities and entry into Phase 2, Feasibility Study and Design Options.

#### *Production Modernization*

The Production Modernization program focuses on the production capabilities of nuclear weapons components critical to weapon performance, including primaries, secondaries, radiation cases, and non-nuclear components. Activities within this program support the Primary Capability Modernization, Secondary Capability Modernization, and Non-Nuclear Component Modernization programs.

Primary Capability Modernization includes the plutonium program and the high explosives and energetics programs. NNSA urgently needs to recapitalize our plutonium pit production fabrication capabilities to support our weapons modernization programs, as high explosive and energetic materials are required for every weapon system in the stockpile and are also under increasing demand.

NNSA's priority infrastructure need is reestablishing a modestly sized production capacity for plutonium pits. This summer, efforts will focus on advancing the Savannah River Plutonium Processing Facility through the Critical Decision (CD) process from CD-0 (Mission Need) to CD-1 (Alternative Selection and Cost Range) and beginning the process toward CD-2 (Performance Baseline) 90 percent design complete. At Los Alamos National Laboratory (LANL), the Los Alamos Plutonium Pit Production Project achieved CD-1 in April 2021 and work has begun on developing the 90 percent design package needed for CD-2. This two-site approach is necessary to re-establish the Nation's ability to produce plutonium pits in support of defense requirements, and to provide needed resiliency against unplanned outages.

Secondary Capability Modernization includes our Uranium, Depleted Uranium, Lithium, Tritium, and Domestic Uranium Enrichment programs. All these programs support the nuclear stockpile and face infrastructure and lapsed capability concerns. NNSA is continuing its progress on the Uranium Processing Facility (UPF), which remains on budget. UPF construction will support 2,500 good-paying jobs in 2022 and 1,100 jobs in 2023. NNSA is also working with its partners to increase production of tritium and is in the early phases of designing the Tritium Finishing Facility (TFF), to replace a 1950s-era facility. The United States no longer maintains a lithium purification capability and relies on material recycling as its main source, which will be exhausted soon. These operations currently take place in a World War

II-era building well beyond its design life, putting both operators and processing at risk. NNSA plans to modernize lithium purification and processing operations in a new Lithium Processing Facility (LPF) built to modern standards.

Non-Nuclear Capability Modernization includes programs to modernize production of non-nuclear components for multiple weapon systems. Non-nuclear components are a significant portion of the costs for the warhead modernization programs due to the number of parts, complexity, and testing required to establish confidence the components will continue to function over the required 20- to 30-year lifetime.

This ongoing successful capital project implementation is advancing at a critical time. As Commander Admiral Charles Richard from U.S. Strategic Command recently testified, “We simply cannot continue to indefinitely life extend Cold War left-over systems...and successfully carryout our national strategy. A particular concern is the aging nuclear weapons stockpile and supporting infrastructure and we can reach a point where no amount of money will adequately mitigate the operational risks the Nation will face due to infrastructure and human talent capability losses.” Put another way: time is money. Continued recapitalization is imperative, otherwise there will be a point at which no amount of money will be able to mitigate the operational risks and losses to infrastructure capabilities that accrued over time.

#### *Stockpile Research, Technology, and Engineering (SRT&E)*

SRT&E provides the data and tools that underpin science-based stockpile decisions, including the knowledge and expertise needed to maintain confidence in the nuclear stockpile without the need for additional underground nuclear explosive testing.

SRT&E covers many critical programs for the nuclear security enterprise.

The Enhanced Capabilities for Subcritical Experiments (ECSE) will produce experimental data enabling assessment of the current stockpile and certification of the future stockpile, minimizing the future need to return to nuclear testing. This capability is needed to help underpin confidence in the certification of the W80-4 LEP, W87-1 Modification, and future warhead acquisition programs.

The Exascale Computing Initiative (ECI) will provide NNSA with next-generation simulation capabilities to support weapons design, warhead assessment and certification, and continued development of the underpinning science needed to support the nuclear stockpile long-term. NNSA remains on track to accept and operate NNSA’s first Exascale high performance computing system for program use in 2023.

The Inertial Confinement Fusion (ICF) program provides high energy density (HED) science capabilities and expertise to provide the data needed to advance warhead performance and production science, and to inform design choices for warhead acquisition programs. In addition, activities like the pursuit of ignition provide not only important scientific understanding, but a unique training environment for the workforce.

These programs, along with our advanced computing and simulation, technology maturation, academic programs, and other SRT&E missions are essential to maintaining our confidence in the stockpile.

NNSA provides significant investment in grants and cooperative agreements with top universities across the country every year, through programs such as the Stewardship Science

Academic Alliances Program and the Minority Serving Institution Partnership Program (MSIPP) to recruit the next generation of scientists and engineers for our nuclear security enterprise, and to conduct cutting-edge science in national security and nonproliferation. In support of the President’s effort to eliminate inequities in Science, Technology, Engineering, and Math (STEM), MSIPP’s mission is to create and foster a sustainable STEM-pipeline that prepares a diverse workforce of world-class talent through strategic partnerships between Minority serving Institutions and the nuclear security enterprise.

#### INFRASTRUCTURE AND OPERATIONS

NNSA’s infrastructure needs are greater than the production complex. NNSA’s infrastructure includes office buildings, light laboratories, emergency operations centers, fire houses, roads, utilities, and the specialized equipment used to support our missions. Infrastructure is the foundation that supports all NNSA missions. Modern, efficient, sustainable, and resilient infrastructure is needed for the nuclear deterrent, nonproliferation, counterterrorism, emergency response, leading-edge research, and solving the climate crisis. NNSA’s mission execution is threatened by deteriorating facilities built during the Manhattan Project and Cold War eras. Today, nearly 60 percent of NNSA’s \$116 billion worth of real property infrastructure is beyond its design life, half of all facilities are in poor condition, and the average age of NNSA’s facilities is 47 years old.

NNSA infrastructure must be resilient and provide the capabilities and capacities for executing its vital national security missions into the future. This requires an array of complementary strategies, including minor and major construction projects, short-term leasing, purchases, and timely disposition of excess facilities. We must modernize and upgrade antiquated infrastructure and address safety and programmatic risks through strategic, risk-informed investments that directly support our nuclear weapons and nonproliferation programs.

Also, key are the personnel needed to safely and securely operate and maintain all NNSA facilities. As NNSA mission scope increases, so does the demand for increased personnel to support new facilities and capabilities being brought on-line, and to support moving to 24/7 operations at many sites across the complex. These individuals are essential to minimizing unplanned outages and to supporting safe and secure operations, particularly in high hazard operations.

#### *Defense Nuclear Security Efforts*

The Office of Defense Nuclear Security's (DNS) primary mission is protecting the facilities, people, and assets that are critical to achieving NNSA's important national security missions. While NNSA faces challenges replacing and refreshing aging physical security infrastructure, it is making key investments to recapitalize this infrastructure through the Security Infrastructure Revitalization Program. Increased security requirements are associated with growth across the nuclear security enterprise, including plutonium pit production efforts. DNS is focused on countering the threat posed by unmanned aircraft systems and aims to complete the installation of counter unmanned aircraft systems at Y-12, the Pantex Plant, and the Nevada National Security Site.

#### *Enhancing Cybersecurity*

Information Technology and Cybersecurity enable every element of NNSA's missions. To meet future requirements, NNSA must modernize its outdated and legacy technology. NNSA must undertake activities and projects that will improve the security of NNSA networks and data, including recapitalizing and modernizing aging infrastructure, executing the IT modernization strategy, and stabilizing inherited legacy networks, systems, and applications and finally, the Emergency Communications Network (ECN). In addition to modernizing legacy networks, NNSA is looking ahead at emerging technologies, which has propelled the convergence of IT and Operational Technology. As NNSA mission requirements expand in scope, IT and cyber programs require modernization, expansion, and innovation in a commensurate fashion. Cybersecurity is a defense and deterrence mechanism and a powerful tool. In the current threat environment, NNSA cannot afford to neglect its cybersecurity capabilities, which serve as frontline assets that protect the information, systems, and networks on which NNSA depends to execute its mission.

#### DEFENSE NUCLEAR NONPROLIFERATION

NNSA's Office of Defense Nuclear Nonproliferation (DNN) is critical to implementing the President's call to "lock down fissile and radiological materials around the world." DNN works worldwide with our partners to prevent state and non-state actors from developing nuclear weapons or acquiring weapons-usable nuclear or radiological materials, equipment, technology, and expertise. Around the globe, DNN has eliminated the need for weapons-usable material at over 100 civilian sites and removed over 7,200 kilograms of highly enriched uranium (HEU) and plutonium from almost 50 countries, achieving permanent threat reduction. DNN's unique capabilities are critical to America's national security and welfare: from promoting and supporting International Atomic Energy Agency (IAEA) safeguards agreements internationally; to supporting diplomatic arms control efforts such as the successfully extended New START treaty with Russia; to partnering with U.S. industry to support non-HEU based production of the vital medical isotope molybdenum-99, which is used in 40,000 procedures every day in the United States.

#### *Nuclear Terrorism and Incident Response*

NNSA's Nuclear Counterterrorism and Incident Response (NCTIR) includes two subprograms: *Emergency Operations* (EO) and *Counterterrorism and Counterproliferation* (CTCP).

EO provides both the structure and processes the Department uses to prevent, prepare for, respond to, recover from, and mitigate all-hazards emergencies that threaten life and property. In addition, EO provides the framework for building, assessing, and improving organizational resilience to ensure uninterrupted performance and delivery of the Department's Essential Functions under any circumstance.

CTCP provides capabilities to counter and respond to nuclear incidents and accidents worldwide. The foundation of NNSA's diverse missions is an unparalleled command of nuclear science, which is harnessed to understand and contend with global nuclear threats. CTCP's expertise influences a wide range of policies to keep nuclear material beyond the reach of terrorists, including security standards for the storage and transport of such material. The office shares knowledge of nuclear and radiological threats with federal, state, local, and international partners by conducting training, exercises, and information exchanges to strengthen emergency preparedness and response. CTCP also develops tools to impede the efforts of proliferant states to obtain nuclear capabilities.

CTCP manages the Nuclear Emergency Support Team (NEST), a cadre of on-call technical specialists who are trained and equipped to respond to all manner of nuclear events. Notable NEST capabilities include mobile teams that can search for nuclear devices and technical personnel whose knowledge of nuclear weapons is used to characterize and defeat such threats. NEST features nuclear forensics capabilities to identify the origin of nuclear material outside of regulatory control or used in a threat device, allowing the United States to credibly threaten retaliation against any state that facilitates an act of nuclear terrorism, constituting an important element of the U.S. deterrence strategy.

#### NAVAL REACTORS

The Office of Naval Reactors 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 warfighting capabilities. Naval Reactors has given the United States unmatched reach with an unparalleled record of over 169 million miles safely steamed on nuclear power and over 7,300 reactor-years of operation.

Naval Reactors' has three major projects—*Columbia*-class reactor plant development, the refueling overhaul of a research and training reactor in New York, and the construction of the Naval Spent Fuel Handling Facility in Idaho. Naval Reactors is committed to supporting the operational nuclear fleet, continue research and development efforts for future generations of nuclear-powered warships, and make progress on both the recapitalization of laboratory facilities and the environmental remediation of legacy responsibilities.

#### NNSA WORKFORCE

NNSA cannot accomplish its mission without recruiting, training, and retaining a highly technical Federal and M&O workforce. In addition to the Federal and M&O workforce, NNSA's success depends on leveraging all parts of American society to bring the best quality ideas, products, and solutions to our shared challenges. NNSA relies on American businesses and labor to execute our national security programs. NNSA provided over \$3.5 billion in funding for contracting opportunities with small businesses and over \$789 million to socially and economically disadvantaged businesses in 2020. This created many high-paying, quality jobs for areas of the country where increased employment opportunities for disadvantaged communities are greatly needed. These investments demonstrate that NNSA's national security missions provide opportunities for all Americans—in fact, our mission success depends on them.

#### 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. NNSA appreciates the many years of bipartisan support from this Committee to our mission and looks forward to continuing to earn that support into the future.

Senator KING. Thank you, Dr. Verdon. Mr. White?

#### **STATEMENT OF MR. WILLIAM WHITE, ACTING ASSISTANT SECRETARY OF ENERGY FOR ENVIRONMENTAL MANAGEMENT**

Mr. WHITE. Chairman King, Ranking Member Fischer, and Members of the Subcommittee, it is an honor to appear before you today.

As the largest environmental cleanup program in the country, the Department of Energy's Office of Environmental Management is committed to cleaning up to the legacy of the national defense

programs that helped end World War II and the Cold War. Even as we grappled with the COVID pandemic, 2020 represented an inflection point for the EM mission. The dedication and resiliency of the workforce, composed of Federal and contractor employees, resulted in a ramp-up in transformational tank waste capabilities, historic skyline changes, and a continued shrinking cleanup footprint.

EM achieved a first by completing removal of a former uranium enrichment complex at Oak Ridge in Tennessee. The last major component of the tank waste cleanup system at Savannah River was completed, accelerating our ability to tackle a key environmental risk there.

Our work was completed at the Tonopah Test Range in Nevada and at Separations Process Research Unit in New York, enabling this land to be transferred from EM.

EM has entered an era of progress built on the accomplishment of our workforce. Across this new era, EM is well positioned to protect the environment, support broader national security missions, and prepare for the future.

Radioactive waste stored in underground tanks at Hanford, Savannah River, and Idaho is among the largest environmental challenges and risks facing the Department. After decades of preparation and support from Congress, and with construction of facilities required for the Direct Feed Low Activity Waste approach complete, Hanford is poised to begin tank waste treatment in December of 2021.

In South Carolina, the tank waste mission is accelerating through operation at both the Salt Waste Processing Facility and the Defense Waste Processing Facility.

In Idaho, we are working toward startup of the Integrated Waste Treatment Unit, which will treat the remaining sodium barium liquid radioactive waste there over the next decade.

EM is also focused on decontamination and decommissioning of excess contaminated facilities across the complex. We have made significant progress this year with the demolition of the Biology Complex facilities at Y-12, and preparations and work are underway on similar efforts at Oak Ridge National Laboratory, Lawrence Livermore, Lawrence Berkeley, and other sites. This important effort reduces risk and it also benefits the broader national security and scientific research missions.

Modernization efforts are also underway at the Waste Isolation Pilot Plant to equip the facility to meet mission needs into the future. At the same time, EM is pursuing world-class technology development as the Savannah River National Laboratory develops innovative solutions in the fields of environmental cleanup, national security, science, and energy.

While remarkable progress has been achieved, the EM mission has decades to go. EM is undertaking a rational planning approach that will boost the ability to make progress in the short term and also advance longer-range mission goals. EM has an ambitious slate of priorities that span the next decade, and these are outlined in our Strategic Vision, a roadmap of priorities through 2031. Among the priorities, completion of our cleanup at four sites: the



Nevada National Security site, Moab, Lawrence Livermore, and Sandia.

In order to support sustainable progress, EM is also investing in building and sustaining a workforce with future talent that promotes diversity and inclusion. We are also building on efforts to improve cost and schedule performance. In recent years, EM has demonstrated an ability to deliver results, completing several projects ahead of schedule and under budget. As the GAO indicated in the latest high-risk report for the Department, EM has made strides in strengthening program and project management capabilities, and based on GAO recommendations, we will continue to focus on improving in this important area.

EM is putting the Federal investment in environmental cleanup to work. As we advance the cleanup mission for communities across the Nation, a safety-first culture is paramount. Cleanup decisions will be based on sound science, and EM's mission will be informed by input from a diverse range of stakeholders, including those most impacted by the environmental legacy of the past.

I sincerely appreciate the Subcommittee's continued support for the EM mission, and I look forward to working with you to continue to deliver progress.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. William White follows:]

#### PREPARED STATEMENT BY WILLIAM "IKE" WHITE

Chairman King, Ranking Member Fischer and Members of the Subcommittee, it is an honor to appear before you today to represent the Department of Energy's (DOE) Office of Environmental Management (EM).

EM is charged with fulfilling the responsibility to clean up the environment in communities that supported national defense weapons programs and government-sponsored nuclear energy research so they can continue to grow and thrive in the future. The mission carried out by EM represents a strong commitment to cleaning up the environmental legacy of the national defense programs that helped end World War II and the Cold War.

#### DELIVERING ON KEY PRIORITIES

As the largest environmental cleanup program in the world, EM has played a key role in the Department's overarching mission to protect the planet for over 30 years. Over that time, EM has made significant progress, completing cleanup activities at 91 out of a total of 107 sites. EM's significant accomplishments to date have included completing the bulk of cleanup activities along the 220-square mile Columbia River Corridor at the Hanford site in Washington state; completing 25 years of successful operations at the Defense Waste Processing Facility to help address tank waste at the Savannah River Site in South Carolina; completing the processing of 65,000 cubic meters of legacy transuranic waste at the Idaho Cleanup Project for off-site disposal; and opening the world's only deep geological repository for defense-related transuranic waste at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

Even as EM grappled with the challenges of the COVID-19 pandemic, 2020 represented an inflection point for many sites across the program. The dedication and resiliency of the EM workforce resulted in a ramp up in transformational tank waste capabilities, historic skyline changes, a shrinking cleanup footprint and contracts that accelerate progress. Key accomplishments were achieved across EM, some years in the making, that position the Department for building momentum for continued progress. These included:

- Completing the Vision 2020 initiative at the Oak Ridge site in Tennessee. This effort entailed the demolition of more than 500 structures totaling 13 million square feet at the East Tennessee Technology Park, and marked the first complete removal of a former uranium enrichment complex in the world.
- Initiating operations of the Salt Waste Processing Facility (SWPF) at the Savannah River Site. The SWPF is the last major component of the tank waste

cleanup system at Savannah River, and its operation will provide a transformative leap forward in EM's ability to address a key environmental risk at the site.

- Completing construction of those facilities at Hanford involved in the Direct Feed Low Activity Waste (DFLAW) system for waste treatment. This positions EM to be able to initiate tank waste treatment at Hanford in the near-term. In addition, EM completed the demolition of the iconic Plutonium Finishing Plant, once one of the highest-risk facilities in the DOE complex.
- Completing environmental remediation and restoration work at the Tonopah Test Range in Nevada and at the Separations Process Research Unit in New York state enabling this land to be transferred out of the EM program.

Building on this strong record of results, EM is entering a new era of cleanup progress. EM has an ambitious set of priorities for 2021 that will result in a ramp up in the ability to tackle radioactive waste stored in underground tanks, as well as skyline changes at some sites; continued progress in key infrastructure improvements at the Waste Isolation Pilot Plant (WIPP) to position the site to continue to support DOE's legacy cleanup and ongoing national security missions; and progress in a variety of risk reduction efforts.

Already this year, EM teams on the ground have ensured that three underground structures at Hanford are in stable condition, demolished one of the final remaining buildings at the former Biology Complex at the Y-12 National Security Complex in Oak Ridge and progressed infrastructure enhancements the Nevada National Security Site Area 5 Radioactive Waste Management Complex.

#### REDUCING ENVIRONMENTAL RISKS

As EM enters a new era, built on the strong progress of our workforce the Department of Energy is well positioned to tackle the tough challenges of addressing radioactive waste stored in underground tanks, demolishing contaminated buildings, remediate contaminated soil and groundwater, safely managing and disposing of waste, and ultimately closing out cleanup sites. In this new era, EM is focused on protecting the environment by reducing risks, supporting the broader DOE national security missions and preparing for the future of the cleanup mission.

Protecting the environment by addressing radioactive waste stored in underground tanks at the Hanford site, the Savannah River site and the Idaho National Laboratory site is a top priority for EM. After decades of preparations, the Hanford site is on the precipice of initiating tank waste treatment in a few short years via the Direct-Feed Low Activity Waste (DFLAW) system. EM is on track for initiating radioactive tank waste treatment at Hanford by the end of 2023. Upcoming activities in advancing the DFLAW system include cold commissioning with simulated tank waste, startup of the melters that will turn treated waste into glass and other tests needed before initiating tank waste treatment. In order to ensure the safe condition of all underground waste tanks at Hanford, EM also maintains a robust Tank Integrity Program, which is important for monitoring the condition of all underground waste tanks at Hanford.

The EM team at Hanford is also continuing key risk reduction activities to protect the Columbia River including groundwater treatment systems, work to prepare Building 324 for demolition, and steps toward the ultimate stabilization of the final two of nine Hanford reactors. The initiative to transfer radioactive capsules to safer dry storage is also continuing.

In South Carolina, the tank waste treatment mission is accelerating through operation of the Salt Waste Processing Facility and the Defense Waste Processing Facility. A high state of readiness for H Canyon at the Savannah River Site is being maintained. Additional risk reduction work is continuing including work towards disposition of remaining transuranic waste and remediating contaminated soil and groundwater.

At the Idaho National Laboratory, EM is working toward start-up of the Integrated Waste Treatment Unit (IWTU). Once operational, the IWTU will turn about 900,000 gallons of liquid waste into a granular solid. Other risk reduction work includes progress towards completion of targeted waste exhumations at the Accelerated Retrieval Project as well as treatment of contact-handled sludge waste. As these projects advance, work will begin to start decontamination and decommissioning of the Advanced Mixed Waste Treatment Project.

#### SUPPORTING NATIONAL SECURITY MISSIONS

In addition to reducing environmental risks at these and other sites across the complex, the EM mission benefits the Department's broader national security and

scientific research missions. Nowhere is this more evident than at Oak Ridge. Oak Ridge is transitioning its highly skilled and experienced workforce from the successful demolition of the former uranium enrichment complex at the East Tennessee Technology Park to begin major cleanup operations at the Oak Ridge National Laboratory and Y-12 National Security Complex. EM is advancing progress on several near-term priorities at Oak Ridge: disposition of the remaining uranium-233 inventory at the Oak Ridge National Laboratory, addressing transuranic debris and sludges, completing remaining soil cleanup activities at the East Tennessee Technology Park, construction of the Mercury Treatment Facility at the Y-12 National Security Complex and deactivation of former process buildings.

Key modernization and infrastructure recapitalization priorities continue at WIPP, a facility that is essential for the disposal of defense-related transuranic waste, aiding not only legacy cleanup activities but ongoing national security programs. These priorities will help ensure WIPP is equipped to meet the needs of the national transuranic waste disposal mission today and into the future.

EM is also pursuing a world-class technology development program to help tackle remaining technical challenges and advance and accelerate the overall cleanup mission. The expertise of the Savannah River National Laboratory (SRNL) is working to develop innovative solutions in the fields of environmental cleanup, national security and science and energy security. EM, the National Nuclear Security Administration and other DOE missions will benefit from anticipated growth of the Laboratory under the recently awarded stand-alone Management and Operating contract.

#### STRATEGIC PLANNING FOR NEW ERA OF CLEANUP

With a mission that will span several decades at some sites, EM is taking steps to ensure a successful and sustainable program that will enable mission completion. EM is undertaking a rational planning approach that will boost the Department's ability to both continue making impactful progress in the short term, and advance toward achieving longer-range mission goals.

EM has an ambitious slate of priorities that cover not only this year, but span the next decade as outlined in its Strategic Vision, a document that provides a clear, concise roadmap to guide priorities through 2031, including completing legacy cleanup activities at four sites including the Nevada National Security Site.

In order to support this long-term sustainable progress, EM is investing in our team to support workforce development and building a workforce that promotes diversity and inclusion. That includes opening up high-quality job opportunities. The Minority Serving Institutions partnership program run through the Savannah River National Laboratory is a part of this overarching effort.

#### PUTTING EM INVESTMENT TO WORK

DOE is putting the federal investment in EM to work to continue advancing the cleanup mission. As that work is carried out, a safety-first culture will be paramount, clean up decisions will be based on sound science and informed by input from a diverse range of stakeholders and the states, tribes and communities most directly impacted by the environmental legacy of the past will have a seat at the table.

The EM program is fortunate to have the strong support of the Energy Secretary and the new DOE leadership team. Most important to our success in the new era for cleanup are the talented and dedicated men and women across the entire EM program. They share the commitment of DOE and EM leadership to this vital mission.

EM will work hand-in-hand with workers, unions, tribal nations, states, local communities, and Congress as progress continues and plans are developed for this next era of cleanup and beyond.

	Fiscal Year 2020 Enacted	Fiscal Year 2021 Enacted
Carlsbad .....	403,599	420,066
ETEC .....	18,200	12,000
Idaho .....	446,300	444,500
Los Alamos .....	220,000	226,000
Lawrence Livermore .....	66,727	36,764
Lawrence Berkeley .....	31,000	30,100
Moab .....	45,000	47,833
Nevada .....	60,737	60,737
Oak Ridge .....	682,348	644,344
Richland .....	1,001,301	1,024,900

	Fiscal Year 2020 Enacted	Fiscal Year 2021 Enacted
River Protection .....	1,616,000	1,645,000
Paducah .....	314,339	315,885
Portsmouth .....	493,427	508,864
Savannah River .....	1,629,924	1,702,870
SPRU .....	15,300	15,000
Sandia .....	2,652	4,860
West Valley .....	79,611	92,411
Defense Closure Site Activities .....	4,987	4,987
Non-Defense Closure Site Activities .....	—	—
Program Direction .....	281,119	289,000
Mission Support Activities .....	14,179	15,079
Technology Development .....	25,000	30,000
Excess Facilities .....	10,000	10,000
Use of Mercury Receipts .....	—	3,000
Uranium Thorium Reimbursements .....	5,250	5,000
D&D Fund Deposit .....	—	—
Subtotal, EM .....	7,467,000	7,589,200
UED&D Fund Offset .....	—	—
15-D-401 Containerized Sludge Removal (RL) .....	(11,800)	—
Use of Mercury Receipts .....	—	(3,000)
Total, EM .....	7,455,200	7,586,200

Senator KING. Thank you, Mr. White, and thank you for that progress report, and we look forward to probing some of those questions with you.

Admiral Caldwell.

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

Admiral CALDWELL. Chairman King, Ranking Member Fischer, and distinguished Members of this Subcommittee, thank you for the opportunity to testify here today. I also thank this Subcommittee for consistently supporting Naval Reactors. This enables my team to provide the Navy with propulsion plans that give our nuclear-powered warships the incredible advantage of unmatched reliability, speed, and endurance to conduct national security missions around the world. Naval Reactors' historical investment in advanced technologies has maintained our competitive edge in the maritime environment for decades. The Navy's highly capable nuclear-powered submarines and aircraft carriers have ensured our warfighting advantage over potential adversaries.

Today's strategic environment is dynamic and increasingly complex. Near-peer rivals are pursuing robust military modernization programs aimed at eroding our maritime preeminence and narrowing the capability gap. I am focused on renewing Naval Reactors' investment in cutting-edge technologies to deliver enhanced capabilities to the existing fleet and for future ships.

There are three areas vital to our ability to provide 24/7 support to the nuclear Navy. First is our small but highly skilled Federal workforce. It is our most important resource. I am focused on ensuring sufficient Federal staffing to meet the demands of sustaining today's fleet and growing future capabilities.

Second, we are renewing our investment in Naval Nuclear Laboratory research and development so that we can maintain superiority over our competitors. These efforts focus on technologies with the potential to deliver greater capability with lower acquisition and lifecycle cost. Specific areas of investment include advanced fuel systems, reactor core automated manufacturing and inspection, and next-generation instrumentation and control technologies.

Finally, I am investing in modernizing critical infrastructure and reducing my program's legacy environmental liabilities. Many of our facilities date back to the inception of the program over 70 years ago. We are increasing our emphasis on retiring facilities no longer in use, and we will do that in an environmentally responsible and cost-effective way.

In addition to these three areas, this Committee's continued support has enabled significant progress on our three national priority projects. The first is the development of the reactor plant for the *Columbia*-class ballistic missile submarine. This supports the Navy's number one acquisition priority. We began manufacturing the lead ship reactor core in FY 2019. This reactor will serve for the life of the ship for more than 40 years. We started construction of the lead ship in this year, 2021.

The second project is the refueling and overhaul of our land-based prototype reactor in New York. There is a dual benefit to this effort. It enables continued research and development to support the fleet and it will provide more than 20 years of training for the Navy's nuclear fleet operators.

The third project is the construction of the Naval Spent Handling Facility in Idaho, which will enable long-term, reliable processing and packaging of spent fuel from the Navy's nuclear-powered warships. Your support of this project has allowed us to make significant progress. To date, we have poured approximately 100,000 cubic yards of concrete. That represents nearly 30 percent of the required foundation concrete volume.

In closing, continued congressional support allows us to balance the investments in today's fleet with the future fleet, it allows us to expand the Navy's ability to project power and control the seas, and it allows us to remain ready for the high-end fight.

Thank you for this Committee's longstanding, strong support of Naval Reactors, and I look forward to answering your questions.

[The prepared statement of Admiral James F. Caldwell follows:]

PREPARED STATEMENT BY ADMIRAL JAMES F. CALDWELL

Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you today. Your strong support for the work we do ensures our nuclear Navy has the ability to carry out vital missions around the world. This support of Congress is vitally important today as we continue to face renewed great power competition and a global pandemic.

Today's strategic environment is dynamic and increasingly complex. Near-peer rivals are pursuing military modernization programs aimed at achieving regional hegemony in the near-term, and eroding the post-WWII international order and United States' preeminence in the long-term. The maritime environment is becoming increasingly contested. To preserve freedom of the seas, deter conflict, defend allies, and protect our national interests, we must sustain and grow our naval capabilities.

Nuclear propulsion is a key enabler of naval power projection, providing unmatched mobility, flexibility, responsiveness, and endurance. These key attributes

ensure our nuclear fleet can meet the demands of forward presence and crisis response worldwide. Today, over 40 percent of the Navy's major combatants are nuclear-powered (68 submarines and 11 aircraft carriers).<sup>1</sup> Advancements in nuclear propulsion are needed as the Navy innovates to maintain our competitive advantage. Naval Reactors' historical investment in advanced technologies has given the Nation an enviable competitive edge in the maritime environment; further investments in advanced technologies are necessary to maintain this technological edge well into the future.

The Navy's highly capable nuclear-powered submarines and aircraft carriers have ensured our warfighting edge over potential adversaries for decades. Our ballistic missile submarines provide the most survivable leg of our nuclear triad, are essential to our ability to deter major warfare, and provide assurance to our allies. Our fast attack submarines operate undetected, safeguard vital commercial sea-lanes, and stand ready to protect American interests. Our aircraft carriers provide our Nation the sustained ability to project combat power, deter conflict, and protect our interests around the world.

Last year, with Naval Reactors support, the Navy continued to meet its strategic deterrent mission and executed numerous missions in the undersea domain that directly impacted the national security of the United States. Our carriers executed the busiest year of deployments in nearly a decade to support vital U.S. military operations around the world.

In aircraft carrier shipbuilding, the USS *Gerald R. Ford* (CVN 78) made great progress since I last appeared before the Committee. Last year, I had the privilege of visiting the *Ford* at sea and seeing first-hand the significant improvements over the *Nimitz*-class, highly capable in its own right. The *John F. Kennedy* (CVN 79) was christened last year and the crew is testing the propulsion plant. Construction continues on *Enterprise* (CVN 80), the first carrier in a two-ship buy that allows the Navy to realize important cost savings, maintain a constant, predictable workload within our industrial base, and continue to deliver the unmatched capabilities of the *Ford*-class to our Navy. The *Ford*-class incorporates the first newly-designed aircraft carrier propulsion plant in 40 years. These ships not only match the high speed of our *Nimitz*-class aircraft carriers but have room to grow, providing 25 percent more energy and three times the electrical generating capacity. Additionally, the propulsion plant design reduces maintenance by 30 percent and manpower by nearly 50 percent.

In ballistic missile submarine shipbuilding, lead ship construction for the *Columbia*-class is underway, which will allow the Navy to continue seamless execution of this vital mission that began over 6 decades ago. The USS *George Washington* (SSBN 598) completed her first deterrent patrol 60 years ago. This year will mark the 40th anniversary of the commissioning of the USS *Ohio* (SSBN 726), the lead ship of today's ballistic missile submarine fleet that, along with three other submarines, was later converted to a guided missile submarine. This year will also mark 20 years since the inactivation of the USS *Kamehameha* (SSBN 642), the last of the "41 for Freedom." Looking forward, the *Columbia*-class will be a bedrock of our national security posture for decades to come. The men and women of Naval Reactors and our industry partners are contributing to this mission by building a reactor plant with a life-of-ship core to serve in excess of 40 years, an accomplishment that builds on the military advantage of longer lived cores that enable the Navy to avoid mid-life refueling and reduce by two the number of *Columbia*-class submarines needed to meet the strategic deterrence mission compared with the *Ohio*-class.

In attack submarine shipbuilding last year, the Navy saw the keel laid for the Pre-Commissioning Unit (PCU) *Idaho* and commissioned the USS *Delaware* and the USS *Vermont*. This brings a total of 19 *Virginia*-class submarines to our fleet, with *Virginias* now comprising over one third of our attack submarines. The Navy is also assessing improvements to capability and lethality for future *Virginia*-class submarines; these improvements not only add capability to today's fleet, but will also allow the Navy to prove potential technologies that could influence the next-generation attack submarine. Naval Reactors is closely synchronized with the Navy on these efforts. In particular, our renewed focus and investments in advanced technologies will pave the way for improvements in speed, energy density, and stealth.

<sup>1</sup>Major combatants, in this instance, include aircraft carriers, submarines, and surface combatants based on the "Active in Commission" column from the Naval Vessel Register.

## NAVAL REACTORS OVERVIEW

This Committee's support has enabled the safe operation of the nuclear fleet, substantial progress on our key projects, and our continued oversight and regulation of all areas across the Naval Nuclear Propulsion Program. Your support has also enabled significant progress on our three major projects—*Columbia*-class propulsion plant development, the refueling overhaul of a research and training reactor in New York, and the construction of the Naval Spent Fuel Handling Facility in Idaho. Finally, the Committee's support ensures Naval Reactors can provide around-the-clock support to the operational nuclear fleet, accelerate research and development efforts for future generations of nuclear powered warships, and make progress on both the recapitalization of our laboratory facilities and the environmental remediation of our legacy responsibilities.

## MAJOR PROJECTS

*Columbia-class Propulsion Plant*

The *Columbia*-class ballistic missile submarine is the Navy's number one acquisition priority. Naval Reactors is supporting lead ship construction and is delivering the life-of-ship reactor core and the electric drive propulsion system for the *Columbia*-class program. Naval Reactors continues lead ship propulsion plant design and safety analysis work required to support lead ship reactor testing and delivery.

*S8G Prototype Refueling Overhaul*

We also continue to execute the refueling and overhaul of the New York land-based prototype, which will enable an additional 20 years of Naval Reactors' commitment to research, development, and training. The project has been steadily working through performance challenges associated with COVID-19 as well as the integration of workforces from multiple shipyards. We continue to provide strong oversight to improve cost and schedule performance. Progress to date includes the removal of all spent nuclear fuel, design, manufacture and installation of a new reactor core, construction of a new cooling tower, and installation of upgraded instrumentation and control systems. The new reactor for this prototype includes *Columbia*-class type fuel modules as part of testing and demonstrating the manufacturability necessary for production and delivery of the *Columbia*-class reactor core.

*Spent Fuel Handling Recapitalization Project*

Naval Reactors is constructing the Naval Spent Fuel Handling Facility, located on the Naval Reactors Facility in Idaho. The facility is critical to our mission to manage spent naval nuclear fuel and support aircraft carrier and submarine fleet requirements. As I testified last year, market conditions such as a shortage of skilled labor, high construction demand, and a remote location, coupled with price volatility for domestic construction materials such as structural steel resulted in higher than anticipated costs. Naval Reactors took a number of immediate actions to minimize impacts to cost and schedule such as deliverable reductions and phase-funding subcontracts when possible. The Program also rebaselined the project in fiscal year 2020 and has continued to work closely with the National Nuclear Security Administration and the Department of Energy to ensure adequate resources are available for the project. More recently, the COVID-19 pandemic and the discovery of unexpected bedrock conditions beneath the facility's foundations have presented challenges that the Project is working through to ensure that the overall Project completion milestone remains achievable. We continue to provide robust oversight and management of this complex and large-scale infrastructure project. Strong support from Congress has enabled the project to make significant progress. To date, we poured approximately 100,000 cubic yards of concrete for excavation site backfill, representing approximately one-third of the required foundation concrete volume, and started procurement of facility structural steel.

## TECHNICAL BASE FUNDING

In addition to our three priority projects, Naval Reactors maintains a high-performing technical base. The technical base is the set of fundamental skills and capabilities necessary to safely and effectively support the nuclear Navy. It includes a foundation of specialists in nuclear materials, nuclear physics, thermal-hydraulic testing, acoustics, electrical design, software development, system development, refueling, and other specialized skills, along with the associated facilities. The technical base is leveraged for our projects, but also performs independent work to support the operating fleet and ensure our technology advantage over our competitors. Specifically, the Program: 1) addresses emergent needs and challenges of our nu-

clear fleet, 2) executes nuclear reactor technology research and development that supports today's fleet and future capabilities and, 3) modernizes critical infrastructure and reduces the Program's legacy environmental liabilities. This base also supports the lean yet highly effective federal workforce that provides the oversight necessary to carry out this important technical work safely and efficiently. These activities are vital to our ability to provide 24–7 support to the nuclear-powered Navy.

#### *Program Direction*

Our small but highly skilled federal workforce is our most important resource. Our talented and diverse workforce strategically differentiates us within the current geopolitical environment. As such, I remain highly focused on attracting, developing, and retaining a talented and diverse workforce to oversee and manage the critical programmatic work. This past year also brought longstanding issues of racial injustice to the forefront of the national dialogue, which served to strengthen my efforts to engage the workforce at every level and ensure we are fostering an environment of promise of opportunity, respect, and empathy. These are core values and will receive my sustained attention.

Building platforms that have over 40 years of expected life, requires staffing continuity to ensure the Nation has a workforce with the deep technical knowledge needed to support Naval Reactors' cradle to grave management of these robust systems. I must have sufficient Federal staffing to meet the demands of sustaining today's fleet and growing future capabilities. The cumulative effect of funding reductions in prior years, personnel costs growing above inflationary rates, and an increase in recent senior level retirements has impeded our ability to reach this goal and challenged our ability to maintain our staffing levels. It is imperative that we execute our staffing plan and avoid any critical gaps in our workforce. I commit to continue to communicate with the Committee and your staff on our requirements and progress in reaching our staffing goals. I respectfully request Congress' support to allow me to recruit, select, develop, and retain the talented workforce that was started by Admiral Hyman Rickover many decades ago and that has proved to be crucial to the success of the Program.

#### *Research and Development*

Our research and development strategy represents a renewed investment in cutting-edge technologies aimed at reversing an eroding capability gap with strategic adversaries like China and Russia. Technology investment must be reinvigorated today to have new technologies ready for future classes of ships and to lower costs, reduce construction timelines, and improve the performance of today's fleet in light of increasing global competition. The teams of talented and dedicated people at our Naval Nuclear Laboratory 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—perform the research and development, analysis, engineering, and testing needed to support current and future Navy requirements.

Our first priority is always support of today's fleet. Our labs perform approximately 4,000 technical evaluations annually that enable Naval Reactors to thoroughly assess and respond to emergent issues, thereby keeping our ships mission-ready while ensuring nuclear safety. These efforts are essential to keep our ships at-sea, such as during the extended deployments of several nuclear aircraft carriers over the last year. Operating abroad for longer than planned, our carrier strike groups demonstrated the U.S. Navy's ability to respond to global events and the unparalleled capability nuclear propulsion brings to at-sea operations.

Historically, Naval Reactors also maintained a robust, technologically-advanced nuclear propulsion research and development program that has enabled substantial gains in warfighting capability and affordability, while providing the Nation with safe, capable, and reliable nuclear propulsion. Over the past 10 to 15 years, Naval Reactors has made tradeoffs to support national priority projects, resulting in a reduced investment in mid- to long-term advanced technology development efforts. Today, we see our adversaries closing the capability gap the Navy has successfully dominated for decades. Looking forward, we must invest in advanced research and development to meet the increased threats from China and Russia.

We need advanced technology that can be leveraged for use in future nuclear powered warships the same way we were able to do for the *Columbia*-class. While researching and developing certain aspects of nuclear technology can take time, we are also leveraging the experience of industry and increasing the agility of our research and development program.

Naval Reactors is beginning to identify and develop new technologies aimed at delivering enhanced capabilities to the existing fleet, meeting aggressive performance



and cost requirements for future ships, and maintaining the U.S. Navy's superiority over our competitors. We are actively pursuing advanced fuel systems, reactor core automated manufacturing and inspection, next-generation instrumentation and control architectures and sensors, and emerging technologies (e.g., advanced power conversion, artificial intelligence, data analytics, additive manufacturing, and advanced robotics). These advancements have the potential to deliver both greater capability and lower acquisition and lifecycle costs. I commit to communicate regularly with the Committee and your staff on these advanced technology maturation efforts.

I want to assure the Committee that our investments are supported by a comprehensive and rigorous planning effort we undertake with our partners at the Naval Nuclear Laboratory. Our annual work execution plans are derived from this comprehensive alignment, both of which I personally review and approve to ensure we are making the right investments and tradeoffs in all areas of our business. Tradeoffs over the last 10 to 15 years have hampered technology development were unfortunately necessary, and I must now ensure strong investment in research and development efforts to advance capabilities into the future. This effort is vital for both existing and future nuclear propulsion capabilities.

#### *Facilities and Infrastructure*

Our laboratory facilities and infrastructure are critical in carrying out Naval Reactors' mission. The budget request supports recapitalizing our Naval Nuclear Laboratory facilities and infrastructure systems, many of which have supported the Program since its inception over 70 years ago. Without this recapitalization we will be unable to effectively support nuclear fleet operations and advanced research and development efforts at the level required by this complex technology. We are continuing our efforts in decontaminating and decommissioning (D&D) older facilities that have been in existence since the start of the Program in the early 1950s. We have approximately \$8 billion in environmental liabilities requiring D&D efforts—about one-third of these facilities are no longer in use. We are increasing our emphasis on retirement of these liabilities in an environmentally responsible and cost-effective manner to support best use of our funding. The Program is also leveraging the Department of Energy Office of Environmental Management (DOE-EM) experience in efficient, safe, and cost-effective remediation of environmental liabilities across the complex. I am pleased with the collaboration on this effort with my partners in DOE-EM.

#### *Conclusion*

The COVID-19 pandemic presents unique challenges. We have worked hard to keep our workforce safe while accomplishing our mission, and I am proud that the Program continues to rise to the challenge. We have learned a significant amount from this pandemic and will continue to apply those lessons learned in the future. I am continually impressed with how my workforce has responded to meet mission requirements with dedication, resiliency, and innovation.

Naval Reactors' mission is critical to our national security and contributes to the Navy's ability to maintain mastery of the undersea domain and sustain a formidable forward presence. Continued congressional support allows us to balance investments in today's fleet with the future fleet, expand the Navy's ability to project power and control the seas, and remain ready for the high-end fight. I appreciate the strong support this program receives from Congress to provide effective naval nuclear propulsion.

Senator KING. Thank you, Admiral. I will begin with questions and we will rote through the Committee.

Mr. Verdon, something you said caught my ear. A lot of what this Committee, the sort of fundamental premise of this Committee is deterrence. It is something that we are concerned with, and deterrence involves credibility of the deterrent itself. You said something about the limitations from not modernizing are no longer over the horizon but they are visible. My concern is they are also visible to our adversaries. Would you agree that that fact alone undermines the deterrent?

Dr. VERDON. I would certainly agree that that is a danger, and it is something, why we are moving as quickly as we can to address.

Senator KING. Modernization across the nuclear enterprise is a part of maintaining deterrence.

Dr. VERDON. That is right.

Senator KING. The other thing that I think you mentioned that is very as part of your work is nonproliferation. One of the things that worries me is to flip deterrence on its head. Deterrence does not necessarily work with a non-state actor, with a terrorist organization. Sometimes they are okay with being blown up.

So in order to prevent attacks of that nature, nonproliferation becomes all the more important, so they cannot get their hands on the material in the first place. Talk to me about your activities in nonproliferation.

Dr. VERDON. So yes, I totally agree with your assessment and we continue to work very, very hard with partners, you know, certainly within the United States but with partners around the world to make sure that we can track and prevent any theft of material, acquisition of material, technologies. That is something that we spend a considerable amount of time on to try to minimize the chance of any non-state actor getting the materials and/or the technologies necessary to do something, you know—

Senator KING. I am going to ask you to make a qualitative judgment. How good are you at that? Are we able to follow nuclear materials with a high level of fidelity?

Dr. VERDON. You know, it is one of these things that you have—I think based on evidence, I think we are doing a good job. Ourselves and our partners are doing a good job with this. We continue to look to improve. We do not rest on our laurels. We are always looking for new ways to see whether we can improve on how we do this. But, you know, we run tests, we run drills, we run all sorts of, you know—we try to run tabletops to make sure that we are really exercising the skills correctly and we have everything we need in place. But we continue to advance the capabilities in those areas to make sure that we never make a mistake.

Senator KING. Are you receiving full cooperation and support from all of the agencies of the intelligence community? I do not want to hear if we have a problem about stovepipes.

Dr. VERDON. No. I think this is an area where I think everybody works very well together, that everybody recognizes the importance of this, and we see strong support and respect for roles and responsibilities and sharing of information and transparency as required. I think everyone does recognize the importance of this.

Senator KING. Well, it is critically important, and I hope you will advise this Committee if you feel that there is any limitation on the data that you are receiving.

Admiral Caldwell, I understand we stopped enriching fuel in 1992, and basically we are working off the stockpile. When do you see a need to further enrichment?

Admiral CALDWELL. Sir, we have enough fuel to support our nuclear fleet through the mid 2050s, and that will depend on the Navy's decisions on force structure. But right now I am in good position through the 2050s. So eventually the Nation is going to have to figure out how we provide that asset. We are working closely with the National Nuclear Security Administration and DOE on alternatives, and, you know, so we would be looking to have some ca-

pability to produce the highly enriched uranium that we need by the 2040 time frame.

Senator KING. Fine. I am going to have questions, Mr. Verdon, on pit production, and Mr. White, on where the progress is, but I am going to yield my time to Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman. Dr. Verdon, at our hearing last week, Senator Rosen brought up underground testing, and Deputy Assistant Secretary for Nuclear Matters, Mr. Walter, he made the point that investment in NNSA's scientific capabilities were essential to help avoid the need to ever return to explosive testing, and he noted, in particular, the role that the Enhanced Capabilities for Subcritical Experiments program plays in that effort.

Can you talk about the connection between modernizing the complex and avoiding the need for testing, as well as the role subcritical experiments play?

Dr. VERDON. Certainly. So in terms of avoiding the testing, the examples that you brought up of Enhanced Capabilities for Subcritical Experiments as an example of an area where we recognized that we had a gap in some experimental data that we needed to help better improve our understanding of nuclear weapons in the absence of testing. So the subject matter experts identified a real state-of-the-art facility that we call the Enhanced Capabilities for Subcritical Experiments that, if worked as designed, will actually give us the data that we used to acquire through nuclear testing. So if it works as designed, it actually will move us further away from the technical need for requiring a nuclear test.

We are working to do that. It will be located in the U1a tunnel complex at the Nevada National Security Site, and that, coupled with a recognition that we still need higher capability in computing, so that we will be putting online our first exascale machine in 2023, to address that gap as well.

So we still do invest in the scientific capabilities that, in particular, the laboratories and plants are key in identifying as gaps in their understanding that they need to fill to support our ability to do the work we need to do in the absence of testing. So all of these act to help us to forestall the need to technically have to return to testing.

Senator FISCHER. These experiments, they are vital to be able to certify the life-extended warheads of the older pits, right?

Dr. VERDON. They are vital for both ongoing and planned warhead modernization programs. So again, they are slated to come online in time to support, in particular, the W80-4 LEP, and the W87-1 modification program. We are using those as drivers, the timeline drivers, to get those capabilities up.

Senator FISCHER. Congress created the Stockpile Responsiveness Program several years ago in order to ensure that our scientists were exercising the full spectrum of skills necessary to support all phases of nuclear weapons lifecycle process. Dr. Verdon, can you give us your assessment of the contribution this program has made so far, and what role do you see it playing in the future?

Dr. VERDON. So, yes. I have been very impressed with the work that is being carried out in the Stockpile Responsiveness Program. I have seen it firsthand, both when I was still present at Lawrence Livermore National Laboratory as the leader of the weapons pro-

gram there, and from here, from headquarters, that the workforce is exercising skills that are necessary, that they normally would not have gotten a chance to exercise. Some of the tasks we provided to them, the creativity that has come out from it has been impressive to see.

We do view it as a very important role in the training of our workforce, and I think we see very positive results from that, in that people can go from that program, train on that program and then move into the actual warhead modernization programs.

Senator FISCHER. Doctor, what lessons has NNSA learned from the delays it has encountered in the B61-12 Live Extension Program, and also the W88 Alt, and are there process improvements that can be applied to future life extension programs?

Dr. VERDON. So, yes. One of the first things we did, as soon as we started it, when we encountered the situations that we had in the 61 and the 88, we formed, actually, one inside review team and then a congressionally directed review team that went out and looked and really scrubbed hard. In fact, the Admiral was kind enough to lend us some people from his organization to be on one of the teams. We really did a scrub of just what occurred, what happened, what lessons did we need to learn, and, indeed, very extensive reports and reviews were written, and we have embraced them and are actually implementing many, if not just about all of the recommendations, onto the W80-4 and the W87-1, as we speak.

So we have taken it very seriously. We are implementing changes based on the lessons that were identified, and we are already seeing benefit from those lessons being applied.

Senator FISCHER. Thank you. Thank you, Mr. Chairman.

Senator KING. Senator Kelly.

Senator KELLY. Thank you, Mr. Chairman, and thank you to our three witnesses for testifying today. This question is for Admiral Caldwell.

So, Admiral, you have often described the Navy submarine force as being in high demand with a high OPTEMPO, and given our adversaries' significant investment in undersea capabilities, I think it is safe to say that this high demand will continue.

I would like to get your thoughts on the state of our industrial base. As you well know, we work closely with the private sector to deliver the Navy's nuclear-powered submarine capabilities. So how would you assess the health of our highly specialized shipyards who support these capabilities?

Admiral CALDWELL. Sir, thanks for the question, and I do agree with you that our submarine force and our undersea forces are going to remain in high demand. I would like to break your question into a couple parts. First I would like to talk about the nuclear industrial base that supports my ability to deliver reactor cores, components, instrumentation, and the things to build the reactor plans.

As we downsized after the Cold War, we downsized that industrial base to the need to support our needs. That is a highly capable, small industrial base that I have a lot of confidence in. We spent a lot of time engaging with our partners in industry. We monitor their performance. We project ahead and forecast, as accu-

rately as we can, what the Nation's needs are, and they have been able to continue to deliver what we need.

As an example, even during COVID, I am on track to deliver all my reactor plant components to the *Columbia* with margin. I think that is a real testament to the strength and the depth and the coordination and cooperation we have with the nuclear industrial base that supports me.

On the shipbuilder side, we have some challenges. If you think about where we have been as a Nation, in the 1980s and the early part of the 1990s we built 30-plus *Los Angeles*-class submarines in about a 10-year period, and we walked away from that investment in being able to do that. We built a few submarines in the early 2000s. We started again on one *Virginia* per year, and then about the 2014–2015 time frame we started to build two *Virginia*-class submarines per year.

So in that vendor base you have a lot of things going on. First, you have an experienced workforce that was here in the 1980s and 1990s. A lot of those folks went home. So we have inexperienced folks that are now learning new trades, including at the supervisory level.

Additionally, you have existing vendors who we have now, with going to two *Virginia* per year and *Columbia* and even *Ford* aircraft carrier construction, we have increased the demand on those existing suppliers. We have also had to go reach out to new suppliers as well. So there is pressure on those suppliers to perform.

We have had some challenges. Senator King asked me, in a phone call earlier, about missile tubes. That was an example of problems in the vendor base. We have come through that with a lot of government oversight and a lot of detailed engagements, and we are going to get back on the cadence for that.

But I think if we are going to continue to build the submarine force and the carrier force that we need, we are going to have to continue to grow that industrial base. We are doing that with an enterprise-wide plan that looks at all of the vendors that support all those programs I just talked about, and I think what is key we have got to get after the basics, we have got to develop the workforce, and we are going to have to have the right oversight at the primes and also by the government.

Senator KELLY. Thank you, and on the training side, it sounds like you are building a new reactor in Schenectady, would be my guess there, right?

Admiral CALDWELL. If I could comment on that, sir that is a reactor that has been in the program for decades.

Senator KELLY. Yeah.

Admiral CALDWELL. In fact, I trained there when I first entered the Navy back in the early 1980s.

Senator KELLY. You are still able to use that reactor that was from the 1980s?

Admiral CALDWELL. Yes. We are still able to use that reactor plant, which I think is an incredible testament to the way it was designed and the way it has been maintained. It has been refueled once, and we are now refueling it a second time. When we complete that refueling we will use that reactor for research and development for the U.S. Navy, and we will train operators for another 20

years. So if you think about that, that is going to be out to the 2040 time frame, and I trained on that in the early 1980s.

Now in that modernization, we are modernizing the infrastructure and the instrumentation and control, so it will be an incredible asset for us going forward.

Senator KELLY. I was just assuming that by now you would have been building a new one there. Many of my classmates at the U.S. Merchant Marine Academy went to work there and are instructing, you know, the world's finest nuclear power plant operators are in the United States Navy.

Admiral CALDWELL. I am ready to take you up there, sir, and show it to you.

Senator KELLY. Thank you.

Senator KING. Thank you, Senator Kelly. Senator Rounds.

Senator ROUNDS. Thank you, Mr. Chairman. Gentlemen, once again thank you for your service. Thanks for being here today.

Admiral Caldwell, the GAO has noted the challenges in maintaining ballistic missile submarines, the SSBNs, with regard to their operational capability due to unplanned delays and extended middle-life maintenance, refueling, overhauls, and refit periods. This is kind of following along some of the comments that you have just made with Senator Kelly.

Can you tell us how the efforts of the NNSA's Naval Reactors program, with respect to the life-of-ship reactor cores for the *Columbia*-class might address these issues, and whether there are other areas where the Naval Reactors program can support the Navy in improving turnaround times for SSBNs as well as carriers in the future?

Admiral CALDWELL. Yes, sir. Thanks for the question. With regards to *Columbia*, we are building this life-of-ship core, which is designed to last 42 years. That is, in my opinion, a remarkable technological and manufacturing achievement. When you consider where we started with the program in refueling *Nautilus* at the 18-to-24-month point, and all that learning and all that growth in technology and manufacturing, we are now going to fuel a submarine that will last over 40 years.

That has tremendous benefit for the Navy. It will take out that midlife refueling. It is going to allow us to operate that strategic deterrent mission with 12 boats versus the 14 we have today. That simple fact saves the U.S. Government \$40 billion in total ownership costs to buy two additional ships. That is really, really important to the Navy.

Now in addition to that, we are investing in technology for today's fleet and the future fleet. So we are trying to get after adding capability to the fleet, and do that in a cost-effective way that reduces the construction spans, and so to get to your point, I am looking to see how can I build even more reliable components that last longer? How can I collect data and used advanced sensors and data analytics to analyze and do condition-based maintenance? Then my time is intimately involved with the shipyards in trying to make sure we have the right rigor, training, oversight in executing the availabilities.

I would like to say that, to your point about overhauls and what-not, even in the midst of COVID, the shipyard that is refueling the

Louisiana was able to achieve a best-of record in terms of the refueling timeline. That is remarkable, even in the midst of COVID.

Senator ROUNDS. May I ask, with regard to those such as the *Boise*, which has been in drydock, literally for years, it sounds to me like what you are sharing is that the challenges for the *Boise* in terms of the extended delay for its midlife refueling and so forth was not because of the need for a delay with regard to the refueling of the reactor itself but rather the other shipbuilding portions of that refueling and midlife rerigging.

Admiral CALDWELL. Fair statement. That is correct, sir, and if I could add a little context on that. *Boise* was headed in for an engineered overhaul, not a refueling. The challenge with *Boise* is that we did not have the capacity in the shipyard to induct her. Rather than simply induct the ship and have her sit idle, we decided to roll her into the shipyard environment when we could accommodate that, and also take advantage of the capacity in the private sector.

So we are working hard to improve the capacity and the performance in our shipyard, and that will affect the *Boise* outcome as well. But just for the record, she is not being refueled, sir.

Senator ROUNDS. Thank you, sir.

Dr. Verdon, could you provide your perspective on the legality and practicality of the government entering into a partnership with the largest civilian enrichment service operating in the U.S., Urenco, for supplying low-enriched uranium to the Watts Bar Nuclear Plant, to produce tritium for weapons. I understand that the GAO wrote a report saying that exercising this course of action is a policy question, and that national security needs for enriched uranium could be met if the government took this approach.

Could you share with me your thoughts on whether that is an appropriate path forward?

Dr. VERDON. Yes, sir. So we have actually conducted a pretty extensive analysis of alternatives of how to provide low-enriched uranium for our defense needs, and that was certainly one option that we carried forward amongst technical options of using centrifuges. So we kept it on the table because it was brought up.

We actually thought it was a pretty big lift to actually do it, but since it is potentially achievable, depending on the allies, we carried forward with the option on the table. But we are pursuing a technological path forward as well, and, you know, we are investing in centrifuge technologies so that we can offer the country a decision in the future of which way we want to go.

Senator ROUNDS. My time has expired, but I would like to pursue that perhaps at a later time. Thank you, Mr. Chairman. Thank you, gentlemen.

Senator KING. Thank you, Senator Rounds. Senator Rosen via Webex, please.

Senator ROSEN. Thank you, Chair King and Ranking Member Fischer, for holding these hearings. It is, of course, a really important topic and important to us here in Nevada.

So last week, of course, Deputy Assistant Secretary of Defense for Nuclear Matters, Andrew Walter, told this Subcommittee that the Enhanced Capabilities for Subcritical Experiment program, or, much easier to say, the ECSE, will enable the NNSA to, quote,

“continue gathering the data to conduct subcritical experiments to certify the nuclear stockpile and ensure that the designs we use in the future remain safe and reliable,” unquote.

So, Dr. Verdon, could you provide us with an update on upgrades to the ECSE facility in the U1a complex at the Nevada National Security Site, and can you tell us how the new facility will help to improve our stockpile stewardship program, scientific capabilities of course including our understanding of plutonium.

Dr. VERDON. Yes. Thank you for the question. Yes, ECSE—easier to say than Enhance Capabilities for Critical Experiments—yes, as I mentioned, it is a state-of-the-art facility that will give us capabilities that we do not presently have within the complex to—in essence, you can think of it is take dental radiographs of an imploding primary, and getting multiple images of it as well other diagnostics, and it is just a capability that we do not have in the complex today.

So bringing that system up online will provide us data that we have not had since we did underground testing, and so we identified it as an important gap in our capabilities and we are moving out to implement it as we speak. As I mentioned, its timelines are driven to support warhead modernization activities within the stockpile.

So it is a very important capability, and we are putting all effort into making sure that it comes up on time and within budget.

Senator ROSEN. So we have lots going on, of course, in Nevada at—I still call it the Test Site. I have lived in Nevada over 40 years. But, you know, your mission is to secure the integrity of our nuclear stockpile, but what are you doing to improve and invest in areas such as resources and support for our workers in the site, and also building the people pipeline, and do you think that you have the funding that you need to bring up your functionality overall, as far as hardware and, of course, the people who work there?

Dr. VERDON. So, as I say, the Nevada National Security Site is a very important site for us, not only for the NNSA mission but I would for broader national security missions writ large. There are a lot of activities that take place at that site that are important.

We have a prioritized list that we revisit every year for infrastructure improvements at the site, and we are executing infrastructure improvements that range from utilities to road, to, as I say, the Enhance Capabilities for Subcritical Experiments. They run the gamut.

You know, clearly we cannot move as fast as we would like to move, but I think we have a very methodical way that we are moving through it to upgrade, prioritized based on risk to program and risk to workforce safety, and we are moving through those in a very methodical manner to upgrade them over time.

Senator ROSEN. Thank you. I appreciate that, and, of course, you know, quickly in the time I have left, we had a secret shipment of plutonium that ended up in Nevada, from South Carolina, and as a part of an effort to restore trust with the people of Nevada we know that NNSA is committed to removing that material, starting no later than this year and completing it by 2026.

Can you provide us, of course in this nonclassified setting, any updates on the removal of the plutonium?



Dr. VERDON. So I can't go into details but I will assure you that we are honoring the commitment that we made. So we are acting on what the commitment was, and we will continue to do so.

Senator ROSEN. Thank you. I see my time is just about up. Maybe we can meet in a classified setting and get the latest updates on that and some other updates on the pits and what is going on down there. Thank you so much.

Senator KING. Thank you, Senator Rosen. Senator Sullivan.

Senator SULLIVAN. Thank you, Mr. Chairman. Admiral Caldwell, I wanted to talk a little bit about the culture of the nuclear Navy. I have always been fascinated by it. It is quite unique, I think exceptional in many ways. Were you interviewed by Admiral Rickover? Are you young enough, or old enough?

Admiral CALDWELL. I am old enough to have been interviewed by Admiral Rickover.

Senator SULLIVAN. How did that go?

Admiral CALDWELL. I did not get to spend much time with him. He was unhappy with some of my academic performance and he kicked me out pretty quickly.

Senator SULLIVAN. Interesting. So it was a short interview?

Admiral CALDWELL. It was a very short interview and I had to promise that I would improve my performance. But he accepted me, and I have to tell you, as I sit here today I am honored to have been in this program for what will be 40 years, and you are right, it has got an incredible culture. We hire fantastic people, and we work hard to retain them, and they do amazing work for us.

Senator SULLIVAN. So that is what I wanted to ask about. Oftentimes you have hearings when Senators or others think the culture has gone bad and something horrible has happened, and, you know, I never like talking about the nuclear Navy with its exceptional record and then you do not want an accident or anything. But it is quite unique, even within the military, even within, I think, American society. What is it that has enabled generations of naval officers and enlisted to operate our nuclear aircraft carriers, our nuclear subs in a way that is both focused on operational excellence and attention to detail, in an enterprise which is complicated, to say the least? But the Rickover culture, I think, some people criticize. I happen to think it is pretty remarkable. What do you think the secret sauce has been, and how do we make sure we continue to do it? Obviously, he is gone, but it is really remarkable, I think.

Admiral CALDWELL. It is a remarkable culture, sir, and I invite you to have a further, deeper dialogue with you. But if I could summarize some of the key points is, first off, going out and finding and recruiting the best people that we can. Admiral Rickover interviewed all of the officers coming into the program. I continue to do that today. In fact, in my job I have interviewed over 4,000 people to come into the program.

Senator SULLIVAN. So that continues.

Admiral CALDWELL. That continues today, sir.

Senator SULLIVAN. You do not throw them out after 5 minutes, do you?

Admiral CALDWELL. I am probably not as colorful as Admiral Rickover.

Senator SULLIVAN. Okay. I mean, if you do, that is okay too, I guess.

Admiral CALDWELL. We aim to have high standards. We are absolutely dedicated to deep technical knowledge. We are brutally honest with ourselves in terms of our performance, and we expect that from all of our teams. We report when we do not do things well, and then we aim to learn from those things and roll that back into our culture. We try to manage problems when they are very small, before they get big.

So there are many aspects to this, but it is the self-critical culture. It is this commitment to perpetually improving your team and continuing to learn from others and mistakes and continue to drive your performance. Admiral Rickover really set high expectations for his people, and we continue to do that today for all the folks in my headquarters as well as our officers and our sailors.

Senator SULLIVAN. Is there anything we can do? Sometimes that is a dangerous question, particularly when things are going well.

Admiral CALDWELL. Well, I think the—

Senator SULLIVAN. Or should we just keep our hands up? What should we do to enable that?

Admiral CALDWELL. The important thing about Naval Reactors is its alignment of authorities, responsibilities, accountability, and the money that supports us. This Subcommittee's continued support for my program enables me to deliver what I need to for the U.S. Navy. It allows me to do the design and to maintain the high standards and keep our ships at sea. All of this stuff is wrapped together. So that is key, I think, and I will continue to convey to you what I think I need to run the program.

Senator SULLIVAN. When Admiral Richardson became CNO, I remember that was considered a little, I don't know, "controversial" may be too strong a word. But it took the traditional, I think it is an 8-year, 4- to 8-year billet that you currently occupy. Is that a statutory billet, and does that help you, and is it 8 years and then you are done? Was it controversial? I thought Admiral Richardson did a great job when he was CNO, but what is your thinking on your billet, which is a little bit of a hard question.

Admiral CALDWELL. It is an 8-year responsibility. It was outlined in an Executive order 12344. It was later codified into law, and it allows the director to gain continuity in the program and to live with their decisions.

Now Admiral Rickover is an extraordinary leader, and I think he had the opportunity to go lead our Navy, and I think that was great for our Navy. I think for me and for the program it is good to have an 8-year director to get fully immersed, to make decisions, and then deal with the consequences of those decisions. That is part of being a nuclear-trained officer is owning the results and owning the path to get to success.

Senator SULLIVAN. Thank you very much. Thank you, Mr. Chairman.

Senator KING. Thank you, Senator Sullivan. Admiral, following up Senator Sullivan's questions, I had the opportunity to spend a couple of days and a night on the USS New Mexico under the ice in the Arctic Ocean. One of my clearest memories was—they were enlisted people who were managing that reactor, and it was their

reactor. You came away feeling that they had an ownership and a commitment to excellence that was quite extraordinary. That was a clear memory from that trip, right up there with breaking through the ice when it was time to go home. But I compliment you on maintaining that culture that Senator Sullivan described.

Admiral CALDWELL. Thank, sir. I think you said the optimal word: ownership, and when I think about it, we have young nuclear operators, maybe a 21-year-old operator at the panel, controlling the reactor. It is pretty impressive what they can do. We are pretty proud of them.

Senator KING. That was exactly my thinking.

Dr. Verdon, I have been to several storage facilities of nuclear warheads and there seemed to be a lot of them. Let me ask a question my constituents might ask if they were sitting here. Why do we need new warheads?

Dr. VERDON. So many times—well, “new” is how you want to define it. Some of them are basically the modernization programs, they are actually replacing like for like, just using newer components, replacing, you know, aged materials or aging components.

Senator KING. So to be clear, that are not entirely new warheads. They are components that are being changed to modernize.

Dr. VERDON. That is for a vast majority of what we have been doing to date has been what we call regular Life Extension Program, where you basically try to reuse as much of the componentry as you can and only replace that which you have to. It is driven by age or, you know, in some cases these warheads were designed to only be in the stockpile for 20 years. So you run out of logistic supplies because the components have gotten so old and they are no longer made, so you have to upgrade them to the newer technologies.

So they are not new in that regard. There is no new military characteristics associated with the warheads.

Senator KING. Thank you. Pits is a matter of some discussion. We have not been making pits, which are an essential component of a nuclear warhead, for some time. Number one, is it necessary to restart pit production?

Dr. VERDON. So my assessment, technically, is yes, it is. I think there are a number of reasons, one being to mitigate risks against what are presently now large uncertainties associated with what is called plutonium aging. It is really the cumulative impact of plutonium decay, radioactive decay, on an existing pit, and then also to address and be able to improve the safety and security of the warheads, based on new safety and security requirements. Then a third would be to potentially respond to what peer adversaries might challenge our deterrent for the future.

So I do assess that manufacturing, having the capability, a modest capability, of manufacturing new pits is important for our deterrent in the long term.

Senator KING. So they have been manufactured at Los Alamos, but I understand that the plan now is to restart the program at Los Alamos but also to have a sister facility at the old MOX facility in South Carolina. Why two facilities?

Dr. VERDON. So when we explored the options of how to re-establish pit manufacturing we looked at obviously one site and we

looked at two sites. In particular, because we had the existing facility at Los Angeles, the Plutonium Facility Number 4, PF4, and what we formerly referred to as MOX facility at Savannah River, having those two existing facilities identified a way to implement pit production at a modest level of around 80 pits per year, which is the goal, but also having resiliency, because we have found at Los Alamos that we have had outages that have lasted a few months to 3 years.

Senator KING. What do you mean by an outage? That is not a power outage.

Dr. VERDON. An outage, that a situation occurs at the production site that causes it to be offline for 3 years, and we have had that. We have actually experienced that, and having that kind of issue occur when you are trying to produce the warheads is not acceptable. It is hard to recover from.

So we identified that the two-site solution, particularly leveraging the existing facilities, was an efficient schedule and cost approach to re-establishing pit manufacturing for the United States.

Senator KING. Aside from the resilience issue, was there any comparison made of costs of one versus two?

Dr. VERDON. So we have looked at that, and again, if you factor in resiliency, if look at two sites that can produce 80 pits a year, you have to compare it to one site that is about 140 pits a year. When we estimate that cost we estimate that to be almost twice as expensive as doing the two-site solution that have put forward today.

Senator KING. Thank you. Mr. White, I keep promising I am going to get the questions, and they are still coming, but it is now over to Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman. I am going to follow up a little bit on the pit production. While we know that Los Alamos and Savannah River are the primary production sites, I got to visit you out at Lawrence Livermore a few years ago as well. Can you talk a little bit about the role that Lawrence Livermore is going to be playing in this, as we look at the efforts, the plutonium efforts of NNSA?

Dr. VERDON. So the present example is a perfect one of the W87-1, where Lawrence Livermore is responsible for the design of that warhead and responsible for the design of the pit that is going to go into that warhead. So they are actually playing a key role as the design agency, working with the Los Alamos production agency. It is not enough just to put the equipment in. You actually have to show that what is produced with that equipment is acceptable for use in the stockpile, and Lawrence Livermore will be playing a key role in showing that what Los Alamos, and ultimately Savannah River, would produce is acceptable for use in the stockpile.

Senator FISCHER. Will the technicians at Livermore be able to produce those pits as well? Will you be training them to do that?

Dr. VERDON. Right now there is expertise at Lawrence Livermore in pit production that is being used to peer review the Los Alamos and Savannah River efforts, but right now there is not plans to have them doing hands-on work.

Senator FISCHER. If Livermore was going to start in pit production, what kind of investments would have to be made there?

Dr. VERDON. There was a pit production capability at Lawrence Livermore but it was decommissioned. So it would be, again, a pretty big expense to stand it back up. It was not of the size that would be necessary right now. We would have to increase the size of it.

Senator FISCHER. Okay. Thank you all. I appreciate you being here today. Thank you, Mr. Chairman.

Senator KING. Just a couple more questions. Mr. White, I mentioned in the opening statement 177 leaking tanks at Hanford. Is that the right number, and what are we doing?

Mr. WHITE. So that is the total number of tanks that we have at Hanford, sir, but it is not the number that we believe are leaking.

Senator KING. Do you have a number on those which you think are leaking?

Mr. WHITE. Yes, sir. There are two tanks at Hanford that we believe are actively leaking. Over the 70-year life of the site, we believe over 60 of the single-shell tanks have leaked at some point in the past.

I think this highlights the importance of a couple of things in terms of our ability to manage that aging tank infrastructure. One is it highlights the importance of the mitigation measures that we have taken over the past three decades to ensure that we are managing the risk of that aging infrastructure. For those single-shell tanks that are the most vulnerable, we have pumped out most of the drainable liquids from those tanks starting in the 1980s, and so for the actively leaking tank we identified recently, for example, most of the liquids in that tank had been pumped out.

Senator KING. So you are triaging the tanks according to their risk.

Mr. WHITE. Yes, sir, and we have also installed pump- and-treat systems in the tank farms that prevent the contamination from the history of operations at the site from reaching the groundwater. We have built up a tank integrity program to ensure that we are monitoring very closely the levels in the tanks and also monitoring the integrity of the infrastructure.

Senator KING. Do you feel confident in your groundwater protection efforts, because this site, I understand, is not all that far from the Columbia River.

Mr. WHITE. The tank farms are several miles from the Columbia River, so depending on your—

Senator KING. Groundwater travels.

Mr. WHITE. The groundwater does travel. It takes a number of decades for contaminants to migrate from the tanks to the groundwater, but we have every indication that the pump-and-treat systems that we are putting in place are, in fact, very effective.

I think this does highlight, though, the importance of moving forward to the ultimate solution, which is to treat and dispose of the tank waste at Hanford.

Senator KING. My understanding is there a glassification process for what is coming out of the top part of the tanks, but what about the really bad stuff that is in the bottom? Is that going to be the

same process? There is a grout process, I understand. Is that the answer for the more contaminated?

Mr. WHITE. For the low-activity vitrification capability we are standing up now, that treats the low- activity part.

Senator KING. Right.

Mr. WHITE. The sludge that you are talking about, that typically is in the bottom of tanks, will most likely be a high-level waste component. There is also a vitrification capability that we need to stand up to treat that as well. We are currently in discussions with the State of Washington on the best approach to use to stand up that vitrification facility over the course of the next decade or so.

Those two capabilities together, however, do not treat all of the tank waste at Hanford, and this gets to the need for supplemental treatment capability. This Committee, in the past, has been very interested and very helpful in pushing us to do research and development into options to do that treatment of the supplemental waste streams. We had an FFRDC look at those in 2017. There were options ranging from grouting to vitrification to steam reforming.

We have not made a decision yet on those options. Last year's NDAA asked us to update that R&D effort, and we are in the process of doing that. We have contracted with Savannah River National Lab to do that update. We are also working with the National Academies to look at the study as the labs do that R&D effort.

At some point over the course of the next few decades we will begin to also need to stand up those supplemental capabilities in order to really get to the bulk of the 50 or more million gallons of tank waste that exists.

Senator KING. I sit on the Energy and Natural Resources Committee with Senator Wyden and Senator Cantwell, so I am channeling them now. But you have used "decades" twice. One is in the motion of groundwater and the other is finding the solution. There is a danger here. I mean, there are some deadlines, and do you feel that we are making adequate progress?

Mr. WHITE. I do. I am very impressed with what the site has done in terms of our ability to stand up the initial vitrification capability on the low-activity side. I believe we will meet our regulatory milestone of having that up and running by the end of December 2023.

We are currently working with the State of Washington and the EPA, trying to figure out what the next approach is going to be on the high-level side. I am hopeful we can come up with something that is feasible and practical, from a technical perspective. But I agree with you, time is of the essence.

Senator KING. Thank you, and, Admiral, you deal with waste at Idaho National Lab. Is that program on track? Can we feel some confidence there?

Admiral CALDWELL. Yes, sir, you should feel some confidence there. I ship my spent fuel to Idaho, and package it for interim storage in steel containers, and then put it in concrete overpacks. I have, today, over 75 percent of my spent fuel is in a concrete overpack in road- ready storage, and additionally, we have responsibilities and commitments to the State of Idaho. I have a near-

term commitment to have any fuel that was in the pool before January 1, 2017, had to be out of the pool by January 1, 2023, and I am going to meet that milestone 18 months in advance of the milestone.

So you should have confidence with what we do, and we will continue to do that. The spent fuel handling facility that we are building out there will allow us to continue to process that fuel and also to continue to meet our responsibilities with the State of Idaho, and to do so in an environmentally responsible way.

Senator KING. Thank you. Senator Fischer, any further questions?

I want to thank all of you for your testimony here today. Again, I apologize for being late at the beginning of the meeting. But I also want to thank you for the important work that you are doing. This is some of the most sensitive and important work in our society. Each of you has a different aspect of it, and I just so respect your attention to the detail, and know that you have the support of this Committee, and also know that you are doing a significant service to the country. So thank you all.

Without further questions, the hearing is adjourned.

[Whereupon, at 6:11 p.m., the Subcommittee adjourned.]





**DEPARTMENT OF DEFENSE AUTHORIZATION  
REQUEST FOR FISCAL YEAR 2022 AND THE  
FUTURE YEARS DEFENSE PROGRAM**

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**WEDNESDAY, JUNE 9, 2021**

UNITED STATES SENATE,  
SUBCOMMITTEE ON STRATEGIC FORCES,  
COMMITTEE ON ARMED SERVICES,  
*Washington, DC.*

**MISSILE DEFENSE STRATEGY, POLICIES, AND  
PROGRAMS**

The Committee met, pursuant to notice, at 4:30 p.m. in room SR-232A, Russell Senate Office Building, Senator Angus King (Chairman of the Subcommittee) presiding.

Subcommittee Members present: King, Rosen, Kelly, Fischer, Rounds, Cramer, and Tuberville.

**OPENING STATEMENT OF SENATOR ANGUS KING**

Senator KING. This is a hearing on missile defense strategy, policies, and programs in review of the Defense Authorization Act Request for Fiscal Year 2022 and the Future Years Defense Program. First let me thank our witnesses, we have two panels, for appearing at today's hearing.

Unlike prior missile defense hearings, we have decided to add a nongovernmental witness panel to obtain a diversity of viewpoints on the subject matter before us. The second panel will be our government witnesses to help explain the fiscal year 2022 budget request and answer questions that may arise in the first panel.

The defense of our Homeland and our allies from missiles is a technologically complicated and geographically unbounded problem. Today most missiles follow a predictable ballistic trajectory, based on the laws of physics, and those laws have not changed since the of Sir Isaac Newton. They can fly tens of kilometers, as the recent conflict with Israel demonstrated, or thousands of kilometers, with an Intercontinental Ballistic Missile (ICBM) moving at about Mach 5.

We have spent hundreds of billions of dollars fielding systems to intercept them, premised on this predictable trajectory, and with relatively good success. However, a new class of missiles, called hypersonic boost glide missiles, are now being fielded with speeds in excess of Mach 20, and with an unpredictable, non-ballistic trajectory. We have not fully fielded systems to track much less intercept them. These missiles bring back issues of technology and stra-

tegic stability that were once at the forefront of the debates in ballistic missile defense decades ago. I hope today's hearing can address the policy implications of this new class of missiles as well as the advances we are making in intercepting ballistic missiles that we have invested so heavily in.

Again, let me thank all of you for appearing today. After Senator Fischer's opening statement each witness will have 5 minutes for their own opening statements, and then we will alternate with Members for 5-minute rounds of questions.

Senator Fischer.

#### **STATEMENT OF SENATOR DEB FISCHER**

Senator FISCHER. Thank you, Mr. Chairman, and welcome to our witnesses. We look forward to hearing your views on the broader missile defense policy, particularly as we hear renewed calls for limitations on United States missile defense to be discussed in negotiations with Russia.

General VanHerck and General Karbler, I also want to express my gratitude to the men and women under your commands who have made some extraordinary sacrifices over the past year in order to perform their mission and defend this Nation. We are grateful for their service.

With respect to the fiscal year 2022 funding request, I am pleased to see its support for programs like the next-generation interceptor as well as space-based sensors and hypersonic defense. However, I remain concerned about the overall level of funding for missile defense proposed in this year's budget. Despite continued testimony and numerous classified briefings for Members, where we hear that threats are growing and becoming more complex, particularly as adversaries increase their development of highly capable hypersonic and cruise missile systems, this budget proposes to fund the Missile Defense Agency at what would be the lowest level since 2016.

I understand that these are part of the hard choices being made across the entire defense budget, and the result of adopting the top line that ultimately reduces spending on defense. Nevertheless, I am concerned that this level of funding, especially if sustained into the future, will be insufficient to pace the growing threats facing our Nation, and we will be left in a precarious situation as a Nation.

We rely on the candid testimony of our witnesses to help us understand the difference between a lean diet and starvation.

Thank you, Mr. Chairman.

Senator KING. Thank you, Senator Fischer.

Dr. Soofer, would you make your opening statement, please.

#### **STATEMENT OF DR. ROBERT M. SOOFER, FORMER DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DEFENSE POLICY**

Dr. SOOFER. Thank you, Chairman King and Ranking Member Fischer. Thank you for the opportunity to appear before the Subcommittee.

For most of the post-Cold War period we have enjoyed a relatively stable, bipartisan consensus on the role of missile defense

in U.S. national security policy, but that was not always the case. Few national security issues provoked more debate during the Cold War than missile defense. The argument hinged on how one perceived the relationship between missile defense and strategic stability. One school of thought held that preserving mutual vulnerability by limiting missile defenses was the key to stability during a crisis and central for avoiding an action-reaction arms race.

The other school of thought, equally strongly held, argued that protection against nuclear missile attack was not only a moral imperative but that even imperfect defenses could contribute to deterrence of nuclear attack by complicating an adversary's prospect of launching a successful disarming first strike. But with the collapse of the Soviet Union, United States missile defense policy shifted from building defenses against near-peer powers to addressing the emerging threat to the Homeland posed by smaller, more unpredictable regional actors, the so-called rogue states.

With a return to great power competition, United States missile defense policy must also cope with China and Russia's growing regional missile defense capabilities, meant to prevent the United States from reinforcing its allies during a conflict. So by centering on regional missile defense and homeland protection against rogue regimes rather than Russia, policymakers have been able to avoid those bitter Cold War debates about strategic stability.

So today, if I may, I would like to address three issues that seem to be attracting attention in the missile defense policy world. One is continued funding for the next-generation interceptor, and homeland defense, more generally. Second is employing the SM-3 missile in support of homeland defense, and third, the relationship between arms control and missile defense.

So to stay ahead of the North Korean ballistic missile threat to the Homeland, the Obama administration added 14 ground-based interceptors to the 30 fielded by the Bush administration. They sought to enhance the ground-based nuclear defense system through a redesigned kill vehicle, RKV. The Trump administration altered that acquisition approach to include a fully modernized interceptor, both the rocket and the kill vehicle, and plan to add an additional 20 GBIs [ground based interceptors], to bring the total to 64. It appears the Biden administration has approved the NGI [next generation interception] development to proceed.

So some national security experts criticize the cost, the efficacy, and even the necessity for NGI, and GMD [ground-based midcourse defense] more broadly. I would like to offer the following points in response.

First of all, while we believe North Korea intends to grow its ICBM force in the coming years, intelligence agencies cannot know with certainty the pace of that growth. Today it is reasonable to assume that an additional 20 GBIs, combined with a nuclear vehicle and improved reliability of a GMD system may be sufficient to stay ahead of the threat. We also hope to eliminate a number of North Korean ICBMs on the ground, easing the burden on the GBIs.

Second, with respect to costs, we need to understand this in context. Combined NGI and GMD funding will account for about 1/2 of 1 percent of the Department of Defense (DOD) budget from fiscal

year 2021 to fiscal year 2026. These are not unreasonable sums to protect a nation against North Korea.

Third, proceeding with NGI, and Homeland defense more broadly, is important for U.S. grand strategy. Modernizing and expanding our homeland defense underpins President Biden's push to revitalize our ties with allies and friends. An important element of reviewing alliances is convincing allies that the United States is prepared to run risks on their behalf. Strengthening United States homeland defenses provides that confidence by reducing our own vulnerability to North Korean reprisals. After all, why would our allies expect us to come to their defense if we are not first willing to provide for our own defense?

Finally, Russia and China, they are going to complain about NGI, despite the fact that they are modernizing their own suite of missile defense systems. They deploy more homeland defense interceptors than we do, 68 nuclear-tipped missiles, and they are modernizing hundreds of regional air and missile defense systems, a missile defense posture which exceeds the U.S., in some respects.

My second issue is the SM-3 missile. As you know, the SM-3 missile is a regional missile, based on ships. When we did the Missile Defense Review in the Trump administration we asked the question, could we use the SM-3 to provide an additional layer of protection for the Homeland, in addition to the GBI? In fact, Congress was thinking along the same lines, because it directed, in the Fiscal Year 2018 NDAA, that we conduct a test of the SM-3 missile against a simple ICBM target. That test took place last November, resulting in a successful intercept.

Now while the SM-3 IIA missile deployed on Aegis ships will continue to play an important regional defense role, the Interceptor may provide a modest additional measure of protection for the Homeland against North Korean ICBMs in an emergency or during a crisis. The ship would have to be in the right place, near our coast, and the right time, and given its smaller size, compared to the GBI, the Interceptor would not provide coverage of the entire United States. Moreover, the SM-3 would not be capable against the more complex Russian and Chinese threats, armed with penetration aids and decoys, nor would it be able to cope with Russia's nuclear air and sea launch cruise missile that can also range the United States Homeland.

For these reasons, it is unlikely this capability will upset strategic stability for the foreseeable future, if ever. As President Putin himself has noted, by the end of this year, 90 percent of Russia's nuclear forces will be modernized, and, in his words, "capable of confidently overcoming existing and even projected missile defense systems."

Now some have argued that Russia's new novel systems are a response to our missile defense plans. Well, there is an alternative explanation for why Russia is developing these new novel nuclear capabilities. According to Rose Gottemoeller, Obama's former New Start chief negotiator, she said Putin is "after nuclear weapons for another reason, to show that Russia is still a great power to be reckoned with. These exotic systems have more of a political function than a strategic or security one." In my view, it is more likely an improved SM-3 missile, even in limited numbers, will con-

tribute to collective efforts to meet the challenges posed by the North Korean regime, thereby enhancing regional and international strategic stability.

In a final analysis, we cannot allow Russia or China to have a veto over the protection of the United States against rogue state threats.

Finally, on arms control. There is a suggestion that you cannot have both missile defense and arms control, and I think history suggests the opposite. The United States has been pursuing missile defense seriously since the mid 1980s. This was the Reagan Strategic Defense Initiative, and since we withdrew from the ABM treaty in 2002. So despite the fact that we have been pursuing missile defenses, Russia and the United States have signed three arms control treaties that have together drawn down nuclear forces by some 85 percent, compared to Cold War highs.

Look, if Russian leaders were seriously alarmed about United States missile defenses, they would not have agreed to these reductions, or more recently to extend the New START Treaty for another 5 years.

To conclude, I would just add that homeland and regional missile defenses provide protection for the Nation, its deployed forces and allies, and are critical enablers of a U.S. grand strategy that relies on alliances to maintain a favorable balance of power and a peaceful world order. For about 2 percent of annual defense appropriations, missile defense provides the United States the freedom of action to respond to crises, to shore up allies, to deter adversaries, and, if necessary, to defeat them and limit damage should deterrence fail.

Finally, deterrence, to be successful, requires the demonstration of resolve. Missile defense is a very tangible measure of U.S. resolve. Failure to do what is necessary to protect this nation against North Korea, a country with one of the lowest-ranked economies in this world, could call into question United States resolve and commitment in the eyes of ally and adversary alike. This would damage U.S. strategic capability and have serious implications for America's broader foreign policy objectives.

Thank you.

[The prepared statement of Dr. Robert M. Soofer follows:]

PREPARED STATEMENT BY DR. ROBERT M. SOOFER

Chairman King, Ranking Member Fischer, thank you for the opportunity to appear before the Subcommittee on Strategic Forces to discuss U.S. missile defense policy. For most of the post-Cold War period we have enjoyed a relatively stable bipartisan consensus on the role for missile defense in U.S. national security policy. But that wasn't always the case.

Few national security issues provoked more debate during the Cold War than missile defense. The argument hinged on how one perceived the relationship between missile defense and strategic stability. One school of thought held that preserving mutual vulnerability by limiting missile defenses was key to stability during a crisis and essential for avoiding an "action-reaction" arms race. The other school of thought, as strongly held as the first, argued that protection against nuclear missile attack was not only a moral imperative, but that even imperfect defenses could contribute to deterrence of nuclear attack by complicating an adversary's prospect of launching a successful disarming first strike.

Congress was divided on the matter from the outset. In 1969 the Nixon Administration requested funding for the Safeguard ABM system—a light defense designed to protect U.S. land-based retaliatory forces against Soviet attack, protect American

cities against China, and provide security against accidental attacks from any source. The Senate vote was 50 to 50 during an attempt to eliminate funding for the system, with Vice President Spiro Agnew casting the deciding vote in favor of Safeguard.

The 1972 ABM Treaty, which limited each side to two ABM sites, seemed to settle the issue in favor of the mutual vulnerability school, at least until President Reagan reopened the debate in 1983 with the Strategic Defense Initiative. This Committee witnessed some heated debates during those years, and while these two schools still exist to some extent, the end of the Cold War brought with it the opportunity to reach common ground on missile defense policy and programs.

With the collapse of the Soviet Union the focus of United States missile defense policy shifted from building defenses against near peer powers to addressing the emerging threat to the Homeland posed by smaller, more unpredictable regional actors—rogue powers in the popular vernacular. With a return to great power competition, United States missile defense policy must also cope with China and Russia's growing regional missile capabilities meant to prevent the United States from reinforcing its allies during a regional conflict. By centering on regional missile defense and homeland protection against rogue regimes (rather than Russia) policy makers have been able to avoid the bitter Cold War debates about strategic stability.

#### U.S. POLICY FOR HOMELAND AND REGIONAL MISSILE DEFENSE

The U.S. maintains two somewhat different policies for Homeland and regional missile defense that sometimes leads to confusion about our policies and intentions.

Maintaining an “advantageous *homeland defense posture* against limited ballistic missile threats,” as noted in the 2010 Ballistic Missile Defense Review, has been the guiding principle of U.S. missile defense policy across Republican and Democratic administrations since the end of the Cold War. Protection of the *Homeland* against ballistic missile attack by regional actors such as North Korea and Iran is a goal shared by Congress as well.

With respect to Russia and China, the United States continues to rely on its nuclear forces (as it did during the Cold War) to deter nuclear threats against the Homeland. It is not U.S. policy to build missile defenses against these much larger and technologically sophisticated threats to the Homeland.

To address missile threats to U.S. deployed forces and allies, our policy has been to strengthen regional missile defense capabilities against the full range of potential threats while working cooperatively with allies to help them better defend themselves. We don't rely only on missile defense systems, but rather pursue a comprehensive and layered approach that includes deterrence, active and passive defenses, and attack operations to destroy offensive missiles prior to launch.

I would like to address three issues that could kindle debate over missile defense policy this year: 1) funding for the Next Generation Interceptor (NGI); (2) employing the SM-3 missile in support of the homeland defense mission; and (3) the relationship between missile defense and arms control.

#### NGI AND HOMELAND MISSILE DEFENSE

To stay ahead of the North Korean ballistic missile threat to the Homeland, the Obama Administration added 14 ground-based interceptors (GBIs) to the 30 fielded by the Bush Administration and sought to enhance the Ground Based Midcourse Defense (GMD) system through a redesigned kill vehicle (RKV) for the GBI. The Trump Administration altered the acquisition approach to include a fully modernized interceptor (both rocket and Kill vehicle) called the Next Generation Interceptor and planned to add an additional 20 NGI/GBIs to the 44 deployed currently in Alaska and California. The Biden administration has approved NGI development to proceed, with Secretary of Defense Austin telling Congress that “*with its emphasis on missile defense and more sophisticated sensors, our budget will also help counter the increasing ballistic missile capabilities of nations like North Korea and Iran.*”

Some national security experts and Members of Congress have criticized the cost, efficacy, and necessity for NGI or the GMD system more broadly, arguing that North Korea could easily overwhelm planned upgrades and future deployments. Other critics are concerned that the expansion of United States missile defense capabilities, meant to pace the North Korean threat, could eventually upset strategic stability with Russia and China.

I would offer the following points in response.

First, while we believe North Korea intends to grow its ICBM force in the coming years, our intelligence agencies cannot know with any great certainty the pace of this growth. Today, it is reasonable to assume that an additional 20 ground-based

interceptors, combined with a new kill vehicle and improved reliability of the GMD system, may be sufficient to stay ahead of the threat. We would hope also to eliminate a number of North Korean ICBMs on the ground, easing the burden on GMD (though the prospects of defeating mobile missiles prior to launch remains a daunting challenge).

Second, the costs, while significant, must be understood in context. In fiscal year 2021, the funding for NGI (\$858 million) is about 8.2 percent of the total MDA budget and will be approximately one-quarter of one percent of DOD's budget over fiscal year 2021 to fiscal year 2026. NGI total program costs amount to approximately 0.18 percent of DOD's budget from fiscal year 2020 to fiscal year 2030. Combined NGI and GMD funding will account for about one-half of one percent of the DOD budget across fiscal year 2021 to fiscal year 2026. These are not unreasonable sums to protect the nation against North Korean and potentially other rogue state ICBMs.

Third, proceeding with NGI, and homeland defense more broadly, is important for a U.S. grand strategy that, according to the White House, seeks to *"promote a favorable distribution of power to deter and prevent adversaries from directly threatening the United States and its allies, inhibiting access to the global commons or dominating key regions."* Adversary offensive missile capabilities are meant to coerce the United States, to limit our freedom of action, to discourage us from supporting our allies or countering regional challengers, and, ultimately, to weaken our alliances. Modernizing and expanding our Homeland defense underpins President's Biden's "push to revitalize our ties with friends and partners." An important element of renewing alliances is convincing allies that the United States is prepared to run risks on their behalf. Strengthening U.S. Homeland defenses provides that confidence by reducing our own vulnerability to North Korean reprisals. *After all, why would our allies expect us to come to their defense if we are not first willing to provide for our own defense?*

Finally, Russia and China are likely to complain about improvements to United States Homeland defenses even while each continues to modernize its own suite of missile defense systems. Russia deploys 68 nuclear tipped ground-based interceptors for the protection of greater Moscow and hundreds of regional air and missile defense systems, a missile defense posture which exceeds the United States in some respects. It is also actively selling its regional missile defenses to nations across Eurasia. China possesses regional air and missile defense systems and has conducted tests of a mid-course defense system against intermediate-range ballistic missiles. President Putin, too, has said that United States missile defense won't be able to stop Russian missiles, which include nuclear air- and sea-launched cruise missiles which can under-fly the GMD system. While there may be some in Russia who genuinely worry about United States missile defenses, Russian leaders more likely use the issue for domestic political reasons and to sow dissension between the United States and its allies.

#### LAYERED HOMELAND DEFENSE AND THE SM-3 MISSILE

As part of its review of missile defense policy, the Trump administration examined whether existing technologies or current weapon systems could contribute to the missile defense mission. One of those approaches included the prospect of employing the SM-3 block IIA missile as an underlayer "to offer an additional defensive capability to ease the burden of the GBI system and provide protection for the U.S. Homeland against evolving rogue states' long-range missile capabilities." Congress was apparently thinking along the same lines when it directed the Department of Defense to conduct a test of the SM-3 against a simple ICBM target by the end of 2020. That test took place last November, resulting in a successful intercept.

While the SM-3 IIA missile deployed on Aegis capable ships will continue to play an important regional defense role, the interceptor may be able to provide a modest, additional layer of protection for the Homeland against North Korean ICBMs in an emergency or during a crisis. The ship would have to be in the right place near our coast at the right time, and given its smaller size compared to the GBI, the interceptor would not provide coverage for the entire United States. Moreover, the SM-3 would not be capable against the more complex Russian and Chinese ballistic missiles armed with penetration aids and decoys—nor would it defend against air and sea-launched cruise missiles.

Russia and China have registered their concerns about this development, as has the arms control community, which fears this potential expansion of United States Homeland defense will spark an arms race or even increase the likelihood of nuclear war—in other words, upset strategic stability.

However, given the limited number of SM-3 IIA missiles programmed over the next five years, as well as the interceptor's inherent technological limitations against complex Russian and Chinese missiles, it is unlikely this capability will upset strategic stability for the foreseeable future, if ever. As President Putin himself has noted, by the end of this year, 90-percent of Russia's nuclear forces will be modernized and, in his words, "capable of confidently overcoming existing and even projected missile defense systems."

Some have suggested that Russia's "novel" nuclear systems are a response to United States missile defense plans and that the recent SM-3 test will only exacerbate this. But there is an alternative explanation. According to Rose Gottemoeller, former New START chief negotiator, Putin *"is after nuclear weapons for another reason—to show that Russia is still a great power to be reckoned with. These exotic systems have more of a political function than a strategic or security one."*

More likely, an improved SM-3 missile, even in limited numbers, will contribute to collective efforts to meet the challenges posed by the North Korean regime, thereby enhancing regional and international strategic stability. In the final analysis, we simply cannot give Russia or China a veto over the protection of the United States against rogue state threats.

#### MISSILE DEFENSE AND ARMS CONTROL

Another important policy consideration is the relationship between missile defense and future nuclear arms control negotiations. There is a sort of conventional wisdom, stretching back to the early days of the Cold War, which suggests that reductions or limits on offensive nuclear forces are made possible through limits on missile defenses. A corollary principle is that it is "wholly impossible" to reach arms control agreements while pursuing missile defenses. This conventional wisdom is wrong, or at least more complicated than currently understood.

In the first instance, the 1972 ABM Treaty did not curtail the arms race; rather, the Russians added some 10,000 nuclear warheads between 1972 and 1984, leading a prominent arms control theorist, Thomas Schelling, to observe in 1985 that "since 1972, the control of strategic weapons has made little or no progress."

History shows that missile defense and nuclear arms control are not incompatible. Even though the United States has been pursuing missile defenses seriously since the mid 1980s, and withdrew from the ABM Treaty in 2002, Russia and the United States have together drawn down their nuclear forces by some 85 percent from Cold War highs. If Russian leaders were seriously alarmed about United States missile defenses they would not have agreed to these reductions or, more recently, to extend the New START treaty for another five years.

To be sure, Russia will want to include missile defense in any future nuclear arms control negotiations or strategic stability talks. We should offer no concessions, but rather hear them out and explore ways to reassure the Russian side, through transparency, technical cooperation where practical, and other confidence building measures, that United States missile defenses pose no threat to Russia's formidable nuclear forces.

#### CONCLUSION

Homeland and regional missile defenses provide protection for the Nation, its deployed forces and allies, and are critical enablers of a U.S. grand strategy that relies on alliances to maintain a favorable balance of power and a peaceful world order.

For about 2-percent of annual defense appropriations, missile defense provides the United States the freedom of action to respond to crises, to shore-up allies, to deter adversaries and, if necessary, to defeat them and limit damage should deterrence fail.

Deterrence, to be successful, requires the demonstration of resolve. Missile defense is a very tangible measure of U.S. resolve. Failure to do what is necessary to protect this Nation against North Korea, a country with one of the lowest ranked economies in the world, could call into question United States resolve and commitment in the eyes of ally and adversary alike. This would damage U.S. strategic capability and have serious implications for America's broader foreign policy objectives.

I thank the Committee for its time and look forward to questions.

[Robert M. Soofer is a non-resident senior associate with the Center for Strategic and International Studies and an adjunct professor with Georgetown University's Security Studies Program. He served as Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy in the Trump Administration and as a professional staff member for the Strategic Forces Subcommittee of the Senate Armed Services Committee.]



Senator KING. Thank you. In the interest of time we are going to submit the backgrounds of Dr. Soofer and Mr. Panda for the record.

Mr. Ankit Panda, please.

**STATEMENT OF MR. ANKIT PANDA, STANTON SENIOR FELLOW, NUCLEAR POLICY PROGRAM, CARNEGIE ENDOWMENT FOR INTERNATIONAL PEACE**

Mr. PANDA. Thank you, Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee. I am honored to be here today before you to offer my views on the missile defense strategy of the United States and its relationship to strategic stability with our nuclear-armed adversaries.

My name is Ankit Panda. I am a Washington, DC-based scholar of the Carnegie Endowment for International Peace, where I study nuclear strategy and missile defense, among other issues. For the last 20 years we have sought to develop a national missile defense architecture capable of defending the Homeland against limited missile threats, namely those from North Korea, which today possesses a minimally capable, rudimentary, intercontinental range ballistic missile capability, and Iran, which may one day possess such a capability.

Today our ambitions for national missile defense remain large. Plans to develop a layered homeland missile defense architecture, in particular, for a major plank of the Missile Defense Agency's near-term efforts. This layered architecture stands to take what was once limited plans for a modest, self-contained homeland missile defense architecture, captured entirely in the Ground Based Midcourse Defense system and its 44 deployed Ground-Based Interceptors, soon to be 64, deployed in Alaska and California, and extended to include sea-based Aegis missile defense, and eventually even ground-based Terminal High Altitude Area Defense systems.

Allow me now to posit that this country's national security could be meaningfully enhance through the tabling of limitations on strategic or homeland missile defense, as part of a reciprocal process involving Russia, and possibly China. Doing so would not only reduce fiscal and opportunity costs in ways that would augment both our conventional deterrence capabilities and nuclear modernization plans, but also promote more stable nuclear deterrence with our adversaries.

The case for limitations rests fundamentally on a national reckoning with the necessities of nuclear deterrence. As the last administration's 2019 *Missile Defense Review* notes, we rely on nuclear deterrence to cope with the strategic forces of Russia and China, which are objectively too vast to be fully absorbed by our existing missile defenses. That I do not dispute.

But Moscow and Beijing reason about our intentions, as we often do theirs, based on our actions and not our statements. As a result, both fear the ability of our current and future missile defense posture to degrade their strategic nuclear retaliatory capability, if not to completely disrupt it. This, in turn, begets instability.

To be clear, I do not posit that our missile defense programs are the sole drivers of Russian and Chinese strategic modernization and force expansion. However, they are salient, and considerable

evidence suggests that we are seeing precisely the kind of action-reaction relationship between strategic offense and defense that spurred the first round of United States-Soviet arms control during the late 1960s once again today.

As was the case back then, limitations should not be unilateral but should nonetheless be on the table, in particular, as we seek a follow-on agreement with Russia to the 2010 Strategic Arms Reduction Treaty, the last treaty of its kind to remain in force between our two countries and due to expire in 2026.

Congress, in particular, has led on this issue in the past and can do so again. For instance, during the final decade of the Cold War it was Congress that limited the Reagan administration's desire to reinterpret the ABM treaty in a way that might permit for a capacious expansion of the Strategic Defense Initiative. This facilitated strategic stability and Congress can once again play this role.

So there are numerous ways in which Congress might lead on this issue to forestall what I see is a costly 21st century arms race that is already underway and enhance American national security in the process.

First, Congress should ask the Department of Defense to study and assess the extent to which our investments in missile defense are spurring qualitative and quantitative force structure changes by our adversaries. DOD has observed, in recent congressional mandated reports, that missile defense is driving certain forms of Chinese and Russian modernization, for instance. A fuller study could inform our national decision-making to ensure a prudent path forward.

Beyond this, Congress should adopt a resolution acknowledging the action-reaction relationship between strategic offensive and defensive arms, as the preamble to the New START Treaty in 2010 did. In doing so, this body can render more credible attempts by this administration, or a future administration, to seek limitations on Russian and Chinese offensive arms of particular concern that would enhance American national security.

Finally, Congress should remain actively involved in ensuring the Missile Defense Agency is subjecting the Ground-Based Mid-course Defense system to realistic testing and evaluation. This can include mandating testing against ICBM target missiles of longer ranges, that would be more representative of, say, a North Korean ICBM. Future testing should also include more realistic environmental and other stressors, including decoys designed to emulate the infrared signature of a target re-entry vehicle, something that is eminently within North Korea's reach today.

My written testimony for this Subcommittee discusses these and other issues germane to today's hearing in greater detail. Thank you for this opportunity today, and I look forward to your questions.

[The prepared statement of Mr. Ankit Panda follows:]

PREPARED STATEMENT BY MR. ANKIT PANDA

Chairman King, Ranking Member Fischer, Members of the Subcommittee, it is my honor to testify before you today on the present and future of missile defenses in the national defense strategy of the United States. My testimony will cover three matters germane to the matter at hand today. First, I describe the full extent of U.S. missile defense capabilities today and near-future plans. Second, I explain how

homeland missile defense—perhaps counterintuitively—harms rather than enhances U.S. national security interests by increasing the odds of nuclear escalation in a crisis and by increasing the costs of peacetime competition with our adversaries. Third, I describe the advantages and disadvantages of introducing missile defense as a topic for consideration in future arms control negotiations with Russia and possibly China. I conclude by recommending potential approaches to limitations that maximize U.S. national security interests and with suggestions for how Congress may proceed in studying these matters.

#### U.S. MISSILE DEFENSE CAPABILITIES AND PLANS

The United States deploys a multi-tiered missile defense system to defend against ballistic and cruise missile threats across the full array of range classes. Despite the commonplace reference to a “layered” missile defense system, it is important to underscore that most currently deployed systems and interceptors are designed and optimized to manage a portion of the full range of ballistic missile threats. In other words, specific systems are optimized to defeat and destroy missiles of a specific range class, with limited overlap in capability across systems. Currently deployed interceptors and missile defense systems cover ballistic missile threats in the mid-course and terminal phases of their flight trajectories. These systems are supported by a complex array of command and control, battle management, and communications systems. A diverse array of land-, sea-, and space-based sensors provides early warning, tracking, and discrimination for the missile defense mission. Air-based sensors additionally support the testing and evaluation of missile defense-related test activities.

The primary missile defense systems in use today are the Ground-Based Mid-course Defense (GMD) system; the ship-based Aegis Ballistic Missile Defense (BMD) and Aegis Ashore platforms; Terminal High Altitude Area Defense (THAAD); and Patriot Advanced Capability-3 (PAC-3) and other Patriot variants.

Each of these systems employs a varying array of interceptor missiles and types: GMD relies on the Ground-Based Interceptor, based in Fort Greely, Alaska, and Vandenberg Air Force Base, California; Aegis BMD relies on the Standard Missile 3 (SM-3) Block IA/IB interceptors and the Standard Missile 6. The SM-3 Block IIA is being procured in limited numbers and will deploy at sea and ashore. THAAD, PAC-3, and other Patriot variants use system-specific interceptors. All interceptor types in use today rely on direct kinetic impact through either a kill vehicle or interceptor—or an interceptor-mounted blast fragmentation warhead in the case of older Patriot systems—to destroy inbound missile threats.

GMD is the sole system developed from the ground-up to address intercontinental-range ballistic missile threats to the U.S. Homeland, but, in November 2020, an Aegis BMD-equipped U.S. Navy *Arleigh Burke*-class destroyer successfully employed an SM-3 Block IIA interceptor to destroy what the Missile Defense Agency described as a “threat representative” ICBM-class target. This test, codenamed FTM-44 and carried out as a result of a congressionally mandated test pursuant to the 2018 National Defense Authorization Act, set up SM-3 Block IIA as potentially the second such system available for potential homeland missile defense. It is and has been the policy of the United States since the 2002 decision by the Bush administration to exit the Cold War-era Anti-Ballistic Missile Treaty to rely on homeland missile defense for “limited” ballistic missile threats to the Homeland. To this end, the 2019 Missile Defense Review (MDR) notes “the GMD system is designed to defend against the existing and potential ICBM threat from rogue states such as North Korea and Iran.”<sup>1</sup> The 2019 MDR adds that “in the event of conflict, [the GMD system] would defend, to the extent feasible, against a ballistic missile attack upon the U.S. Homeland from any source.”

Efforts to generate a layered homeland missile defense system, incorporating GMD and Aegis with SM-3 Block IIA, remain underway. MDA’s fiscal year 2022 plans include pursuing a layered homeland defense approach that will further assess SM-3 Block IIA’s suitability for a counter-ICBM mission. MDA further plans to evaluate THAAD’s capability to participate in the defense of the contiguous United States, with a THAAD-specific flight test to this end planned for as early as fiscal year 2023.

THAAD, PAC-3, other Patriot systems, and sea-and land-based Aegis BMD systems provide in-theater missile defense in Europe and Asia to protect United States servicemembers, military facilities, and allied territory from ballistic and, in certain

<sup>1</sup>Missile Defense Review, U.S. Department of Defense, 2019, [https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR\\_Executive%20Summary.pdf](https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf), pp. XII.

cases, cruise missile threats. Successive U.S. administrations have maintained cooperative ballistic missile defense programs with key allies. This includes the European Phased Adaptive Approach (EPAA), which features land-and sea-based sensor, interceptor, and battle management system deployment to defend NATO territory against evolving threats as ballistic missiles proliferate. In Asia, successive administrations have cooperated extensively with Japan on ballistic missile defense, with Tokyo notably having codeveloped the SM-3 Block IIA with the United States. South Korea and Australia have also been close partners on missile defense in Asia. Finally, for more than 3 decades, the United States has supported Israel's indigenous missile defense programs.

Apart from these existing capabilities, the Missile Defense Agency continues to study, research, develop, and evaluate a range of new sensors, interceptors, and other missile defense-related technologies. Some of these programs cover hypersonic defense, sensor integration, new kill vehicles (the Common Kill Vehicle Technology program), and the THAAD-PAC-3 Missile Segment Enhancement (MSE) integration. In fiscal year 2021, MDA requested \$9.187 billion to support these activities in addition to the sustainment and procurement of deployed missile defense capabilities.<sup>2</sup>

Since the mid-1980s, Congress has appropriated in excess of \$200 billion<sup>3</sup> for the Missile Defense Agency (MDA) and its predecessors, the Ballistic Missile Defense Organization (1974–2002; renamed MDA) and the Strategic Defense Initiative Organization (1984–1993).

#### *Homeland Missile Defense*

The highest-end missile defense mission today is that of protecting the U.S. Homeland from limited nuclear attacks. In 2002—4 years after North Korea's first-ever test of a satellite launch vehicle—the George W. Bush administration announced the deployment plan for the GMD system. As the system was announced, the administration sought to achieve an initial operational capability before 2005. This timeline—unusually compressed for a program with the ambition and challenging technical goals given to GMD—was nominally met, with MDA declaring a “limited defensive capability” by the end of 2004, though just how limited was not admitted.<sup>4</sup> The nominal claim was not based on any realistic testing of the system against ICBM-class targets. In the 16 years since, GMD has endured delays, unexpected technical hurdles, cost overruns, and exhibited irregular successes over its limited testing history.<sup>5</sup>

GMD has been tested just twice against what MDA has described as “threat representative” targets—targets emulating potential ICBM threats to the Homeland. Both tests—FTG-15 in 2017 and FTG-11 in 2019—were declared successful by MDA, but the target missile in both did not faithfully emulate the trajectory, velocity, or potential countermeasures that might accompany a real North Korean ICBM launch against the continental United States.<sup>6</sup>

Across the 19 intercept tests in the program's history, MDA has assessed a success in 11 cases, including the three most recent tests. Technical and programmatic hurdles have complicated GMD's planned development. For instance, a notable set of technical hurdles were found to be associated with faulty divert thrusters—small rockets meant to offer fine in-flight trajectory adjustments—across multiple tests.<sup>7</sup> Most notably, plans to replace the program's older, troubled exoatmospheric kill vehicle (EKV) with the Redesigned Kill Vehicle (RKV) were canceled in 2019.<sup>8</sup> In-

<sup>2</sup> Missile Defense Agency, Budget Estimates Overview: Fiscal Year (FY) 2021, <https://www.mda.mil/global/documents/pdf/budgetfy21.pdf>.

<sup>3</sup> Estimate derived from collating fiscal year 2018, fiscal year 2019, and fiscal year 2020 appropriation with available MDA historical funding data. For more, see Historical Funding for MDA FY85–17, U.S. Missile Defense Agency, [https://www.mda.mil/global/documents/pdf/FY17\\_histfunds.pdf](https://www.mda.mil/global/documents/pdf/FY17_histfunds.pdf).

<sup>4</sup> Missile Defense Agency, Annual Financial Statements, fiscal year 2004, [https://comptroller.defense.gov/Portals/45/documents/cfs/fy2004/FY\\_2004\\_MDA\\_Financial\\_Report.pdf](https://comptroller.defense.gov/Portals/45/documents/cfs/fy2004/FY_2004_MDA_Financial_Report.pdf).

<sup>5</sup> Laura Grego, George N. Lewis, and David Wright, “Shielded from Oversight: The Disastrous US Approach to Strategic Missile Defense,” Union of Concerned Scientists, July 2016, <https://www.ucsusa.org/sites/default/files/attach/2016/07/Shielded-from-Oversight-full-report.pdf>.

<sup>6</sup> Laura Grego and David Wright, “Analysis of GMD Missile Defense Test FTG-15,” Union of Concerned Scientists, March 15, 2018, 15, <https://www.ucsusa.org/resources/analysis-gmd-missile-defense-test-ftg-15>.

<sup>7</sup> David Willman, “A Test of America's Homeland Missile Defense System Found a Problem. Why Did the Pentagon Call It a Success?,” Los Angeles Times, July 6, 2016, <http://www.latimes.com/projects/la-na-missile-defense/>.

<sup>8</sup> Jen Judson, “Pentagon Terminates Program for Redesigned Kill Vehicle, Preps for New Competition,” Defense News, August 21, 2019, <https://www.defensenews.com/pentagon/2019/08/21/dod-tanks-redesigned-kill-vehicle-program-for-homeland-defense-interceptor/>.

stead, the Department of Defense now plans to procure a new interceptor—the Next-Generation Interceptor, or NGI—to phase-in as a replacement for the GMD system’s silo-based Ground-based Interceptors (GBIs). According to MDA Director Vice Adm. Jon Hill, NGI was “the result of the first holistic technical assessment of homeland defenses the department has conducted since initial system operations began in 2004.”<sup>9</sup>

Despite GMD’s test record and trouble programmatic history, U.S. civilian and military leaders alike have expressed confidence in the system. General John E. Hyten, Vice Chairman of the Joint Chiefs of Staff, has stated that he has “100 percent confidence in those capabilities against North Korea.”<sup>10</sup> Lt. General James Dickinson, commander of the United States Army Space and Missile Defense Command, has expressed “no concerns” regarding GMD’s capabilities.<sup>11</sup> While these statements appear to be subjective expressions of confidence in the system, GMD’s actual testing record does not indicate anywhere close to a perfect level of system effectiveness. Even the most effective U.S. missile defense systems as evaluated through testing—notably, THAAD—can be expected to offer a perfect defense.

#### *Arms Control Today and Missile Defense*

No arms control treaty currently proscribes the United States’ pursuit of homeland or theater missile defense systems. The first and last major treaty to do so—the 1972 ABM Treaty between the United States and the Soviet Union—was discarded by the Bush administration to augment homeland missile defense capabilities against what was then seen as a potential North Korean intercontinental-range nuclear threat. The ABM Treaty, an outcome of the first United States-Soviet Strategic Arms Limitation Talks (SALT I, 1969–1972), did not completely ban missile defenses, but limited each of its parties to 200 deployed, fixed interceptors at two sites; a 1974 protocol halved this to 100 interceptors at a single site.<sup>12</sup>

The 2010 Strategic Arms Reduction Treaty (New START) between the United States and the Russian Federation—the sole strategic arms reduction treaty in force between the two and due for expiration in 2026—does not provide for meaningful limitations on missile defense, but the preamble text to the Treaty notes that both countries “recognize the interrelationship between strategic offensive and strategic defensive arms and that this interrelationship would become more important as strategic nuclear arms were reduced.” Since the Bush administration’s decision to exit the ABM Treaty in 2002, no U.S. administration has proposed exploratory talks with any United States nuclear-armed adversary—Russia, China, or North Korea—on the matter of limiting missile defenses.

#### STRATEGIC STABILITY AND MISSILE DEFENSE

For any two adversarial states practicing nuclear deterrence, strategic stability between them exists when both arms race stability and crisis stability exist. These subsidiary conditions for strategic stability govern the incentives each side has—in peacetime—to expand its available set of offensive weaponry (arms race stability) and, in a crisis, to employ nuclear weapons first (crisis stability). Strategic stability is desirable because it reduces the financial and opportunity costs of competition in peacetime and, in a crisis, lowers the probability that either side will seek to deliberately escalate a crisis in pursuit of strategic advantage. Ultimately, this reduces the odds of a devastating nuclear war.

Missile defenses—particularly homeland missile defenses—interact with these subsidiary requirements for strategic stability in important ways.

First, one side’s investments in missile defenses in peacetime will prompt the other to reassess its force size and posture. Because stable nuclear deterrence depends on a shared acceptance between adversaries of a “balance of terror,”<sup>13</sup> the

<sup>9</sup> “Contracts Awarded for Next Generation Interceptor Program,” U.S. Department of Defense, accessed May 26, 2021, <https://www.defense.gov/Newsroom/Releases/Release/Article/2547665/contracts-awarded-for-next-generation-interceptor-program/>.

<sup>10</sup> “A Conversation with General John Hyten, Vice Chairman of the Joint Chiefs of Staff,” CSIS Event, January 17, 2020, [https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/200121\\_John\\_Hyten.pdf](https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/200121_John_Hyten.pdf).

<sup>11</sup> Jason Sherman, “Army’s Top Air Defender Remains Confident in GBI Fleet after RKV Termination,” InsideDefense.com, October 22, 2019, <https://insidedefense.com/daily-news/armys-top-air-defender-remains-confident-gbi-fleet-after-rkv-termination>.

<sup>12</sup> Protocol To The Treaty Between The United States Of America And The Union Of Soviet Socialist Republics On The Limitation Of Anti-Ballistic Missile Systems, available at <https://2009-2017.state.gov/t/avc/trty/101888.htm#protocolabm>.

<sup>13</sup> Albert Wohlstetter, “The Delicate Balance of Terror,” Product Page, 1958, <https://www.rand.org/pubs/papers/P1472.html>.

introduction of any new defensive capability that is perceived as upsetting this balance will create incentives for further investment in offensive capabilities to restore balance. This “action-reaction phenomenon” between offensive and defensive investments was once recognized as the foundation of the United States-Soviet arms race during the Cold War.<sup>14</sup>

In the years since withdrawal from the Anti-Ballistic Missile Treaty in 2002 and as early as the National Missile Defense Act of 1999,<sup>15</sup> the United States has maintained that existing Homeland missile defense capabilities are designed to cope with “limited” threats from so-called rogue states like North Korea, and should not be seen as threatening to Russia or China, and therefore causative of arms racing. Finally, in 2017 North Korea did acquire a rudimentary intercontinental-range nuclear delivery capability. Iran may one day acquire such a capability.

The origins of United States intentions to focus missile defense on countries other than Russia (whose offensive forces are too numerous to defend against) can be traced back to the post-Cold War GPALS—or Global Protection Against Limited Strikes—program, which was introduced by the George H.W. Bush administration as a successor to the Reagan administration’s Strategic Defense Initiative.

U.S. messaging on the limited objectives of homeland missile defense, however, has been inconsistent at times. Notably, during the public unveiling of the 2019 MDR, former President Donald J. Trump indicated that it was the goal of the United States “to ensure that we can detect and destroy any missile launched against the United States—anywhere, anytime, anyplace.”<sup>16</sup> (emphasis added)

This marked an authoritative endorsement of a much more far-ranging set of objectives for current and future missile defense plans in the United States—even as it appeared to be inconsistent with the published text of the 2019 MDR which reiterated the “limited” objective for homeland missile defense and explicitly stated that “nuclear deterrence” (as opposed to missile defense) would “address the large and more sophisticated Russian and Chinese intercontinental ballistic missile capabilities.”<sup>17</sup> The 2019 MDR is somewhat internally inconsistent on this question. In the case of ballistic missile attacks against the United States Homeland from countries other than North Korea or Iran, the 2019 MDR notes that GMD would defend “to the extent feasible, against a ballistic missile attack upon the United States Homeland from any source” (implying that GMD would endeavor to limit damage in a strategic nuclear war with Russia and China). In any case, Russian and Chinese military planners (who like their American counterparts tend to plan on the basis of worst-case scenarios) never were reassured that United States missile defenses would not be directed against them.

Second, beyond stimulating arms racing, once missile defenses are developed, tested, and deployed, they can introduce deleterious sources of uncertainty in decision-making during a crisis, prompting escalatory behavior where restraint might otherwise have prevailed. In a system of bilateral nuclear deterrence where survivable offensive systems exist under conditions of relative parity, each side might seek to avoid deliberate escalation because of the inability to assure the complete destruction of the other side’s arsenal—thereby subjecting oneself to the adversary’s retaliatory strike. In broad strokes, numerical parity of this kind is stabilizing because it deprives each side of the incentive to ever strike first, promoting stability in a crisis.

The introduction of strategic missile defenses—even in modest numbers—can upset this. Whereas one side’s first strike would otherwise have left the other with an assured retaliatory capability, the attacker’s defenses would now have the capability to degrade and absorb this retaliation. As a result, the victim’s retaliatory capability would no longer be assured because their ballistic missile reentry vehicles (RVs) might be intercepted long before they are able to detonate on or near the attacker’s territory. In recognition of this dilemma, the would-be victim, in a crisis, faces strong incentives to employ their nuclear arsenal first—to maximize the destruction of the would-be attacker’s nuclear arsenal and limit damage to their own territory. These dynamics can manifest even if both sides possess missile defense capabilities. As a result of the introduction of strategic missile defenses, crises are thus prone to instability and deliberate escalation.

<sup>14</sup> Robert McNamara, quoted in Morton H. Halperin, “The Decision to Deploy the ABM: Bureaucratic and Domestic Politics in the Johnson Administration,” *World Politics* 25, no. 1 (1972): 62–95, <https://doi.org/10.2307/2010431>.

<sup>15</sup> National Missile Defense Act of 1999, Pub. L. No. 106–38, 113 Stat. 205 (1999).

<sup>16</sup> Remarks by President Trump and Vice President Pence Announcing the Missile Defense Review, White House, January 17, 2019, <https://trumpwhitehouse.archives.gov/briefings-statements/remarks-president-trump-vice-president-pence-announcing-missile-defense-review/>.

<sup>17</sup> Missile Defense Review, U.S. Department of Defense, 2019, [https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR\\_Executive%20Summary.pdf](https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf).

It was these dangers that once prompted a shared recognition of the dangers of unrestrained investments in defensive homeland missile defense technologies by the United States and the Soviet Union. In 1968, then-U.S. Secretary of Defense Robert McNamara and Soviet premier Alexei Kosygin arrived at a shared understanding of these dangers, noting that the nature of the offense-defense balance necessitated limits on anti-ballistic missile (ABM) systems.<sup>18</sup> This, among broader concerns about the costs of peacetime arms racing, laid the groundwork for the 1972 ABM Treaty.

Importantly, behaviors and postures that are stabilizing are often not those that confer unilateral, absolute advantage. In other words, what is most stable for the system of deterrence is not always what is perceived to be the best of all worlds for the United States. Because stable nuclear deterrence is predicated on a shared investment by the United States and each of its nuclear-armed adversaries in the “balance of terror,” strategic missile defense—even as it might mitigate and limit damage to the United States in a nuclear conflict—is destabilizing. Even as the U.S. has emphasized the “limited” objectives of homeland missile defense in the post-Cold War era, Russia and China harbor anxieties about the future strategic direction of our missile defense investments and the potential for technological breakthroughs. These nations, ultimately, reason about their own security and deterrence needs based on what we do rather than what we say.

#### RUSSIAN, CHINESE, AND NORTH KOREAN RESPONSES TO UNITED STATES MISSILE DEFENSES

Several ongoing investments and modernization processes in Russia, China, and North Korea present challenges to current and future United States missile defense systems. Each of these countries sees the need to assure the ability of its nuclear warheads to penetrate U.S. Homeland missile defenses as an essential requirement of nuclear deterrence.

##### *Russia*

Russia’s ongoing strategic nuclear modernization includes several qualitative investments that are explicit responses to advances in United States Homeland missile defense capabilities. These include the so-called ‘March 1’ set of systems memorably introduced by Russian President Vladimir Putin in speech to the country’s Federal Assembly on that date in 2018. These systems include a nuclear-powered cruise missile and a nuclear-powered autonomous thermonuclear torpedo, among others. In his speech, Putin justified these investments as a response to the U.S. withdrawal from the ABM Treaty, which he described as the “cornerstone of the international security system.”<sup>19</sup>

Five of the six systems introduced by the Russian president that day are designed to either directly evade midcourse missile defenses, or support the evasion of midcourse defenses by other systems. The under-development SS–X–29 Sarmat heavy ICBM, based in a hardened silo, is a traditional approach to countering missile defenses, featuring penetration aids and multiple warheads. The thermonuclear warhead-toting Poseidon unmanned underwater vehicle—designed for release by a submarine—bypasses midcourse missile defenses and potential future threats to manned submarines near their ports. The SS–19 Mod 4 Avangard introduces a hypersonic glide vehicle payload, which employs a nonballistic trajectory to deliver a thermonuclear payload while spending the majority of its flight path at altitudes below GMD’s engagement envelope. Despite apparent difficulties in testing, the SSC–X–9 Burevestnik nuclear-propelled cruise missile appears designed to leverage its apparent limitless range to introduce unpredictable azimuths of attack and possibly even loiter outside U.S. airspace in a crisis; as a cruise missile, it could be vulnerable to point defenses, but not to midcourse defenses. (It is largely infeasible for the United States to develop and deploy point defenses in sufficient quantities to defend all valuable targets.) Finally, the Peresvet road-mobile directed energy weapon appears designed to ‘dazzle’ and degrade United States space-based optical and radar sensors that might be used to track Russian road-mobile ICBMs for targeting or possibly cueing missile defenses. (The sixth and final system, Kinzhal, is a theater-range air-launched aeroballistic missile.)

One of the above systems, Avangard, is deployed and is accountable under New START. Peresvet is also deployed. The others are unlikely to be deployed during the

<sup>18</sup> “Foreign Relations of the United States, 1964–1968, Volume XIV, Soviet Union,” Office of the Historian, U.S. Department of State, February 21, 1968, <https://history.state.gov/historicaldocuments/frus1964-68v14/d238>.

<sup>19</sup> President of Russia, “Presidential Address to the Federal Assembly,” March 1, 2018, <http://en.kremlin.ru/events/president/news/56957>.

remaining treaty lifespan of New START and, as a result, may be contentious topics in the pursuit of a follow-on treaty.

#### *China*

Sequential annual reports on the Chinese military, produced by the Department of Defense pursuant to a congressional requirement, have emphasized that recent qualitative nuclear modernization efforts in China—including the adoption of multiple warheads on certain Chinese ICBMs and the development of hypersonic boost-glide systems—are in part a response to current and future United States missile defenses. In 2014, DOD observed that China was “working on a range of technologies to attempt to counter United States and other countries’ ballistic missile defense systems.”<sup>20</sup> The 2020 iteration of this report further observed that Beijing’s efforts to develop hypersonic and directed energy weapons were, among other rationales, driven by a Chinese interest in enabling the “defeat of missile defense systems.”<sup>21</sup> United States investments in missile defense are also promoting China’s ongoing modernization from a primarily land-based nuclear force to a full-scale triad, incorporating more survivable ballistic missile submarines and the PLA Air Force, which has readopted a nuclear mission as of 2019 after having no nuclear delivery role since the 1980s. Authoritative Chinese documents, including the 2013 edition of the People’s Liberation Army’s *Science of Military Strategy*, note that the “active development of a missile defense system by the United States and some of [China’s surrounding nations]” necessitates the “development of sea-based nuclear strength.”<sup>22</sup> As Lt. Gen. Scott Berrier testified earlier this year before this Committee, the United States Defense Intelligence Agency has assessed that China will double the size of its nuclear arsenal in the next decade.<sup>23</sup>

Chinese strategists have been particularly concerned about United States missile defenses in parallel with the development of increasingly precise conventional offensive weapons. Given the country’s lean nuclear force size—estimated to be in a “low-200s,”<sup>24</sup> according to an unclassified Department of Defense assessment—one of the scenarios that Chinese strategists fear is a United States conventional strike, which might succeed in the destroying many of China’s available land-based nuclear systems and associated command-and-control infrastructure, leaving whatever retaliatory capability then available subject to absorption by U.S. missile defenses. Chinese thinking on the nuclear relationship with the United States concedes the vast quantitative and qualitative advantages United States nuclear forces enjoy over Beijing’s own nuclear capabilities. The predominant concerns that appear to have driven Chinese investments in nuclear modernization over the last decade are strategic missile defenses and advanced convention precision strike capabilities. In addition to its concerns regarding strategic missile defense, Beijing has expressed strong objections to the United States deployment of theater missile defense systems. In 2016 and 2017, Chinese officials strongly objected to the United States deployment of a THAAD battery in South Korea, pointing to the possibility that the battery’s powerful AN/TPY-2 radar could be integrated with current and future United States Homeland missile defense systems to better enable the tracking and discrimination of Chinese nuclear warheads.<sup>25</sup> Despite its concerns, China rebuffed United States invitations to bilateral technical talks on the THAAD system.<sup>26</sup>

<sup>20</sup> *Military and Security Developments Involving the People’s Republic of China* 2014, Office of the Secretary of Defense, [https://archive.defense.gov/pubs/2014\\_DOD\\_China\\_Report.pdf](https://archive.defense.gov/pubs/2014_DOD_China_Report.pdf), pp. 30.

<sup>21</sup> *Military and Security Developments Involving the People’s Republic of China* 2020, Office of the Secretary of Defense, <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWERREPORT-FINAL.PDF>, pp. 148.

<sup>22</sup> *Science of Military Strategy* (2013), unofficial translation by the China Aerospace Studies Institute, [https://www.airuniversity.af.edu/Portals/10/CASI/documents/Translations/2021-02-08%20Chinese%20Military%20Thoughts-%20In%20their%20own%20words%20Science%20of%20Military%20Strategy%202013.pdf?ver=NxAWg4BPw\\_NylEjxaha8Aw%3d%3d](https://www.airuniversity.af.edu/Portals/10/CASI/documents/Translations/2021-02-08%20Chinese%20Military%20Thoughts-%20In%20their%20own%20words%20Science%20of%20Military%20Strategy%202013.pdf?ver=NxAWg4BPw_NylEjxaha8Aw%3d%3d), pp. 269.

<sup>23</sup> Scott Berrier, Statement for the Record: Worldwide Threat Assessment, Armed Services Committee, U.S. Senate, 2021, <https://www.armed-services.senate.gov/imo/media/doc/2021%20DIA%20Annual%20Threat%20Assessment%20Statement%20for%20the%20Record.pdf>.

<sup>24</sup> *Military and Security Developments Involving the People’s Republic of China* 2020.

<sup>25</sup> Ministry of Foreign Affairs of the People’s Republic of China, “Wang Yi Talks about US’s Plan to Deploy THAAD Missile Defense System in ROK,” February 13, 2016, <https://www.fmprc.gov.cn/ce/cgla/eng/topnews/t1340525.htm>.

<sup>26</sup> Andrea Shalal, “U.S. Hopes for Talks with China about Possible THAAD Move to South Korea,” Reuters, March 23, 2016, <https://www.reuters.com/article/us-southkorea-usa-missiledefense-china-idUSKCN0WO2P2>.



*North Korea*

As the most resource-constrained of the three nuclear-armed United States adversaries, North Korea's options are most limited for qualitatively coping with American missile defenses. However, Pyongyang appears to be investing in countermeasures and continues a quantitative build-up in its nuclear forces that was called for by leader Kim Jong Un directly during his January 1, 2018, New Year's Day address. As of May 2021, at least 10 unique launchers for intercontinental-range ballistic missiles have been seen in the country—six based on modified logging trucks imported from China in 2011 and four apparent indigenous ones. North Korea possesses two ICBM designs that have been flight-tested three times and has introduced three other ICBM designs that have yet to be flight-tested. The newest of these untested designs—seen at a military parade in October 2020—may be capable of accommodating advanced payloads, including multiple reentry vehicles<sup>27</sup> (MRVs) or a single large reentry vehicle supplemented by ballistic missile defense countermeasures. Pyongyang continues to maintain a network of survivable shelters, tunnel networks, and underground facilities in its mountainous northern provinces to complicate United States efforts to track and target its ICBM and other long-range missile launchers in a crisis. At the 8th Party Congress of the Workers' Party of Korea in January 2021, Kim Jong Un called for the development of more responsive solid propellant-based ICBMs and more advanced warheads. In these ways, the ballistic missile threat from North Korea remains significant and continues to grow.

According to the Missile Defense Agency, 44 of a planned 64<sup>28</sup> Ground-Based Interceptors (GBI) for the GMD system—the BMD system chiefly designed to cope with the North Korean threat to the Homeland—are currently emplaced.<sup>29</sup> Assuming that four such interceptors are available for use against each incoming North Korean reentry vehicle in a contingency, North Korea could saturate the existing GMD system in its ideal engagement mode with just 11 reentry vehicles. With 10 known ICBM launchers—at least four of which appear capable of accommodating a larger ICBM capable of delivering multiple reentry vehicles—Pyongyang's path to this goal is eminently achievable. At 64 deployed GBIs, the saturation point would shift to 16 reentry vehicles. The GMD system could cope with greater numbers by relying on two or three interceptors per incoming reentry vehicle, but this would come at the cost of reducing the system's overall expected effectiveness. The lack of robust North Korean flight-testing and the lack of any non-lofted flight-testing for its RVs lower the probability that all of Pyongyang's available ICBMs would perform as desired, but the risk of successful nuclear delivery by North Korea to the United States Homeland is great enough to merit serious consideration in current and future planning. As Gen. Mark Milley, the chairman of the Joint Chiefs of Staff, emphasized in recent congressional testimony, North Korea's ICBMs present a "real danger" to the United States Homeland.<sup>30</sup> Moreover, as early as 1999—one year after Pyongyang's launch of the Taepodong-1 satellite launch vehicle, which birthed current United States Homeland missile defense efforts—a United States intelligence community National Intelligence Estimate suggested that even resource and technology constrained states like North Korea would find the means to develop countermeasures.<sup>31</sup> NORTHCOM is aware of the shifting challenge from North

<sup>27</sup> MRVs are not to be conflated with MIRVs. The former release multiple reentry vehicles along the flight vehicle's ballistic trajectory while the latter allows for the independent targeting of multiple reentry vehicles at varied targets—through the use of a separate, powered "bus".

<sup>28</sup> Following the cancellation of the RKV, the next 20 interceptors for GMD are planned to be of the new NGI type.

<sup>29</sup> U.S. Missile Defense Agency, Ground-based Midcourse Defense (GMD), <https://www.mda.mil/system/gmd.html>.

<sup>30</sup> Statement of General Mark A. Milley, USA, 20th Chairman of the Joint Chiefs of Staff, Department of Defense Budget Hearing, House Appropriations Committee, Defense Subcommittee, May 27, 2021, <https://docs.house.gov/meetings/AP/AP02/20210527/112682/HHRG-117-AP02-Wstate-MilleyM-20210527.pdf>.

<sup>31</sup> U.S. National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015," September 1999, <https://fas.org/irp/threat/missile/nie99msl.htm>. The estimate offers the following assessment: "Many countries, such as North Korea, Iran, and Iraq probably would rely initially on readily available technology—including separating RVs, spin-stabilized RVs, RV reorientation, radar absorbing material (RAM), booster fragmentation, low-power jammers, chaff, and simple (balloon) decoys—to develop penetration aids and countermeasures."

Korea and has indicated that new qualitative developments in North Korea's missile capabilities could create "increased risk" for GMD as early as 2025.<sup>32</sup>

North Korea may be exploiting certain perceived gaps in the existing GMD system. For instance, GMD has yet to exhibit success against a target reentry vehicle in an intercept test carried out at "night"—where the exoatmospheric target in mid-course flight would be obscured by the earth's shadow and, as a result, exhibit a differing infrared signature from a daytime test, where it would be illuminated by the Sun. (Ground-based radar sensors are indifferent to these lighting conditions, but sensors on the interceptors' kill vehicle are not.) In 2017, North Korea conducted two of its three ICBM tests at nighttime (in July and November). These tests may have been designed to indicate a North Korean interest in operationalizing an ability to launch under conditions that Pyongyang may perceive to be least favorable for United States Homeland missile defense capabilities as tested and evaluated.

Separately, a new suite of quasiballistic short-range ballistic missiles in development in North Korea appear to be designed to stress United States and South Korean missile defense capabilities. Some of these missiles—including a system the United States intelligence community calls the KN23—appear to spend most of their flight path at altitudes above the maximum engagement altitude of Korean Peninsula-based PAC-3 systems, but below the minimum engagement altitude of THAAD. These systems could be armed with nuclear weapons should North Korea choose to do so in the future.

#### LIMITING DEFENSES AMID GREAT POWER COMPETITION

The absence of any formal limits on U.S. Homeland missile defense plans and deployments is harming U.S. national security interests by promoting our adversaries to pursue meaningful qualitative force build-ups. Relatedly, a lack of limitations is leading to ever-growing peacetime opportunity costs as MDA's ambitions continue to grow in response to evolving missile threats. During the Cold War, the United States and the Soviet Union were able to arrive at a shared understanding on the perils of mutual investment in ABM systems amid the arms race of the time in an environment of mistrust and amid competition. Matters are considerably more complicated today, for some of the reasons outlined above. Because the core source of insecurity for American adversaries—and the most likely source of arms race instability and crisis instability—is homeland, or strategic, missile defense, it would be prudent and sensible for Congress to consider and study the role of possible limitations in this area to support United States national security objectives, including in future arms control processes with Russia and/or China.

#### *Candidate Approaches for Limitations*

The planned 64 interceptors for GMD—even assuming they perform ideally—are wholly insufficient to neutralize anything but a small tranche of Russia's strategic nuclear forces. Nevertheless, Moscow's concerns about United States Homeland missile defense remain prominent. China fears the effect GMD might have in a conventional or nuclear first-strike scenario, where its remaining retaliatory forces may be small enough to be fully absorbed by available GMD interceptors. At North Korea's current known ICBM force size, GMD remains nominally sufficient, but the system's less-than-ideal test record raises questions about its ability to perform in real world conditions. The replacement for GMD's currently deployed GBIs—the Next-Generation Interceptor (NGI)—has an uncertain future and independent cost estimates have suggested a roughly \$13 billion figure.<sup>33</sup> These reasons make GMD the most obvious candidate system for potential limitation in exchange for reciprocal concessions from Russia and/or China.

Beyond GMD, the November 2020 test of an SM-3 Block IIA interceptor from an Aegis BMD guided-missile destroyer against an ICBM-class target complicates matters. This congressionally-mandated test has revealed that the Block IIA interceptor's latent counter-ICBM capability—a capability that had been acknowledged by MDA as early as 2008—may be more than nominal.<sup>34</sup> Because SM-3 Block IIA is

<sup>32</sup> Jason Sherman, "NORTHCOM: U.S. to Assume 'increased Risk' against North Korean ICBMs in 2025," InsideDefense.com, January 29, 2020, <https://insidedefense.com/daily-news/northcom-us-assume-increased-risk-against-north-korean-icbms-2025>.

<sup>33</sup> Jen Judson, "Next-Gen Intercontinental Ballistic Missile Interceptor Estimated Cost? Nearly \$18B," Defense News, April 27, 2021, <https://www.defensenews.com/pentagon/2021/04/27/next-gen-intercontinental-ballistic-missile-interceptor-estimated-to-cost-nearly-18-billion/>.

<sup>34</sup> Ankit Panda, "A New U.S. Missile Defense Test May Have Increased the Risk of Nuclear War," Carnegie Endowment for International Peace, November 19, 2020, <https://carnegieendowment.org/2020/11/19/new-u.s.-missile-defense-test-may-have-increased-risk-of-nuclear-war-pub-83273>.

designed for basing in the widely used and manufactured Mark 41 Vertical Launch System canister, which exists on U.S. Navy ships, allied ships, and at Aegis Ashore installations alike, verifiably limiting this system will be an immense challenge. The United States might voluntarily limit further testing of the Block IIA interceptor against other ICBM-class targets; such a measure would require a radical rethinking of current plans for a layered homeland defense approach. The target missile used in the November 2020, despite being described as “threat representative” by MDA, exhibited a far shorter range and hence speed than the vast majority of notional Russian and Chinese ICBMs. (ICBMs are understood to be any missiles capable of ranging more than 5,500 kilometers; in practice, Russian, Chinese, and North Korean ICBMs would range greater distances to reach targets in the 48 contiguous U.S. states.) MDA could declassify details about the target used in the FTM-44 test, which could demonstrate that its “threat-representative” nature may be overstated. It could further refrain from testing the SM-3 Block IIA against any longer-range target missiles in the future.

Despite the verification difficulties associated with the Block IIA, one approach could be to explore, as part of an arms control process, a formal delineation of strategic and nonstrategic missile defense systems through certain technical parameters. One such approach was included in the September 1997 demarcation agreement between the United States and the Soviet successor states that remained party to the ABM Treaty (including Russia), which specified thresholds for interceptor and ballistic missile target missile velocities.<sup>35</sup> Given notional divergences between the burnout velocity of an SM-3 Block IIA interceptor and burnout velocities for current and future anticipated interceptors for the GMD system, such an approach could create the means to exclude SM-3 Block IIA from a broader cap on homeland missile defense interceptors. It bears noting, however, that SM-3 Block IIA’s burnout velocity is greater than the 3 km/s threshold negotiated and agreed between the former ABM states parties in 1997.

Neither concession above should be on offer unilaterally or prior to the acceptance by either negotiating counterparty—Russia and/or China—to serious, sustained talks on the full range of issues that merit coverage in a future arms control agreement. Because such an agreement is far more likely to materialize with Russia in the short-term—given decades of bilateral experience in arms control—than with China, Congress and the administration should focus energies here. The basic requirement is to recognize that there is little chance to limit, let alone reverse, offensive nuclear arms racing if the United States is not willing at least to explore trade-offs that could be negotiated between offensive and defensive capabilities.

With Moscow, a willingness to discuss limitations on homeland missile defense could be useful leverage to address the matter of Russia’s large inventory of Treaty-unaccountable nonstrategic nuclear weapons. It is possible that beyond the apparent strategic benefits of Russia’s new ‘March 1’ systems in their ability to challenge U.S. midcourse missile defenses, Russia has pursued their development to seek leverage in future arms control talks. The Russian position ahead of potential talks on a New START-successor agreement has emphasized the role of offensive and defensive capabilities alike. Russian Foreign Minister Sergey Lavrov emphasized in May 2021 that “[e]verything that affects strategic stability (nuclear and non-nuclear arms, offensive and defensive weapons) must be on the negotiating table.”<sup>36</sup>

With China, United States national interests could similarly be served by leveraging an opening on missile defense to seek additional transparency from Beijing on its nuclear and missile activities of concern. This is especially the case given the ongoing and future anticipated growth of China’s nuclear warhead stockpile—a trend driven in large part due to anxieties over United States missile defense capabilities. Even if China’s inexperience in bilateral arms control and aversion to transparency regarding its nuclear arsenal stand to lower the odds of formal talks, United States willingness to address missile defense through such a process can only serve as a useful inducement given strong Chinese interest in the matter. Arms control manifests out of a mutual interest in restraint, after all.

Finally, despite the long list of United States concerns with ongoing Russian and Chinese nuclear modernization, subjecting missile defense to possible limitations

<sup>35</sup>First Agreed Statement Relating To The Treaty Between The United States Of America And The Union Of Soviet Socialist Republics On The Limitation Of Anti-Ballistic Missile Systems Of May 26, 1972, available at <https://2009-2017.state.gov/t/avc/trty/101888.htm#scddocuments>.

<sup>36</sup>“Foreign Minister Sergey Lavrov’s Statement and Answers to Media Questions at a Joint News Conference Following Talks with Minister of Foreign Affairs and International Cooperation of the Republic of Sierra Leone David John Francis,” May 17, 2021, <https://www.mid.ru/foreign-policy/news/-/asset-publisher/cKNonkJE02Bw/content/id/4736245>.

will allow for usefully limiting adversary investments in these technologies as well. As the United States Department of Defense has noted, both China and Russia possess and are developing missile defense systems that could pose a challenge for United States nuclear delivery systems.<sup>37</sup> Given that one of the core arguments in favor of proceeding with the Ground-Based Strategic Deterrent (GBSD) next-generation ICBM concerns its ability to better pace evolving adversary missile defenses, limitations could provide meaningful flexibility to U.S. nuclear modernization options.

#### *The Risks of Limitations*

Given that current homeland missile defenses exist to protect the Homeland from a “limited” North Korean attack, the most serious short-term risk associated with limiting existing homeland missile defenses pertains to Pyongyang’s force-sizing. Under a hypothetical arrangement with Russia that freezes GMD in its current stage and results in the cancellation of NGI, North Korea would need to produce just two more ICBM launchers to reach a point where its capabilities could theoretically, under ideal conditions, overwhelm GMD’s optimal engagement mode of four-interceptors-per-reentry-vehicle.<sup>38</sup> (For the purposes of simplicity, this assumes no effort to destroy or degrade North Korea’s launchers and command-and-control early in a conflict, and also that United States defensive systems will be effective in realistic wartime conditions.) Efforts by Pyongyang to introduce multiple warheads or even modestly complex countermeasures and penetration aids (in the vein of the United Kingdom’s Cold War-era Chevaline penetration aid, for instance) could complicate this further. This could be assuaged by simply readopting the 1974 ABM Treaty protocol quantitative limitation of 100 interceptors, which would allow United States Homeland missile defenses to meaningfully react to North Korean force changes in the coming years. Pyongyang seeks to retain, at a minimum, a rudimentary capability to deliver nuclear weapons to the United States Homeland and this is unlikely to change short of an unlikely transformation in the nature of the United States-North Korea relationship. As a result, it is conceivable that GMD interceptor constraints could grant North Korea an assured capability to hold the U.S. Homeland at risk, which would represent a major source of risk to the Homeland should strategic deterrence with Pyongyang fail. However, like Russia and China, the United States can seek to manage the risks posed by North Korea’s growing arsenal by relying on nuclear and conventional deterrence. But by retaining a poorly tested homeland missile defense system, we risk the worst of all worlds: immense spending in peacetime on a capability that cannot perform as required in a conflict.

#### MORE NATIONAL SECURITY WITH LESS NATIONAL MISSILE DEFENSE

Allow me to conclude with the idea that fewer missile defenses might manifest substantially greater national security for this country: this is not necessarily intuitive, but if the United States continues to be invested in the enterprise of nuclear deterrence and seeks stable nuclear deterrence, then it is in our interest to contemplate limitations.

With regard to future investments in missile defense, Congress should take a leading role in assessing the consequences of missile defense programs on strategic stability. It would be prudent, for instance, to ask that the Department of Defense study and assess in depth the extent to which U.S. missile defenses are promoting adversary qualitative investments in more sophisticated offensive weapons. Such a study could better inform U.S. investments in missile defense and the pursuit of future arms control.

Congress should further adopt a resolution acknowledging the inherent action-reaction relationship between strategic offensive and defensive arms in a global context. This premise already appears in the preamble to the 2010 New START Treaty and, as mentioned earlier, was the basis of early U.S.-Soviet arms control efforts. Adopting such a resolution would not be tantamount to an admission by this country that missile defense would have no role in the defense of the Nation; it would simply acknowledge, as Republicans and Democrats alike once did during the Cold War, that the arms race is fundamentally driven by perceived imbalances in offen-

<sup>37</sup> “Missile Defense Becomes Part of Great Power Competition,” U.S. Department of Defense, accessed May 26, 2021, <https://www.defense.gov/Explore/News/Article/Article/2291331/missile-defense-becomes-part-of-great-power-competition/>.

<sup>38</sup> An ongoing service life extension project is likely to lower the interceptor requirement per incoming reentry vehicle. Open sources do not indicate whether this has been implemented to date. Jason Sherman, “MDA: GMD SLEP Will Improve Interceptor Fleet While Waiting for NGI,” InsideDefense.com, May 18, 2021, <https://insidedefense.com/daily-news/mda-gmd-slep-will-improve-interceptor-fleet-while-waiting-ngi>.

sive and defensive arms. It would also empower the ability of the United States to credibly seek limitations on existing and future Russian and Chinese homeland missile defense systems, reducing the need for the United States to expend additional resources on assuring our own ability to penetrate those defenses.

Finally, with regard to the future development pertaining to GMD, Congress should take a more active role in mandating that MDA conduct future tests with environmental and other stressors more reflective of real-world conditions. Future budgets should additionally demand transparency from MDA concerning the types of target missiles used in specific tests and the parameters used to evaluate success and failure. In particular, MDA witnesses before this chamber should be asked to offer technical justifications for why certain target missiles can be considered “threat-representative” given significant apparent divergences with real intercontinental missile threats. More specifically, given North Korea’s observed flight-testing of ICBMs at nighttime, Congress should mandate that MDA fully evaluate the ability of the GMD system to cope with nighttime intercepts.<sup>39</sup> Congress should additionally require the testing of GMD against target missiles with countermeasures that are likely to be reflective of actual adversary practices (such as multiple dummy reentry vehicles exhibiting physical and infrared signatures similar to the target reentry vehicle). Some of this testing can also be incorporated into budgeting for the NGI, if that program proceeds as planned.

It strikes me as especially prudent to consider the opportunity costs associated with missile defense as we enter this decade. The trajectory of our relations with both Russia and China—and to a lesser extent, North Korea—remains poor. As a result, minor and major crises leading up to and crossing the threshold into war are not unimaginable. Given that these crises will be most sensitive to the U.S. military’s efforts, in conjunction with our allies, in the realm of conventional deterrence, any measures that might moderate or slow the nuclear arms race can liberate essential resources for allocation elsewhere. In addition to their salutary effects on strategic stability, strategic missile defense limitations can be fiscally prudent and facilitate ongoing efforts to deter, through conventional means, great power conflict. Theater missile defenses need not be subject to limitation, given their meaningful contribution to augmenting deterrence-by-denial in critical theaters.

In the case of the U.S. Navy and sea-based missile defenses, Congress should also be cognizant of the opportunity costs associated with the missile defense mission: any Aegis BMD-capable ship armed with interceptors and tasked with a homeland missile defense mission is unable to fulfill other requirements, including providing in-theater missile defense and, for instance, defending a carrier strike group against anti-ship ballistic missiles. Congress should, as a result, request that the Secretary of Defense report annually on homeland ballistic missile defense operations by U.S. Navy assets, including the impact of these operations on overall force readiness. These opportunity costs are likely to grow especially acute in the Indo-Pacific region.

The above recommendations can ensure that Congress plays a leading role in steering this Nation toward a strategically prudent and responsible missile defense policy—one that maximizes our national security interests while averting an unnecessary nuclear arms race at a time when conventional challenges loom large. In this regard, our choices with regard to homeland missile defense in the coming years stand to be immensely consequential: not solely with regard to nuclear stability, but also with regard to the ability of the United States to deter and manage the consequences of intensifying great power rivalries.

Senator KING. Thank you both.

Mr. Soofer, I am trying to understand this. Our missile defense system is not designed to intercept missiles from either China or Russia. Is that correct?

Dr. SOOFER. Yes, sir.

Senator KING. What is our principal defense against missiles from China and Russia?

Dr. SOOFER. The same defense that we had during the Cold War, sir, the nuclear deterrent.

<sup>39</sup>The IFT-10 test in December 2002 for GMD did involve nighttime conditions, but resulted in a failed intercept due to the inability of the kill vehicle to successfully separate from the booster.

Senator KING. Deterrent. If that is effective against China and Russia, why isn't it effective, or wouldn't it be effective against North Korea or Iran?

Dr. SOOFER. Right. Well, North Korea, arguably, may not have the same rational perspective on these issues as Russia.

Senator KING. But wouldn't the leader of North Korea understand that if he attacks this country, his country would disappear from the map? I mean, that would deter even the most unstable leader, it would seem to me.

Dr. SOOFER. Well, the question is who has got more at stake at this point. The concern is that he would not believe that we would use nuclear weapons against North Korea for fear of his reprisal against the United States, and by having missile defenses, you take away that consideration.

Senator KING. Let me change the subject slightly to the capability of the missiles. The missile defense system that we are talking about is principally to deal with the threat of ballistic missiles. Is that correct?

Dr. SOOFER. Yes, sir.

Senator KING. My understanding is that it would not deal with the threat of hypersonic glide vehicles. Correct?

Dr. SOOFER. Well, currently they do not, but the Missile Defense Agency is working on defense against hypersonics, both against long-range systems and the shorter-range systems our forces would encounter in regional campaigns.

Senator KING. So we believe that there will be a future capability. Is that going to be a capability of the new missiles that we are talking about authorizing in this process?

Dr. SOOFER. I am not completely familiar with the budget requests at this point, but I do know that the Missile Defense Agency is working on sensors and an intercept capability against hypersonic threats. But that is not what I was referring to in the SM-3 IIA missile. The SM-3 IIA is a regional missile, a Navy missile, that intercepts ballistic missiles on the midcourse phase, and the hope is that we could give it some capability to also intercept very simple North Korean ICBM missiles that are headed from North Korea to, say, Guam or Hawaii, or even the continental United States.

Senator KING. Mr. Panda, you talked about the action-reaction. There is a finite number of Interceptors. Right now it is 44, and we are talking about going to 64. Can't that capability be defeated by North Korea simply by having more incoming missiles?

Mr. PANDA. Excellent question, Senator. So I will just first note that I am the author of a recent book on North Korean strategic nuclear forces, and I spend more time than I would like looking at pictures of North Korean missiles.

As far as I know, North Korea today has 10 ICBM launchers. As far as I am also aware, based on open sources, MDA's concept of operations for GMD relies on using four Interceptors per incoming target re-entry vehicle, soon to become three, but currently four, I believe.

So if we just do the math, North Korea would need to add a single additional ICBM launcher to potentially saturate GMD, and based on GMD's testing record, the single-shot probability of kill,

which is the probability that a single GMD system shot at an incoming North Korean re-entry vehicle would succeed, based on open sources again, that number appears to be just a little over 50 percent.

So based on that assessment, Senator, I would say that North Korea can probably today bet on delivering a thermonuclear warhead to the continental United States, and I believe that that is entirely the reason that Kim Jong-un today feels that he has a nuclear deterrent. He declared, in November 2017, that his nuclear deterrent was complete, before turning to negotiations with the United States.

So I do think that that would be a correct assessment.

Senator KING. But this is exactly what you are talking about, is as you build up your missile defense then your adversary is incented to build up their side of the offensive capability. Is that your position?

Mr. PANDA. That is correct. North Korea, of course, is quite resource constrained, Senator, so if we were to go to 64 GBIs I cannot predict today whether Kim Jong-un would have the resources or the wherewithal to keep building ICBM launchers and ICBMs to cope with that. I will, however, point out that qualitative modernization is also underway in North Korea. In October 2020, North Korea demonstrated a missile, the largest road-mobile missile anywhere in the world today, because most countries do not deploy road-mobile liquid propellant missiles like North Korea does. But the missile that they demonstrated appears to be large enough to carry multiple re-entry vehicles. North Korea is also working on countermeasures, which will include sophisticated and unsophisticated decoys.

So I completely think that even North Korea can certainly cope with qualitative advancements to our own missile defense.

Senator KING. Mr. Soofer, I am out of time, but I think you wanted to respond?

Dr. SOOFER. Right. You know, we do not just try to deal with North Korea and ICBMs with active missile defense. It is a combination of deterrence, as you suggest, as well as attack operations. We are going to try to find as many of these launchers on the ground as possible and take them out before they launch, and then there is active defense, right?

But the bigger point here is if we were not to compete with North Korea, if we were not to build missile defenses against the North Korean threat, what kind of signal is that going to send to our allies? If we are not willing to defend ourselves against North Korea, a country that can barely afford to feed itself, why would our allies think that we are going to risk our own lives to come to their defense?

Senator KING. Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman. Dr. Soofer, I am sure you have seen a recent letter by a number of advocates to President Biden encouraging him to discuss limitations on U.S. missile defenses in the upcoming talks with Putin. The letter refers to comments the President made back in 2001, when as a Senator he opposed the Bush administration's plans to deploy a national

missile defense system, and predicted it could trigger an arms race with Russia and China.

So let me ask you, did that prediction come true, and what empirical evidence is there linking missile defense to an arms race, and more broadly, is there evidence that missile defense is incompatible with arms control?

Dr. SOOFER. Thank you, Senator. I do not think that is what has happened. So exactly what happened. We withdrew from the ABM Treaty in 2002. Everybody had anticipated at the time that you had this huge arms race. Both sides would build more offenses to overcome defenses. What did we have? We had the Moscow Treaty, which took us from 6,000, under START, to 2,200. We went down from 6,000 to 2,200, even though we withdrew from the ABM Treaty, and then we had the New START Treaty, which took us down to 1,550.

What arms race are they talking about? There has been no arms race. In fact, it is just the opposite. When we signed the ABM Treaty in 1972, the Russian inventory, the Soviet inventory, went from about 2,500 warheads to over 10,000 nuclear warheads. It was just the opposite. This idea of action-reaction, it is too simple. There are many reasons why countries choose not to build nuclear weapons.

But clearly our withdrawal from the ABM Treaty, our deployment of 44 Ground-Based Interceptors, has not spurred an arms race. The Russians recently agreed to extend the New START Treaty by 5 years. If they were so alarmed by our missile defenses and our plans to add 20 more NGIs, why would they agree to that?

Senator FISCHER. Dr. Soofer, Russia and China have been expanding their nuclear arsenals in recent years, but these actions have come while United States missile defense capabilities have remained relatively unchanged. For example, the most significant enhancement of our homeland missile defense system has been the construction of the radar in Alaska. With the failure of the RKV program, and our GMD system has not received the upgrades that were planned for that, and then we have seen the expansion, the proposed expansion, of the fleet from the 44 Interceptors to 64, which was announced in 2017, it has not taken place.

So I think we have demonstrated also that the SM-3 IIA missile has some capabilities against the ICBMs, but this demonstration was conducted in December 2020, which is long after the Russian and the Chinese have undertaken their nuclear expansions. That is a comment.

What is your view of Russia's complaints against United States missile defenses and its attempt to portray its actions, such as a deployment of a variety of new nuclear systems that were announced by Putin in 2018 as responses to our nuclear defense programs?

Dr. SOOFER. Senator, as I quote I read by Rose Gottemoeller suggests, Russia does this for political reasons. They have their own domestic political problems. Putin has to exert his control over the oligarchs, right? He is more concerned about sowing dissention between the U.S. and its allies. Missile defense is a prime vehicle for doing that. Even here in the United States, they interfere with our debates by suggesting that missile defense is something that alarms them. But again, the evidence suggests that despite their



talk, they continue to negotiate with us. They continue to reach reductions.

I am not suggesting that we do not talk to Russia about this. Even the Trump administration, on at least five occasions, spoke to the Russians about the role of missile defense and strategic stability. You know, if the Biden administration wants to pursue that, then I think it is totally appropriate.

Senator FISCHER. Does Russia need a nuclear-powered cruise missile to overwhelm our missile defenses?

Dr. SOOFER. Clearly no. Clearly not. They have air-launched cruise missiles, sea-launched cruise missiles. So no.

Senator FISCHER. Thank you.

Senator KING. Senator Kelly.

Senator KELLY. Thank you, Mr. Chairman. Mr. Panda, earlier you were talking about the probability of kill of our systems. I think you said a PK of 0.5, roughly. So where does that data come from, if you can say in an open hearing? Then I wanted to go back to the number of ICBMs that The Democratic People's Republic of Korea (DPRK), that you believe that they have, and obviously there are two approaches to this. We can increase the number of GBIs. Currently I believe we have 44. But the other approach here could be how do we improve on the PK number? So can you elaborate a little bit about where we are on that?

Mr. PANDA. Absolutely, Senator. So, first of all, I have never been in government. I have never held a clearance, so my assessments are entirely based on open sources. The actual PK number is, I believe, classified. The assessment that I am offering is primarily based on the testing history of the system, which allows us to extrapolate reasonably. Of course, there have been multiple statements made by officials expressing their confidence in the system, which I will just point out that that is different from the technical parameters of GMD's actual performance.

So based on your other observation about the two possible approaches on how we can get our PK up, I will say, Senator, if we are to sustain missile defenses—and when I talk about limitations I am not talking about eradicating missile defense by any means. I do believe that the ABM Treaty, for instance, allows for 100 Interceptors at two fixed sites, per the 1974 protocol to the treaty.

What I do want to see if we do continue to invest in missile defense, that we do it right, that testing and evaluation are realistic. I will point out that GMD has been tested against ICBM-class targets that MDA describes as, quote, “threat representative.” But to my knowledge, the target missiles used in these test are far shorter range than an actual ICBM that would have to travel from North Korea's northern provinces, where they base their ICBM forces, to the United States Homeland.

So I will just emphasize that again, Senator. If we are to continue to proceed with maintaining a missile defense, and this is regardless of whether or not we pursue arms control, our missile defenses should be realistically tested and evaluated. If we are going to continue to spend taxpayer money on this enterprise, it needs to be realistic. It needs to demonstrate a capability that is real. Because ultimately—and I believe my co-witness pointed this out—missile defense comes into play when strategic deterrence has

failed, and ultimately no one in this room is in favor of allowing the United States to face a nuclear attack.

So if nuclear deterrence is here to stay, my preference, and I am sure the preference of most Americans, will be that it works as best as it can, and that means that testing and evaluation need to be done properly and done in ways that are realistic. Thank you.

Senator KELLY. So just to follow up on this. So we are talking with SM-3 GBIs, we are talking midcourse. If we start to look into systems that could intercept in a boost phase, any sense for what kind of probability of kill we would have with those systems at this point?

Mr. PANDA. Sure, Senator. That is an excellent question. Boost-phase defense has been a topic of query for over 20 years. There have been multiple studies done. The primary pitfall with boost-phase defense is that we physically need to base our Interceptors, or whatever launch vehicle for the Interceptors, be that a drone, a fighter, near the adversary's territory, and really the only country with which this would be viable would be North Korea, which has ocean and international waters on both sides. But again, this would only come into play in a crisis. Effectively, it would be simply infeasible to keep an F-35 or a drone or any other kind of launch vehicle in the air long enough, at all times, to intercept any North Korean missile launch.

Another point that I will point out is that, you know, we have been talking strategic stability, and you raised this point with boost-phased defense. There are, of course, other concepts that we have been looking into—counterforce targeting of North Korean launchers before they can launch, left-of-launch techniques, including cyberattacks.

A subcomponent of strategic stability that has not been surfaced in today's discussion is crisis stability. We have talked about arms race stability, and that mostly refers to the peacetime buildups on both sides. Crisis stability refers to our incentives in a crisis, and for Kim Jong-un, knowing that the United States is so fundamentally qualitatively advanced compared to North Korea, the incentives to use nuclear weapons first in a crisis grow the more we indicate that we are willing to destroy his missiles early in a crisis. Kim Jong-un has fundamentally developed these weapons because he thinks that using them first gives him the best rational chance at survival in a conflict.

If I could counsel one thing it would be that it is fine to pursue missile defense. It is fine to protect the United States Homeland from nuclear attacks from North Korea. But we need to be careful about the kinds of incentives that we generate for the North Korean leadership in a crisis. Because my assessment is that fundamentally that Kim Jong-un is rational, but that his rationality, ultimately, has manifested in a way that favors the first use of nuclear weapons in a crisis.

Senator KELLY. Thank you.

Senator KING. Senator Cramer.

Senator CRAMER. Thank you, Mr. Chairman. I just kind of want to follow up a little bit with that. Given that theory, would the same thing apply to, say, missile-tracking satellites, and everything

else in the value chain? Do those have the same impact on possible response?

Mr. PANDA. Thank you, Senator. Missile tracking can facilitate counterforce targeting of North Korean assets, and ultimately, because these assets will be used anywhere round the world where our forces need them, they can simply also be used against China and Russia, this has already led to, for instance, Russia's development of a ground-based laser, called Peresvet, which is designed to disrupt, dazzle our observation satellites. The Russians do not want us tracking their ICBM transporter launchers.

We have not talked a lot about China today, so let me just offer one observation there. The primary Chinese concern is not solely our missile defense. China is also quite concerned about our conventional precision strike capabilities. Because Chinese nuclear forces are lean, I believe the Defense Intelligence Agency has attested to the fact that Chinese nuclear forces are currently in the low 200s but expected to double in size by the end of the decade.

One of the things that China is particularly concerned about is a conventional campaign, waged by the United States against its nuclear forces, which are primarily land-based. The People's Liberation Army Force, for the first time since the 1980s, has now re-adopted a nuclear mission, beginning in 2019.

But all of this means that missile tracking, while an important component of facilitating missile defense and counterforce, can ultimately be destabilizing.

Senator CRAMER. Dr. Soofer, would you want to respond to any of that?

Dr. SOOFER. Well, it can be destabilizing, but it can also be very stabilizing if it provides deterrence. If China understands that we have these capabilities in place, they will not start a war, and you have deterrence at the outset. So in that case it can be stabilizing. It depends on your perspective.

Senator CRAMER. Thank you. That is all I have. Thank you, Mr. Chairman.

Senator KING. Senator Tuberville.

Senator TUBERVILLE. Thank you, Mr. Chairman. Dr. Sooter, you previously stated that a strong missile defense system is exactly how U.S. prevents escalation and protects our Nation. We are falling behind our peers and near-peers at an alarming rate. If U.S. continues down this path, what do you believe the outcome would be, and what changes do you believe we should—what should happen in the next 5 years?

Dr. SOOFER. Thank you, Senator. I think it is important, perhaps, to think of the problem set in two ways. One is the threat to the Homeland, right, and that is by Russia and China and by the rogues. For Russia and China, we are going to have to continue to rely on nuclear deterrent to prevent them from attacking us, right? But for the rogues, we have to stay ahead of them. If we do not stay ahead of them, again, it shows the rest of the world that we lack the will to compete with North Korea and China, and that makes our allies very nervous. So that is the first problem set.

The second problem set has to do with regional threats. The strategy of Russia in Europe and China in Asia is to keep us from reinforcing our allies during war. If they can keep us from inter-

vening they feel that they can win, and so they are building all these missiles in order to attack our bases, our ports, our ships, to keep us from reinforcing.

Our policy here is to strengthen our regional missile defenses, help our allies be able to defend themselves with regional defenses, and again, all this provides a deterrent at the outset so they do not contemplate even a conventional attack. I think there is fairly broad bipartisan consensus on that approach to missile defense.

Senator TUBERVILLE. Thank you. Mr. Panda, GMD dates back 15 years. Are you supportive of updating the NGI?

Mr. PANDA. Well, Senator, I think it really depends. If we proceed with NGI, I will not focus on the cost issue because ultimately, at the end of the day, if we have a missile defense system that can prevent damage to the U.S. Homeland from thermodynamic attack and it works, it is very difficult to really put a price tag on that. It is effectively priceless. Of course, if we look at the record, reality is a little bit different there.

So once again I will just emphasize that if we are to proceed with NGI, and if we are to pony up the big taxpayer bill that comes with that, my preference and my sort of counsel would be that we proceed and demand that testing is done in a way that really does facilitate the development of a missile defense system that can work and can provide that level of defense. Because ultimately, that map I sort of laid out earlier, when it comes to North Korean ICBM—and again, recognizing that that is the primary reason we have homeland missile defense—the more we can improve that, the fewer number of interceptors we can assign to incoming re-entry vehicles, the harder it becomes for Kim Jong-un to keep up with that pace. Unfortunately, based on our current approach, that just does not seem to be viable.

Senator TUBERVILLE. Thank you. Dr. Soofer, do you want to add something?

Dr. SOOFER. I concur.

Senator TUBERVILLE. Thank you. Thank you, Mr. Chairman.

Senator KING. I want to thank this panel. You have been very thoughtful and provocative, which is exactly what we needed to discuss the strategic underpinning of this subject. I want to call our next panel to the table.

I hope that both of you, in light of the questions and the discussion today, will file additional testimony if you feel it would be helpful to the Committee. I appreciate it.

Our government witnesses, Ms. Leonor Tomero, this is your second time in a couple of weeks, so welcome back to the Committee. She is Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy; General Glen VanHerck, Commander, U.S. Northern Command and North American Aerospace Defense Command; Lieutenant General Daniel Karbler, Commander, U.S. Army Space and Missile Defense Command and Joint Functional Component Command for Integrated Missile Defense; and Vice Admiral Jon Hill, Director of the Missile Defense Agency.

I think we will start with Ms. Tomero on the policy question, Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy.

**STATEMENT OF MS. LEONOR TOMERO, DEPUTY ASSISTANT  
SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DE-  
FENSE POLICY**

Ms. TOMERO. Thank you, Chairman, and thank you for welcoming me back to the Subcommittee. Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for the opportunity to testify before you today on the missile threat and the Department's missile defense policy and priorities. I ask permission to submit my opening remarks for the record.

Senator KING. So ordered.

Ms. TOMERO. Thank you. Along with left-of-launch capabilities in our nuclear and conventional forces, missile defense plays a key role in U.S. defense. With regard to the threat environment, as missile technology matures and proliferates, the threat to the U.S. Homeland, allies, partners, and our deployed forces is increasing. The Democratic People's Republic of Korea, DPRK, continues development and deployment of more capable intercontinental ballistic missiles that have destabilized and reshaped the security environment in East Asia. Iran's short- and medium-range ballistic missiles comprise the largest missile force in the Middle East. Both the DPRK and Iran are extending the range reliability and accuracy of their missile forces.

Additionally, Russia and China continue to develop and field increasingly advanced and diverse regional offensive missile capabilities. These capabilities form the backbone of their anti-access aerial denial strategy, intended to deny the United States freedom of action to protect military power and to protect our allies and partners.

To address these evolving challenges, the Department will review its missile defense policies, strategies, and capabilities to ensure that we have effective missile defenses. The review will align with the National Defense Strategy and contribute to the Department's approach to integrated deterrence, and we expect to complete this strategy by January of 2022.

With regard to homeland defense, the Department is committed to defending the United States against rogue state missile threats. DOD recently initiated the development of the next-generation Interceptor, and NGI will increase the reliability and capability of missile defense of the United States. As this program moves forward, it will align with the administration's defense goals and priorities.

With regard to regional defense, missile defenses would also remain central to maintaining the U.S. enduring advantage to flow forces into militarily consistent regional environment and to safeguard those forces should a conflict arise.

Additionally, the Department will continue to ensure that we bring a more integrated approach to air and missile defense that not only assists with defense against various types of ballistic missile threats but also enables defense against cruise missiles and unmanned aerial systems. IAMD will field interoperable and integrated missile defense sensors, Interceptors, and command and control to improve capability against a range of threats.

With regard to critical enablers, in addition to improving today's operational systems, we are examining new enabling technologies. Secretary Austin has noted the importance of enhancing our global network of integrated sensors. Space-based and land-based sensors enable a variety of capabilities such as detection, tracking, and targeting through all phases of flight for an incoming missile. U.S. commercial innovation is already transforming this field.

In fiscal year 2022, we will continue to develop the prototype Hypersonic and Ballistic Tracking Space Sensor, the HBTSS, that will allow the tracking of hypersonic threats and add resiliency to our sensor architecture. The Department's approach for regional hypersonic defense will first focus on defense in the terminal phase.

Information superiority is critical to the future battlefield, and is necessary to enable rapid planning and employment in a joint operating environment. To that end, the Department is developing multiple cyber-hardened, advanced, all-domain awareness for our command and control architectures that will enable timely and accurate decision-making to address emerging threats. We will continue to develop capabilities for left-of-launch and missile defeat that will play an important role in effectively countering limited missile attacks.

With regard to cooperation with our allies and partners, engaging and working with our allies and partners to enhance our collective missile defense efforts is a core focus area for the Department. The Indo-Pacific is a model for cooperative missile defense efforts with strong allies, including Japan, the Republic of Korea, and Australia. NATO continues to form the backbone of European joint and combined operations, and in the Middle East, United States-Israel missile defense collaboration demonstrates the mutual benefits of technology sharing with our allies and partners, along with our efforts to strengthen missile defense cooperation with key Gulf cooperation countries. Additionally, my office leads a series of dialogues that share information on regional and global missile threats.

In conclusion, as the Department prepares its strategic review, I can assure Members of this Committee that we are steadfastly committed to the key missile defense missions and priorities, including working with allies and partners to meet the challenge of growing missile threats in a cost-effective manner that strengthens regional and strategic stability.

I look forward to your questions. Thank you.

[The prepared statement of Ms. Leonor Tomero follows:]

#### PREPARED STATEMENT BY MS. LEONOR TOMERO

##### INTRODUCTION

Chairman King, Ranking Member Fischer, and distinguished Members of the Sub-Committee, thank you for the opportunity to testify before you today on the missile threat environment and the Department's missile defense policy vision and priorities. It is an honor to appear beside VADM Hill. I look forward to answering your questions.

This Committee's support for missile defense has been vital to the progress that U.S. and allied and partner missile defenses have made to address current and emerging missile threats from potential adversaries; and it will remain essential to

support the Department's security commitments, as this Administration begins to formulate its defense policy.

The Consolidated Appropriations Act, 2021 demonstrated Congress's bi-partisan support for missile defense. Congress also supported key initiatives such as the integrated air and missile defense programs (IAMD) within the Military Departments and Services by continuing to fund enabling programs including the Army's integrated air and missile defense battle command system (IBCS), and the Navy's advanced IAMD-capable flight III destroyers. The resources requested maintain and extend the service lives of our current missile defense assets, promote readiness, increase capacity, reinforce deterrence and assurance missions, and enable us to invest in critical technologies needed to counter the growing spectrum of future missile threats.

#### THREAT ENVIRONMENT

As missile technology matures and proliferates, the threat to the United States, allies, partners, and our deployed forces steadily grows. Potential adversaries continue to expand their inventories and add new and increasingly sophisticated systems, often for the purpose of creating political instruments of regional or global coercion.

The Democratic People's Republic of Korea (DPRK) continues development and deployment of more capable intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs). The Office of the Director of National Intelligence (ODNI) suggests that the DPRK may resume ICBM testing to destabilize the security environment in East Asia, while seeking to drive a wedge between the United States and its allies.

Iran is extending the range, reliability, and accuracy of its missile forces at a concerning rate. Although Iran is not currently developing nuclear weapons, it has increased the size and enrichment level of its uranium stockpile, and has ignored restrictions on advanced centrifuge research and development. Even though it does not currently possess the capability to launch nuclear payloads at intercontinental ranges, Space Launch Vehicle (SLV) programs, such as the one that successfully placed a satellite in orbit in April 2020, develop similar technologies required for an ICBM capability, should they choose to pursue one.

The regional missile threat is also concerning as potential adversaries continue to field more accurate and lethal offensive missile systems capable of threatening the United States, allies, partners, and deployed forces.

The DPRK will pose an increasing threat to the United States, South Korea, and Japan as it continues to improve its missile force. During its January 2021 military parade, the DPRK unveiled a growing and more diverse ballistic missile force. Furthermore, recent testing demonstrates that Pyongyang continues its efforts to field more advanced and reliable short- and medium-range systems.

Iran's short- and medium-range ballistic missiles comprise the largest missile force in the Middle East, which it wields to threaten regional stability. The Office of the Director of National Intelligence (ODNI) assesses that Iran will take risks that could escalate tensions and threaten U.S. and allied interests in the coming year, using its missile forces as part of a range of tools to threaten military action and advance its goals.

Russia maintains one of the most numerous and sophisticated missile inventories in the world. Its regional anti-access area denial (A2/AD) strategies undergird broader strategic goals. The 2021 Annual Threat Assessment notes that Russia will continue to use its missile forces to undermine United States influence, reshape international norms, and divide our network of international alliances and partnerships.

In 2019, China launched more ballistic missiles than the rest of the world combined while also placing a heavy emphasis on testing hypersonic glide vehicles (HGV). Missile systems form the backbone of the PRC's anti access/area denial (A2/AD) strategy to inhibit U.S. power projection capabilities, coerce our allies and partners, and reshape the balance of power in the Indo-Pacific region.

Potential adversaries seek to defeat U.S. missile defenses not just through advances in offensive missile technology, but also through coercive diplomatic campaigns. We have repeatedly seen Russian and Chinese efforts to sow disinformation regarding United States missile defenses to threaten the strength of U.S. partnerships and of U.S. and allied forces; while simultaneously increasing their own homeland and regional missile defenses.

This evolving missile environment informs our missile defense efforts moving forward, which are part of a larger strategic framework to leverage all elements of national power to prevent and deter conflict, and to prevail should conflict occur.

## POLICY FRAMEWORK FOR UPCOMING STRATEGIC REVIEW

To address the evolving challenges to our security and the security of our allies and partners, the Department will review its missile defense policies, strategies, and capabilities to ensure they align with broader U.S. national security and national defense strategies. This review will be informed by several principles.

First, we will work to ensure we have an effective and affordable defense to address the rogue state ICBM threat to the United States. Missile defenses will provide protection of the United States from a limited attack from rogue actors. This protection will also contribute to diminishing the coercive potential of these states who may seek to constrain the ability of the United States to provide credible security assurances to our allies and partners during a crisis or conflict.

Second, we will examine means to enhance our regional posture to support our allies and partners and to defend deployed forces abroad. Our regional missile defenses will continue to contribute to the United States' ability to operate throughout the world. They will enable regional and trans-regional military operations and exercises, providing force protection in contested environments.

Third, missile defense will remain an important component of our strategy to assure U.S. allies and partners that we stand firm in our security commitments. Not only will missile defense partnerships reinforce the indivisibility of U.S. and allied joint security interests, these relationships will also provide opportunities for allied and partner cooperation, co-development, and burden sharing.

Lastly, as Secretary Austin stated, the Department must maintain credible deterrence against advanced threats, and right-size our missions around the world in a transparent and principled manner. Therefore, we must carefully align the scope of our missile defense programs with operational requirements, and clearly communicate their intent to help avoid miscalculation.

In this context, the Department will examine the appropriate mix of capabilities and tools to protect our forces, deter our adversaries, and address future uncertainty while strengthening strategic stability, and reducing risks of miscalculation.

## HOMELAND DEFENSE

The United States is strengthening its homeland defenses and is pursuing more advanced capabilities over the long term. As Secretary Austin has noted, defending the Nation is a key priority for DOD, and missile defense against rogue state threats is a central component of this mission.

The United States is currently defended from rogue state ICBM threats by the Ground-Based Midcourse Defense (GMD) system with Ground Based Interceptors located at Fort Greely, Alaska, and Vandenberg Air Force base, California. The threat is not static and neither is our commitment to improving the defense of the Nation. To that end, the Department recently initiated the development of the Next Generation Interceptor (NGI) in order to augment and potentially replace the current GMD interceptors and increase the overall reliability and capability of the GMD system when it begins deployment in late fiscal year 2028. The fiscal year 2022 budget includes \$926 million to support NGI development and program risk reduction. As this program moves forward, it will do so in a manner that aligns with the Administration's defense goals and priorities. The Department is also executing the Ground-Based Interceptor (GBI) Service Life Extension Program, which will ensure reliable defense from rogue state threats while we develop NGI to improve current GMD capabilities.

Any future decision to augment the missile defense of the United States, will ensure the overall homeland missile defense posture is sized to provide effective protection of the United States against a limited rogue state ballistic missile attack. As part of our upcoming strategic reviews and consistent with direction in National Defense Authorization Act for Fiscal Year 2020 Congressional direction, the Department will examine potential options and concepts for strengthening the defense of the United States. It is important to note that the United States continues to rely on nuclear deterrence to protect against the more sophisticated and numerically large Russian and Chinese intercontinental missile threats.

Additionally, DOD will continue to look across our ballistic missile defense capabilities in order to seek synergies with the cruise missile defense (CMD) mission, and maximize investment. Policy and NORTHCOM/NORAD are working across the Department to ensure the United States is appropriately examining potential approaches to our CMD posture and capabilities.

Another vital component of effective U.S. and regional defense, which Secretary Austin has noted, will be to enhance our global network of integrated sensors. Space-based and land-based sensors enable a variety of capabilities such as detection, tracking, and targeting through all phases of flight for an incoming missile.



As the rogue threat evolves in capability, discrimination remains key to enhancing the performance of the GMD system. For this reason the Department is requesting an additional \$133 million to support the initial fielding of the Long Range Discrimination Radar in Clear, Alaska later this year; with operational acceptance in fiscal year 2023. As we look to space, integrating the Space-based Kill Assessment capability into our missile defense architecture and exploring advanced proliferated low earth orbit space sensor development, in particular, will be critical for the future of homeland and regional missile defeat and defense programs.

#### REGIONAL DEFENSE

This Administration's Interim National Security Strategic Guidance affirms that "Regional actors ... continue to pursue game-changing capabilities and technologies, while threatening U.S. allies and partners and challenging regional stability." It is critical that we maintain support for regional missile defense systems to address missile threats and the A2/AD strategies of potential adversaries. The Interim Strategy goes on to say that "despite these steep challenges, the United States' enduring advantages—across all forms and dimensions of our power—enable us to shape the future of international politics to advance our interests and values, and create a freer, safer, and more prosperous world." Missile defenses will remain central to maintaining the U.S. enduring advantage to flow forces into a militarily contested regional environment, and to safeguard those forces should a conflict arise.

Over the past decade, the United States has made progress in developing capabilities for protection against regional missile threats. The Department plans to explore new regional capabilities and upgrade current regional systems such as Patriot, Terminal High Altitude Area Defense (THAAD), and the SM-3 interceptors to maximize their interoperability and the defended battlespace. It is also important to increase the capacity of our regional systems to maintain credible and capable war-fighting capabilities. For this reason, the Department supports: \$295 million for SM-3 Block IIA procurement, \$352 million for SM-3 Block IB interceptors, procuring additional SM-6 interceptors, the continued development and eventual procurement of Patriot Missile Segment Enhancement (MSE) interceptors, and increasing the capacity of regionally deployed THAAD systems.

The Department will continue to ensure that we bring a more integrated approach to air and missile defense (IAMD) that not only assists with defense against various types of ballistic missile threats but also enables other regional missions, such as defense against cruise missiles and unmanned aerial systems. Thus, U.S. geographic Combatant Commands, are developing IAMD initiatives that will inform future missile defense operational architectures and cooperation strategies with allies and partners. The objective of these efforts is to field interoperable and integrated missile defense sensors, interceptors, and command and control—capable against a range of threats and tailored to their unique operating environments.

A testbed for our IAMD development path will be the missile defense of Guam. China's A2/AD capabilities increasingly threaten to erode the United States ability to ensure its presence in the Western Pacific and reinforce allies and partners in the region. The Department is examining the ways in which it can ensure the effective defense of Guam from various missile threats. Survivable, scalable, and affordable IAMD, in combination with offensive capabilities and passive defense measures, provide the means to strengthen deterrence and, if deterrence fails, limit disruption to U.S. regional military operations. Lastly, as Secretary Austin stated regarding capable regional threats, "we will ... guarantee freedom of action in contested, complex operating environments ... while using all of our tools to lower the risk of escalation with our adversaries."

#### ADVANCED TECHNOLOGY

In addition to improving today's operational systems, we are examining advanced concepts and technologies. Our investment strategy and priorities will focus on how best to address more advanced adversary missile threats, especially those being designed to complicate our current regional missile defense architectures.

For example, in fiscal year 2022 we will continue to develop the prototype Hypersonic and Ballistic Tracking Space Sensor (HBTSS). This is a priority for the Department to be able eventually to assist with fire control for regional defense, and also for hypersonic missile warning and attribution, in general. This demonstration will be an important step towards building the capability and resiliency of our space sensor architecture.

As part of our future hypersonic defense architecture, the Department will also request funds to support a future regional Glide Phase Intercept demonstration ca-

pability. Our approach for regional hypersonic defense is to initially focus on terminal phase defense.

Another concept being explored for its utility to the IAMD terminal defense mission is directed energy. The Department is analyzing various directed energy concepts and their application as a complement to existing missile defense systems.

Central to any future battlefield will be information superiority to enable rapid planning and employment in a joint operating environment. To that end, the Department is developing various cyber-hardened, advanced all domain awareness command and control architectures that will enable timely and accurate decision-making to address emergent threats and coordinate responses. These developmental systems will greatly enable the “any sensor, best shooter” concept that is foundational to effective IAMD.

#### COOPERATION WITH ALLIES AND PARTNERS

Working closely with key allies and partners in Europe, the Middle East, and the Indo-Pacific region to enhance our collective security is key priority for this Administration. To that end, engaging and working with our allies and partners to enhance our collective missile defense efforts is a core focus area for the Department. The Indo-Pacific is one of the most important regions of the world, and is a model for cooperative missile defense efforts with strong allies such as Japan, the Republic of Korea, and Australia. The Department will continue to work with Japan to enhance its fleet of missile defense assets as Japan works towards its next generation of maritime defense. The United States has recently completed upgrading the Republic of Korea’s (ROK) Patriot batteries and looks forward to shared analysis for enhancing the ROK’s and Korean-based United States Forces’ layered defenses against threats from DPRK. Our working groups, interoperability initiatives, and hosting of U.S. missile defense systems help to maintain our regional security presence.

NATO continues to form the backbone of European joint and combined operations. A few highlights for missile defense include Aegis Ashore Poland, which will soon join Romania in providing defense against the potential Iranian missile threat; and the procurement of Patriot units and the European-produced SAMP-T (Surface-to-Air Missile Platform/Terrain), by several countries. Allies such as Germany and the United Kingdom are developing their own organic systems, while the U.S., through MDA, continues to execute a range of research and development initiatives with our NATO partners. The Department is also pursuing the advancement of IAMD interoperability through the Formidable Shield exercise series. These efforts will provide important tools and capabilities in dealing with regional missile challenges intended to undermine or weaken the NATO Alliances ability to respond to aggression.

In the Middle East, United States-Israeli missile defense collaboration is at the cutting edge of missile defense technology and serves as evidence of the mutual benefits of technology sharing with our allies and partners. Our annual contribution to Israel of \$500 million continues our longstanding bilateral cooperation on missile defense. We will continue to explore applications for the very capable Israeli missile defense systems across the region and beyond. With our other allies and partners in the region, the Department’s efforts center on bilateral cooperation with key Gulf Cooperation Council (GCC) countries. For example, the United Arab Emirates, Qatar, and Saudi Arabia have purchased a mix of United States THAAD and/or Patriot batteries and radars. Multilaterally, the Department will continue to work with our GCC partners to foster a more integrated approach to regional missile defense cooperation.

Additionally, DOD participates in a series of bilateral, trilateral, quadrilateral, and multilateral dialogues that share information on regional and global missile threats, exchange operational IAMD visions, discuss modernization efforts and future capability development, and seek new opportunities for joint research, training, and co-production/co-development. From a strategic standpoint, and as Deputy Secretary Hicks testified, cooperation in this area strengthens our common protection, enhances deterrence, and provides assurances essential to the cohesion of our alliances in the face of growing regional missile threats, coercion, and attacks. Operationally, by developing a more coordinated, and where possible, integrated approach to air and missile defense, we will improve our ability to work with allies and partners to address adversary A2/AD strategies and capabilities collectively.

#### CONCLUSION

As the Department prepares for its strategic review, I assure Members of this Committee that it will remain committed to key missile defense missions and priorities. In today’s complex operating environments we must be prepared to meet the

risks and danger from missile threats together as allies and partners. Lastly, in an emerging multi-domain battlefield, it will be critical to invest in effective missile defense technologies in a responsible, cost-effective manner that maintains regional and strategic stability and reliably retains U.S. advantage long into the future.

Senator KING. General VanHerck.

**STATEMENT OF GENERAL GLEN D. VANHERCK, USAF, COMMANDER, UNITED STATES NORTHERN COMMAND AND NORTH AMERICAN AEROSPACE DEFENSE COMMAND**

General VANHERCK. Chairman King, Ranking Member Fischer, and distinguished Members of the Committee, it is a privilege to testify before you again today. I am honored to serve as the Commander of the United States Northern Command and North American Aerospace Defense Command, and I am grateful to appear beside my colleagues here as they are crucial partners in homeland defense.

The United States Northern Command and NORAD separate commands, yet work seamlessly to accomplish the critical mission of defending North America against all threats, whether posed by our competitors, natural disasters, or a pandemic.

We are in an era of renewed strategic competition, and this time we are facing two nuclear-armed peer competitors, both focusing on circumventing our homeland defenses. Additionally, North Korea's recent unveiling of a new intercontinental ballistic missile, capable of threatening North America and Hawaii, is means to constrain options in a crisis.

I remain concerned about my ability in the near future to defend the Homeland. Potential adversaries continue to develop capabilities to hold our Homeland at risk, from all vectors, all domains, kinetically and non-kinetically. They seek to exploit a perceived gap between our nuclear deterrent, which I believe is the foundation of homeland defense, and our conventional homeland defense capabilities. To close this perceived gap, we must accelerate efforts to transform our culture to think and operate globally and digitally across all domains, and factor homeland defense into every strategy, plan, force management, force design, acquisition, and budgetary decision.

The United States Northern Command and NORAD are aggressively pursuing a left-of-launch framework that provides the President of the United States and the Secretary of Defense less escalatory options that increase decision space and deterrence in strategic competition, vice end-game kinetic defeat and conflict.

With the Missile Defense Agency leading the effort, progress on the next-generation Interceptor is on the right trajectory, but further delays will be detrimental to defense and deterrence by denial capability. We must also capitalize on globally layered, multi-threat detection systems, such as over-the-horizon radar, hypersonic and ballistic missile tracking space sensor, which can adequately address both my capability and capacity concerns of emerging threats.

Progress is also being made on the information dominance capabilities within the Department. The additional capabilities USNORTHCOM is pioneering, as demonstrated in the latest Global Information Dominance Experiment, are focused on prying data

from existing stovepipe networks to enable all-domain awareness. By ingesting data streams into cloud-based architecture, where the power of artificial intelligence and machine learning is unleashed, we can drastically reduce processing time across the globe and rapidly enable information dominance and decision superiority, all 11 combatant commanders endorsing and field these capabilities as soon as possible.

United States NORTHCOM and NORAD will continue to lead and accelerate the Department's digital transformation through development of global, all-domain awareness, sensors, and networks, data standards, and infrastructure to share information quickly and efficiently. In doing so, we will improve our ability to defend the Homeland against emerging threats, including improved ballistic missiles, low-altitude hypersonics, and long-range, low-radar, cross-section cruise missiles.

NORTHCOM and NORAD take solemn pride in executing the Secretary of Defense's top priority by standing watch to defend our Nation. I am grateful for the trust and responsibility you place in me as the Commander of NORTHCOM and NORAD. Thank you, and I look forward to your questions.

[The prepared statement of General Glen D. VanHerck follows:]

#### PREPARED STATEMENT BY GENERAL GLEN D. VANHERCK

Chairman King, Ranking Member Fischer, and distinguished Members of the Committee: Thank you for the opportunity to testify, and for allowing me the honor of representing the soldiers, sailors, airmen, marines, guardians, coast guardsmen, and civilians of United States Northern Command (USNORTHCOM) and North American Aerospace Defense Command (NORAD), including the members of the Canadian Armed Forces who are a vital and essential part of the NORAD team.

Since I assumed command of USNORTHCOM and NORAD, each day has afforded me the opportunity to lead a workforce of dedicated, innovative, and resilient warfighters and public servants. That fundamental commitment to our vital missions is clearly evident as USNORTHCOM and NORAD have kept the watch and defended our Nations in what is certainly the most dynamic and complex strategic environment I have encountered in my 33 years in uniform.

Our competitors continue to take increasingly aggressive steps to gain the upper hand in the military, information, economic, and diplomatic arenas. USNORTHCOM meets each of those challenges head-on—and we have done so while supporting whole-of-government efforts to safeguard our citizens through the coronavirus pandemic and historically severe hurricane and wildfire seasons, and also simultaneously synchronizing the deployment of troops to support federal law enforcement personnel on the southwest border. The cascading events of the past year placed unprecedented strain on our people, our interagency partners, and our institutions, and I am proud that we overcame each of those challenges and emerged more resilient.

That steadfast commitment is more important than ever as our competitors continue to challenge our Homelands through multiple means in all domains. Defending our Nations, our citizens, and our way of life requires constant vigilance, and USNORTHCOM and NORAD have demonstrated time and again that our commands remain determined, focused, and ready. But we must keep moving forward. Looking to the future, we will continue to pursue innovative capabilities and strategies to detect, deny, deter, and, if necessary, defeat potential threats posed by peer competitors, rogue nations, transnational criminal organizations, and foreign and domestic violent extremists. No matter the challenge or circumstance, this Committee should rest assured USNORTHCOM and NORAD are always on guard.

#### THREATS

The global geostrategic environment continues to rapidly evolve. While the United States has spent the last 30 years projecting power forward to combat rogue regimes and violent extremists overseas, our competitors pursued capabilities to circumvent our legacy warning and defensive systems and hold our Homeland at risk. Peer com-

petitors like Russia and China are undermining the international rules-based order and challenging us in all domains. Further, rogue states like North Korea and Iran are also pursuing capabilities to nullify our military advantages, threaten our networks with cyber weapons, and—in the case of North Korea—develop nuclear weapons. Meanwhile, violent extremist organizations continue to devise plots to attack our citizens and our way of life.

During the Cold War, we were overwhelmingly focused on defending the United States and Canada from a single nation-state threat. After the Soviet collapse, Iraq's invasion of Kuwait, and later the attacks on September 11, 2001 we shifted our focus to non-state and rogue actors. Today, we don't have the luxury of focusing regionally or on only one threat at a time. In the last decade, we've seen a sharp resurgence in the nation-state threat as our global competitors deploy increasingly sophisticated capabilities to hold the United States and Canada at risk and limit our options in a crisis. Concurrently, the terrorist threat continues to evolve in ways that challenge our homeland defense capabilities. As a result, today's threat environment is likely the most complex we have ever faced, as potential adversaries threaten us in all domains and from all vectors.

#### *Russia*

Russia presents a persistent, proximate threat to the United States and Canada and remains the most acute challenge to our homeland defense mission. Russian leaders seek to erode our influence, assert their regional dominance, and reclaim their status as a global power through a whole-of-government strategy that includes information operations, deception, economic coercion, and the threat of military force.

In peacetime, Russian actors conduct sophisticated influence operations to fan flames of discord in the United States and undermine faith in our democratic institutions. In crisis or conflict, we should expect Russia to employ its broad range of advanced capabilities—non-kinetic, conventional, and potentially nuclear—to threaten our critical infrastructure in an attempt to limit our ability to project forces and to attempt to compel de-escalation. Offensive capabilities Russia has fielded over the last several years include advanced cyber and counterspace weapons and a new generation of long-range and highly precise land-attack cruise missiles—including hypersonics. These capabilities complicate our ability to detect and defend against an inbound attack from the air, sea, and even those originating from Russian soil.

Russia also continues to modernize all three legs of its nuclear triad. In December 2019, Russia fielded the world's first two intercontinental ballistic missiles (ICBMs) equipped with a hypersonic glide vehicle payload that will challenge our ability to provide actionable warning and attack assessment. In the coming years, Russia hopes to field a series of even more advanced weapons intended to ensure its ability to deliver nuclear weapons to the United States. These include the Poseidon trans-oceanic nuclear torpedo and the Burevestnik nuclear-powered cruise missile, which—if perfected—could enable strikes from virtually any vector due to its extreme range and endurance.

Finally, Russia continues to conduct frequent military operations in the approaches to North America. Last year, NORAD responded to more Russian military flights off the coast of Alaska than we've seen in any year since the end of the Cold War. These Russian military operations include multiple flights of heavy bombers, anti-submarine aircraft, and intelligence collection platforms near Alaska. These efforts show both Russia's military reach and how they rehearse potential strikes on our Homeland. Last summer, the Russian Navy focused its annual OCEAN SHIELD exercise on the defense of Russia's maritime approaches in the Arctic and Pacific. The multi-fleet exercise, intended in part to demonstrate Russia's ability to control access to the Arctic through the Bering Strait, included amphibious landings on the Chukotka Peninsula opposite Alaska, as well as anti-submarine patrols and anti-ship cruise missile launches from within the U.S. Exclusive Economic Zone.

#### *China*

China continues to pursue an aggressive geopolitical strategy that seeks to undermine United States influence around the globe and shape the international environment to its advantage. In the USNORTHCOM area of responsibility, China has made deliberate attempts to increase its economic and political influence with our close partners in Mexico and The Bahamas. While the United States remains the economic and military partner of choice in the region, China is seeking to grow its trade and investment in Mexico and, over the past few years, has invested in The Bahamas' vital tourism sector through marquee infrastructure projects. Militarily, China is rapidly advancing a modernization program that seeks to erode our military advantages and deter us from intervening in a regional conflict.

China remains among the world's most capable and brazen cyber actors, stealing volumes of sensitive data from United States Government, military, academic, cleared defense contractors, and other commercial networks each year. In a crisis, China is postured to transition rapidly from cyber exploitation to cyber attack in an attempt to frustrate our ability to flow forces across the Pacific, and globally. China also continues to advance its counter-space capabilities that could threaten our space-based communications and sensors. In the foreseeable future, China will likely be able to augment its cyber-attack capabilities with a new family of long-range precision-strike weapons capable of targeting key logistical nodes on our West Coast that support U.S. mobilization and sustainment.

China also continues to expand and modernize its strategic nuclear forces to rival those of Russia and the United States in sophistication, if not in numbers. Over the last decade, China fielded dozens of road-mobile ICBMs and several ballistic missile submarines designed to enhance the survivability of China's nuclear deterrent and ensure its ability to retaliate following any attack. In the next decade, China will deploy a new generation of advanced weapons—some of them hypersonic—that will further diversify their nuclear strike options and potentially increase the risks associated with United States intervention in a contingency.

#### *North Korea and Iran*

The Kim Jong Un regime has achieved alarming success in its quest to demonstrate the capability to threaten the United States Homeland with nuclear-armed ICBMs, believing such weapons are necessary to deter U.S. military action and ensure his regime's survival. In 2017, North Korea successfully tested a thermonuclear device—increasing the destructive potential of their strategic weapons by an order of magnitude—as well as three ICBMs capable of ranging the United States. In October 2020, North Korea unveiled a new ICBM considerably larger and presumably more capable than the systems they tested in 2017, further increasing the threat posed to our Homeland. The North Korean regime has also indicated that it is no longer bound by the unilateral nuclear and ICBM testing moratorium announced in 2018, suggesting that Kim Jong Un may begin flight testing an improved ICBM design in the near future.

Iran continues to advance its military technologies and threaten the security of United States Forces and allies throughout the Middle East. Iran adheres to a self-imposed range limit on its ballistic missile force that prevents it from directly threatening the United States. Nonetheless, Iran is developing and testing ICBM-relevant technologies through its theater missiles and space launch platforms—including its first successful orbit of a military satellite in April of 2020—that could accelerate the development of a Homeland-threatening ICBM should Iran's leaders choose to pursue such a system. Iran retains the ability to conduct attacks via covert operations, terrorist proxies, and its growing cyber-attack capabilities, which it has already employed against U.S. financial institutions.

#### DEFENDING THE HOMELAND

USNORTHCOM's defense of the Homeland provides the foundation for the full spectrum of the Department of Defense's worldwide missions and supports the missions of every other combatant command. The ability to deploy forces overseas, support allies, deliver humanitarian assistance, and provide presence and reassurance around the globe relies on our ability to safeguard our citizens, as well as national critical infrastructure, transportation nodes, and leadership. As competitors field highly advanced and agile long-range weapons systems and seek to act on growing territorial ambitions, we are adapting our thinking, evolving our own capabilities, and enhancing our operations and exercises to accurately reflect a changing world while remaining a relevant force.

The United States has long relied on our nuclear arsenal to serve as the strategic deterrent against an attack on our Homeland. In today's threat environment, strategic deterrence remains foundational to our national defense. A safe, secure, and effective nuclear force remains the most credible combination of capabilities to deter strategic attack and execute our national strategy. The U.S. strategic deterrent has helped to maintain a careful balance between nuclear powers and remains the bedrock of our national defense, as the longstanding doctrine of deterrence by punishment makes clear to potential adversaries that a large-scale attack on the United States or our allies would result in an overwhelming and devastating response.

However, over the last decade, our competitors have adapted new techniques and fielded advanced weapons systems with the potential to threaten the Homeland below the nuclear threshold. Simply stated, the missiles and delivery platforms now in the hands of our competitors present a significant challenge to our legacy warning and assessment systems and defensive capabilities. Advanced systems posing

threats to the Homeland have already been fielded in large numbers, and our defensive capabilities have not kept pace with the threat. The notion that the Homeland is not a sanctuary has been true for some time, and that will remain the case for the foreseeable future. Therefore, we must ensure effective nuclear and conventional deterrents are in place to defend the Homeland and ensure our ability to project power where and when it is needed.

Highly advanced cruise missiles, hypersonic missiles, and stealthy delivery platforms provide our competitors with the ability to hold targets in the Homeland at risk with conventional weapons. That fact has led us to emphasize improved all-domain awareness and the development of a layered sensing grid to provide warfighters and decision makers at the strategic, operational, and tactical levels with increased awareness and decision space.

The reality of a vulnerable Homeland and the risks associated with rising global competition are driving our commands to collaborate with interagency and industry partners to find and deliver smarter, more affordable technology. To outpace our competitors, we cannot be satisfied with incremental steps; instead, we must continue to increase the pace and tempo of our technological advancements. This work is essential, and we are proud of our close collaboration with a host of interagency and industry partners and international allies as we work together to outthink our competition, outpace threats, and defend what we hold most dear. That global focus and cooperation is also reflected in our growing wargaming capacity, including major homeland defense exercises such as Vigilant Shield and our participation in the Large Scale Global Exercise series.

#### THE PATH TO DECISION SUPERIORITY

I believe our future success in USNORTHCOM, our fellow U.S. combatant commands, and NORAD requires all-domain awareness, information dominance, and decision superiority. Our competitors have invested heavily in weapons systems that can be launched against distant targets with little to no warning, as well as stealthy delivery platforms specifically designed to evade detection by existing sensors. As a result, the successful execution of USNORTHCOM and NORAD missions in the digital age relies on significantly improving global all-domain awareness through the development of a fused ecosystem of networked sensors extending from space to the seafloor.

This network will pull data from an array of repurposed systems, legacy sensors enhanced through low-cost software modifications, and a limited number of new sensors to provide robust indications and warning and persistent tracking of the full spectrum of potential threats to the Homeland from the seafloor to on orbit. Integrating and sharing data from this global sensor network into common platforms will allow leaders to observe potential adversaries' actions earlier in the decision cycle, providing more time and decision space at all levels.

That decision space is where the true value of improved domain awareness resides. Harnessing the capability of distributed multi-domain sensors, machine learning, and artificial intelligence will provide military leaders, the intelligence community, and senior civilian officials with the information necessary to anticipate, rather than react to, competitors' actions.

All-domain awareness is the first critical step on the path to decision superiority, and USNORTHCOM and NORAD require and have prioritized capabilities that improve our domain awareness and global integration with our fellow warfighters. Sensors and systems such as Over the Horizon Radars, polar satellite communications, Integrated Underwater Sensor Systems, and space-based missile warning and tracking sensors are essential to our missions. While the benefits to continental defense are clear, these capabilities will also help every U.S. combatant commander around the world while enhancing USNORTHCOM and NORAD's collective ability to defend the United States and Canada.

In September 2020, just after I assumed command of USNORTHCOM and NORAD, the commands partnered with the United States Air Force and United States Space Command in the second onramp demonstration of the Air Force's Advanced Battle Management System (ABMS). This large-scale joint force demonstration established a network with embedded machine learning and artificial intelligence to rapidly detect, track, and positively identify a simulated cruise missile threat, while providing a common operating picture and all-domain awareness for commanders at multiple levels.

The ABMS onramp demonstration provided a brief but exciting glimpse into the future of USNORTHCOM and NORAD. By creating potential pathways for accessing and distributing data in ways that allow leaders to think, plan, and act globally rather than relying on outdated regional approaches, we are significantly amplifying

the capability of the joint force. Through these and other efforts, USNORTHCOM and NORAD are actively working to deliver information dominance by fusing new technologies to increase decision space for commanders and senior civilian decision makers. Ultimately, our objective is to enable leaders and commanders all over the world to quickly assess any situation and take the steps necessary to stay well ahead of an adversary's next moves in order to deter and deny in competition, de-escalate in crisis, and defeat in conflict.

In March of this year, USNORTHCOM and NORAD led a Global Information Dominance Experiment (GIDE) that brought leaders from all 11 combatant commands together in one collaborative environment. GIDE demonstrated the strategic value of Joint All-Domain Command and Control by allowing combatant commands to rapidly share information across all domains and collaborate in near real-time. During this experiment, which included a NORAD live-fly exercise, we worked with industry partners to fuse all-domain sensing within a common data system in order to develop globally integrated courses of action and advance the Joint Force's information dominance capability. This experiment demonstrated the power of artificial intelligence and machine learning tools, which have the ability to expand decision space for decision makers. Through GIDE events, we will continue to test these capabilities, improve global integration, and help the DOD and allies increase all-domain awareness to enable information dominance—and ultimately achieve decision superiority.

The prototype Pathfinder data analytics project provides another example of how USNORTHCOM and NORAD are working to leverage existing but stovepiped data streams to the benefit of both operational and strategic decision makers. In our ongoing prototype efforts, Pathfinder gathers data from multiple distinct military and civilian air domain sensors and, through automation and machine learning models, produces a fused common operating picture to improve the reliability of the data and increase the decision space that will someday soon be available in real time to our assessors and watch-standers. This low-cost, rapidly developed system will have long-term benefits for our domain awareness and has already shown some of the advantages that information dominance will provide to warfighters around the world.

Information is power, but only if it is accessible, sharable, and actionable. Unlocking the enormous potential of the data currently being collected by a global layered sensor grid will allow us to gain a decisive advantage over competitors and potential adversaries. Currently, vast quantities of data are trapped by incompatible systems and antiquated organizational structures. Breaking down these stovepipes is achievable, but doing so will require innovation and coordination across various agencies, to include technology that allows for timely exploitation of the massive volume of data collected by our sensor networks. More importantly, it will also depend on breaking away from a culture that favors compartmenting and isolating information, in order to fully realize the full potential of our capabilities—including those that reside with our allies and partners. As the defense and intelligence communities connect systems and sensors, consideration of national electromagnetic spectrum management policies is needed to ensure that necessary connections and bandwidth are accessible.

As our competitors rapidly develop and deploy advanced capabilities with clear intent to overcome the U.S. technological advantage, the Department of Defense and the U.S. Government as a whole must also modernize our requirements and acquisition processes to stay ahead. Given the current pace of technological advancement, we must take full advantage of the forward-thinking solutions our industry partners can offer. To succeed in this era of Great Power Competition, it is essential to rapidly deliver capabilities to the warfighter by streamlining the processes for prototyping, testing, and moving promising technologies into production.

The success of USNORTHCOM and NORAD's Pathfinder program, along with much of the work done by DOD's Defense Innovation Unit, show what is possible when we provide innovators and technical experts the resources and flexibility to tackle even the most daunting challenges. The same approach should also be applied to software development and acquisition. Success in competition and in conflict will increasingly depend on the ability to field software-based capabilities faster than our adversaries. For that reason, I am encouraged by the new model championed by the Office of the Under Secretary of Defense for Acquisition and Sustainment that will enable the Department of Defense to acquire software through modern development practices and deliver needed capability at the speed of relevance.

Armed with timely and accurate information, equipped with modern sensors and software, and backed by a flexible and responsive conventional deterrent that provides defeat mechanisms below the nuclear threshold, commanders and senior civil-



ian leaders will achieve decision superiority with the options and time necessary to allocate resources wherever needed to deny or deter aggression in competition, de-escalate potential crises, and defeat adversaries should conflict arise.

#### MISSILE DEFENSE

##### *Ballistic Missile Defense*

The need for a robust and modern ballistic missile defense system has been strongly reinforced over the past year. Despite United States efforts in 2020 to reach an agreement with Kim Jong Un, North Korea continued its development of ICBMs capable of striking targets in the United States. As North Korea continues its pursuit of advanced long-range strategic weapons—including the new systems displayed during their 10 October 2020 parade—USNORTHCOM remains committed to maximizing the capability and capacity of our ballistic missile defense systems.

USNORTHCOM is focused on developing and fielding advanced sensors capable of tracking potential missile threats and providing improved discrimination capability to our warfighters and assessors. Simultaneously, USNORTHCOM is collaborating with our partners in the Missile Defense Agency (MDA) to ensure that the Next Generation Interceptor (NGI) is fielded and operational as soon as possible. Of note, USNORTHCOM worked hand-in-hand with MDA to ensure all of our operational requirements are addressed in the NGI acquisition process. When fielded, NGI will add 20 interceptors to the current inventory, and will provide greater reliability and capability.

As competitor missile technology advances, USNORTHCOM is also working with MDA toward a layered missile defense capability that will allow for a more flexible and responsive defense of the Homeland against both ballistic missile and cruise missile threats. The successful engagement of an ICBM-class target by an SM3-IIA interceptor on 16 November 2020 was an historic achievement and a critical step toward establishing this layered capability. Defending the United States Homeland against the ballistic missile threat remains a complex and technically challenging endeavor, and I am grateful to the Committee for your continued support as we take the steps necessary to ensure the success of this critical mission.

##### *Cruise Missile Defense*

As evidence of both the global nature of the threat and the implicit trust in our bi-national command, NORAD is developing the requirements for the defense of the United States and Canada against advanced cruise missiles. In this capacity, NORAD works closely with the U.S. military Services, the Canadian Joint Operations Command, and a host of other dedicated DOD and Canadian Defence Ministry partners to share costs and ensure a clear, common understanding of the threat and what will be required to mitigate the risk to our nations.

Modern cruise missiles are difficult to detect and can be launched from significant distances against targets in the United States and Canada from launch sites on Russian soil and by long-range bombers, attack submarines, and surface vessels. Whether subsonic or hypersonic, these missiles can range targets in the Homeland and present a very real challenge for our defensive capabilities. Russia has already amassed an inventory of both nuclear and conventional variants, while China is expected to develop similar capabilities in the next decade.

The proliferation of these systems creates all the more incentive for focused investments in improved sensor networks, domain awareness, and information dominance capabilities. Those investments, coupled with the development of layered denial, deterrence, and defeat mechanisms capable of addressing current and emerging threats, are fundamental to the defense of our Homeland.

#### CONCLUSION

As USNORTHCOM and NORAD look to a future marked by rapid shifts in the geopolitical environment and technological advancement, we are guided by the lessons of the past. Key among those is that we cannot overcome challenges in isolation. By viewing changing conditions and competitor actions from a global perspective, our problems become more solvable and the solutions more affordable. USNORTHCOM and NORAD will continue to build our partnerships, collaborate with fellow warfighters, and work toward overcoming shared problems rather than continuing to focus on point solutions to isolated threats.

To that end, I look forward to working with the Committee and with all of our innovative industry and interagency partners as we move quickly to develop and field the capabilities required to defend our nations now and well into the future. Together, I believe we can eliminate outdated barriers that only serve to stifle infor-

mation sharing, and simultaneously foster a mindset that favors creative, forward-looking approaches over unproductive reliance on legacy systems and processes.

Finally, and perhaps most importantly, we will continue to prioritize our most vital asset: our people. With that in mind, I would like to take this opportunity to publicly recognize the select group of USNORTHCOM and NORAD personnel responsible for standing the operational watch 24 hours a day, every day. Their mission is crucial to our defense, and these military and civilian watch-standers have spent much of the last year under strict but necessary isolation protocols to mitigate the risk of a COVID outbreak. They and their families have endured long periods of separation during an already difficult time, and they have done so without any expectation of public recognition. I am honored to lead men and women of such selflessness and professionalism, and our citizens should rest assured these extraordinary defenders have the watch.

Senator KING. Thank you. General Karbler.

**STATEMENT OF LIEUTENANT GENERAL DANIEL L. KARBLE, USA, COMMANDER, U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND/JOINT FUNCTIONAL COMPONENT COMMAND FOR INTEGRATED MISSILE DEFENSE**

Lieutenant General KARBLE. Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, I am honored to testify before you today. Thank you, especially, during the unprecedented health crisis of this past year for supporting our servicemembers, civilians, contractors, and their families, in your continued support to space and air and missile defense.

I am here today as the Commander of the Joint Functional Component Command for Integrated Missile Defense, and as the Army's proponent for Air and Missile Defense, or AMD, Forces and Capabilities. I am responsible for providing General VanHerck the soldiers who stand ready to defend our Nation from an intercontinental ballistic missile attack, as well as the soldiers who provide critical missile warning to Army and joint warfighters.

As air and missile threats become more diverse and numerous from adversaries worldwide, the Army AMD enterprise continues to work hard to ensure our warfighters and our Homeland are protected.

I would like to take this opportunity to briefly thank and highlight the mission accomplishments of our team of nearly 3,000 soldiers, sailors, airmen, marines, guardians, and civilians in the challenging COVID environment that we continue to endure. During this past year, in support of SPACECOM, STRATCOM, and NORAD/NORTHCOM, these outstanding men and women provide the Army and Joint Force with satellite communications, space situational awareness, and missile warning defense, and protected our Homeland 24/7, 365, from ballistic missile attack. Even in the pandemic environment, they did not miss a beat.

To outline one of numerous examples of putting mission first and how Army families have sacrificed during the pandemic, members of our ground-based missile defense crews adhered to 12 consecutive months of stringent measures ensuring the uninterrupted execution of their mission, including sequestering crew members from their homes and families. Essentially, our missile defense crews lived in a bubble throughout their operational rotations on this essential, no-fail mission. While they and their families reside in Colorado Springs, Colorado, and Fort Greely, Alaska, the crew-

members were basically away from their families for extended period of time.

A positive I have drawn from this pandemic is my daily realization that I have never been more proud and thankful for our greatest asset, our people. Every day I am awed by their dedication and unwavering sacrifices to the Nation. I consider it an honor and a privilege to lead and serve alongside them. The continued support of Congress is critical to our ability to recruit, develop, retain, and resource such a highly qualified and mission-ready team.

I look forward to addressing your questions. Thank you.

[The prepared statement of Lieutenant General Daniel L. Karbler follows:]

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RECORD VERSION

STATEMENT BY  
LIEUTENANT GENERAL DANIEL L. KARBLER, USA  
COMMANDING GENERAL,  
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND  
AND  
COMMANDER,  
JOINT FUNCTIONAL COMPONENT COMMAND FOR  
INTEGRATED MISSILE DEFENSE

BEFORE THE

SUBCOMMITTEE ON STRATEGIC FORCES  
COMMITTEE ON ARMED SERVICES  
UNITED STATES SENATE

FIRST SESSION, 117TH CONGRESS

FISCAL YEAR 2022 AUTHORIZATION REQUEST FOR MISSILE DEFENSE

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**Introduction**

Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee, thank you for your continued support of our Service Members, Civilians, and Families and your continued support of the Army, the U.S. Strategic Command, the U.S. Space Command, the Department of Defense, and the space and missile defense community. Thank you also for the opportunity to testify before this Subcommittee. I am honored to highlight the important space and missile defense capabilities and ongoing enhancements that enable the defense of our Nation, forward stationed and deployed forces, allies, and partners.

Today, with my assigned roles, I bring both an Army and a joint perspective on effective space and missile defense capabilities. Within the Army and joint communities, my responsibilities encompass several mission areas.

As the commander of the U.S. Army Space and Missile Defense Command (USASMD), I have Title 10 responsibilities to organize, train, and equip Army space and missile defense forces. I serve as the Army's force modernization proponent for space, missile defense, and high altitude forces and capabilities. Further, with regard to missile defense, I am the Army Service component commander to U.S. Strategic Command (USSTRATCOM). In this role, I am responsible for planning, integrating, coordinating, and providing Army missile defense forces and capabilities in support of USSTRATCOM missions. In the space mission area, I support the U.S. Space Command (USSPACECOM) by providing trained and ready Army space warfighters and capabilities to compete, fight, and win in the space domain.

I also serve as the Army's air and missile defense (AMD) enterprise integrator. In this role, I synchronize the balanced execution of the Army's AMD posture across the functions of force planning and sourcing requirements, combat and materiel development, AMD acquisition, and lifecycle management. I coordinate with the AMD community of interest to balance priorities, inform resourcing decisions, and pursue innovative approaches in order to fulfill our AMD mission requirements.

Finally, as the commander of USSTRATCOM's Joint Functional Component Command for Integrated Missile Defense (JFCC IMD), I am responsible for providing essential global missile defense expertise in support of USSTRATCOM's Unified

Command Plan (UCP) directed missions. This entails 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. These efforts deter adversaries, assure allies, and defend U.S. deployed forces, allies, and partners against missile attacks.

Both commands are uniquely organized to conduct joint, global operations for space and missile defense and comprise multi-component Soldiers, Airmen, Sailors, Marines, Guardians, and dedicated Civilians and Contractors geographically postured to support diverse missions. Our vision is a People First team of professionals providing space, missile defense, and high altitude forces and capabilities to support joint warfighting readiness in all domains. To accomplish this vision, USASMD is organizationally aligned to accomplish three major tasks, which 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 space, air, and missile defense capabilities. The command aligns its activities to these priorities:

- Accomplish our mission as a People First team of empowered, innovative, ready, and resilient professionals.
- Provide trained and ready forces for space, missile defense, and high altitude missions.
- Conduct integrated planning and synchronized operations in the execution of our space and missile defense missions.
- Prepare for future conflict.

My intent today is to highlight the dedicated diverse people who serve in the geographically dispersed organizations under my command, to briefly outline the strategic environment, and to emphasize the responsibilities USASMD bears as a space and missile defense and space force provider to combatant commanders (CCDRs). I would also like to summarize key Army AMD developments in the context of a comprehensive approach to addressing the evolving air and missile threat. Finally, I will outline JFCC IMD's role as a warfighter advocate supporting USSTRATCOM's coordinating authority for global missile defense planning.

### People First

USASMDC and JFCC IMD cannot carry out our wide-ranging, no-fail, national security missions without the dedication of our greatest asset—our people. We place “People First” as we recruit, train, and develop Army space and missile defense professionals. The continued support of Congress is critical to our ability to develop and retain a highly qualified and mission-ready team. Despite the many challenges created by the ongoing coronavirus pandemic throughout the past year, our professionals remained focused on providing space and missile defense capabilities that enable multi-domain operations so combatant commanders can effectively maneuver and win. Countless examples before, and especially during, the pandemic, illustrate how our strength lies in our agile, adaptive space and missile defense team of almost 3,000 highly trained and skilled Soldiers, Sailors, Airmen, Marines, Guardians, and Civilians who stand vigilant 24/7/365 around the world, protecting the joint warfighter and defending the homeland. During the pandemic, we integrated all possible safety measures to protect personnel, preserve the command's deployable element capability, and ensured continued readiness through training and certifications. Our innovative and empowered personnel have adapted magnificently and remain the heart of both commands. Recently released results from the 2020 Federal Employee Viewpoint Survey indicates an increasing sense of workplace pride and satisfaction within our team. It is our people who make us strong; it is our people who make winning possible.

**Spanning Across 11 Time Zones,  
Nearly 3,000 Soldiers, Sailors,  
Airmen, Marines, and Civilians  
in 23 Worldwide Locations.**

### Threat Capability Proliferation and Development

The U.S. faces challenges from adversaries who are developing capabilities to challenge, limit, or exceed our military advantage. These challenges include more lethal ballistic and cruise missiles. We must contend with a growing prevalence of enhanced air and missile threats due both to the proliferation of advanced technologies and indigenous production of these technologies. The result of this trend is an increased array of ballistic and cruise missile systems that threaten U.S., allies, and



partner missile defense capabilities as well as an ever-increasing propensity for adversaries to use these weapons against U.S. and partner forces. Our potential adversaries continue to seek and develop missile systems with advanced countermeasures, including maneuverable and multiple independent reentry vehicles and electromagnetic jamming. These characteristics, coupled with an increase in mobility, accuracy, and lethality, are intended to challenge and defeat our missile defense capabilities. Hypersonic glide vehicles delivered via ballistic missile boosters, as well as hypersonic cruise missiles under development, continue to advance as emerging threats that pose significant challenges to our systems. With the proliferation of missile technology around the world, indigenous development of ballistic and cruise missile systems is becoming increasingly affordable. Approximately 30 countries possess ballistic missile expertise with many willing to share with other countries. Threats to the homeland and other theaters will only increase.

China's missile development program continues to be the most diverse and robust in the world. Within the last two years, China has launched over 100 ballistic and cruise missiles, more than the rest of the world combined, to test and evaluate weapon system performance and effectiveness. In an effort to counter perceived threats to its national sovereignty, and reassert its perceived historical dominance throughout the Pacific and East Asia region, China continues bolstering its ballistic and long-range land attack and anti-ship missile capabilities, its command and control, and its rhetoric. Continued development enhancements provides China mainland ability to conduct precision strikes in the Western Pacific, Indian Ocean, and South China Sea. China continues emphasis on hypersonic glide vehicles to counter ballistic missile defense systems.

Russia, with its large strategic arsenal, continues upgrading both fielded and future systems with improved technologies. Moscow claims to have upgraded 82 percent of its nuclear triad, is developing several novel nuclear-capable systems, and has exhibited a growing ability to project power with long-range precision cruise missiles. Moscow is also investing significant resources in the fielding of hypersonic weapons. In October 2020, Russia successfully tested its multi-role Tsirkon hypersonic anti-ship missile with land attack capability. These new capabilities are specifically

designed to thwart ballistic missile defenses, challenge deterrence, and target our capabilities, increasing risk to allies, partners, and the homeland.

Rogue actors North Korea and Iran continue to expand their military capabilities, including the development of new ballistic and cruise missile systems, to further their regional goals to threaten the U.S. and its allies. The March 2021 North Korean missile launches highlighted the threat that its missile program continues to pose to the region,

the U.S., and the international community.

**“Defending the United States homeland against the ballistic missile threat remains a complex and technically challenging endeavor...”**

- USNORTHCOM SASC Posture Statement  
March 2021

These launches followed the October 2020 parading of an unprecedented number of ballistic missile launchers and new, larger submarine launched ballistic missiles and intercontinental ballistic missiles (ICBMs). Despite economic sanctions and the continued impact of COVID-19, North Korea continues to

modernize and increase the survivability,

lethality, and diversification of its missile force. North Korea continues to emphasize the importance of its missile program for its self-defense and pursue development of a diverse short- to long-range ballistic missile inventory as a means to leverage political and economic gain and wield coercive influence over its neighbors.

Iran has the largest ballistic missile force in the Middle East. One only has to look back at the brazen missile attack on Al-Asad Air Base in Iraq in January 2020 to realize Tehran is more than willing to use its missiles to demonstrate strength and resolve, as well as to ensure the regime’s survival and achieve regional dominance. Iran continues to increase the lethality, accuracy, reliability, and survivability of its missile forces, including systems with increasing ranges and anti-ship capabilities, as well as underground ballistic missile launchers. Iran has unveiled several land attack cruise missiles that could complicate missile and air defense systems. Iran is pursuing a space launch vehicle program that could shorten the pathway to future ICBM capability to further challenge U.S. strategic influence and dominate its neighbors.

Our adversaries, and in some cases, non-state actors, have proven increasingly brazen in wielding missile technologies to oppose our presence and influence, but there are additional threats that present a challenge to our missile defense capabilities. Unmanned aircraft systems (UAS) have advanced technologically and proliferated exponentially over the past decade. As technology has progressed, both reconnaissance and attack capabilities have matured to the point where UASs represent a significant threat to Army combat operations from both state and non-state actors. The broad number of missions enabled by UAS platforms in terms of size, velocity, range, altitude, and flexibility complicates the counter-UAS (C-UAS) mission for AMD forces. We appreciate that Congress authorized the Department to take actions to mitigate the increasingly challenging UAS threat to facilities and assets related to the Department's missile defense mission.

We expect space, cyber, and electronic attacks will evolve around the anti-access/area-denial (A2/AD) strategies of our adversaries. Our ability to successfully counter these continuously advancing threats will rely heavily on our increased use of space and space-enabled capabilities. Space sensors, in greater numbers and diverse bandwidths, will expand our capability and capacity to track, discriminate, and support successfully engage incoming ballistic, cruise, and hypersonic weapons.

The strategic AMD environment is becoming more challenging as threat systems continue to proliferate in number and advance in complexity. Our evolution of capabilities requires a holistic strategy that effectively integrates alternative approaches and technologies to defeat air and missile threats. A comprehensive approach, including attack operations, active and passive defenses, and integrated command and control (C2), increases lethality and enables more efficient and effective active missile defense capabilities. In addition, implementing technological advances requires more joint and partner nation data-sharing to enable integration of current and future capabilities. We continue to prioritize integrated (IAMD) resources to optimize warfighter support and partner with the Missile Defense Agency (MDA), combatant commands (CCMDs), and the Services in pursuit of fiscally responsible methods to address evolving threats.

**Global Posture to Counter the Threat**

Strategic positioning must seek to deter adversary missile systems' development, deployment, and employment. To that end, a layered and integrated approach that synchronizes offensive and defensive capabilities ensures U.S. forces are prepared to leverage the full complement of fires in crisis and conflict. Effective active defense and pre-launch attack operations requires successful integration of multi-domain capabilities spanning from tactical to strategic, departmental to interagency, and includes allies and partners.

To counter the threat and meet the objectives of the 2018 National Defense and Army Strategies, USSTRATCOM and the U.S. Army continue to enhance homeland and regional active missile defenses as part of our evolving joint all-domain operations concept. We must also continue to work with our allies and partners in Europe, the Indo-Pacific region, and the Middle East to increase missile defense systems and operations integration and interoperability.

In conjunction with our allies and partners, the Department maintains deployed and forward-stationed Patriot; Terminal High Altitude Area Defense (THAAD); Army Navy/Transportable Radar Surveillance and Control, Model 2, Forward-Based Mode (AN/TPY-2 FBM) radars; Avenger Air Defense Systems; Sentinel radars; and counter-rocket, artillery, and mortar (C-RAM) forces to enhance our AMD posture, sending a deterrence message to competitors and assurance to our friends. Through deployed and forward-stationed AMD commands and air defense brigade headquarters, we continue to work with regional partners and allies to increase information and data-sharing that leverages partner nations' growing capabilities and capacity. These efforts are intended to reduce the strain on U.S. forces and enhance strategic flexibility while enabling more timely modernization of our AMD assets.

Army Air and Missile Defense 2028 is the framework guiding AMD readiness and modernization. It is the product of the Army AMD enterprise, which consists of agencies and organizations that develop, maintain, sustain, train, and employ AMD capabilities. This document is based on the 2017 National Security Strategy, the 2018 National Defense Strategy, the 2019 Missile Defense Review, the U.S. Army in Multi-Domain

Operations 2028, and the Army Operating Concept, as well as the changing operational and threat environments and the rapid pace of technological advancement.

The Air and Missile Defense Cross-Functional Team (AMD CFT) is the key agent that is rapidly facilitating capability development in accordance with AMD 2028. It is ensuring future capabilities transition quickly from concept, to prototyping, to fielding. The programs that Army AMD is rapidly developing are: Integrated AMD Battle Command System (IBCS); Maneuver-Short Range Air Defense (M-SHORAD); Indirect Fire Protection Capability (IFPC); and Lower Tier Air and Missile Defense Sensor (LTAMDS). The AMD CFT also works closely with the Rapid Capabilities and Critical Technologies Office (RCCTO) on DE capabilities to include high energy lasers (HEL) and high power microwave (HPM) systems.

#### **Providing and Enhancing Missile Defense Capabilities**

In accordance with Title 10 responsibilities, USASMDC is a force provider of missile defense capabilities. As a force provider, our first major task is to provide trained and ready missile defense forces and capabilities to the CCDRs. 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 CCDRs, also leverage the capabilities we provide. For example, USASMDC Soldiers serving in the homeland and in remote and austere forward-deployed locations operate the Ground-based Midcourse Defense (GMD) system and the AN/TPY-2 FBM radars. Highlights of the capabilities provided to current operations and readiness by our missile defense professionals include:

**"While current capabilities provide defense of the homeland against a rogue ballistic missile threat, a concerted effort and commitment is required to expand and improve existing capabilities for both homeland and regional missile defense."**

- USSTRATCOM SASC Posture Statement  
April 2021

*Support to Homeland Missile Defense:* Soldiers from the 100<sup>th</sup> Missile Defense Brigade (MDB), headquartered in Colorado Springs, Colorado, and the 49<sup>th</sup> Missile Defense Battalion, headquartered at Fort Greely, Alaska, are ready to defend our Nation from an ICBM attack 24/7/365. In support of U.S. Northern Command (USNORTHCOM), Army National Guard and Active Component Soldiers operate the GMD Fire Control Systems located at the Fire Direction Center in Alaska and the Missile Defense Element in Colorado; a detachment oversees operations at Vandenberg Air Force Base, California. These Soldiers, in conjunction with USNORTHCOM, also oversee maintenance of GMD interceptors and ground system

**"...support continuing improvements to our homeland missile defense architecture."**

- SECDEF SASC Confirmation Hearing  
January 2021

components. At the Fort Greely Missile Defense Complex, the 49<sup>th</sup> Missile Defense Battalion military police secure the interceptors and C2 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. Soldiers from the 1st Space Brigade provide combatant commanders with certified AN/TPY-2 FBM missile defense batteries that support strategic and regional missions. These batteries are globally located in five strategic locations where they provide a tangible contribution to both homeland and regional defense. Soldiers manning these radars, deployed to remote and austere locations, demonstrate daily our Nation's commitment to defend deployed forces, allies, and partners from ballistic missile attacks while also providing space domain awareness.

*Support to Global Missile Defense Test and Development:* Soldiers from the 100<sup>th</sup> MDB and the 49<sup>th</sup> Missile Defense Battalion 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 MDB to sustain and improve their proficiency and validate operational employment of the system.

*Global Missile Defense System Development:* MDA continues to evolve the GMD weapon system to enhance existing capabilities, as well as deliver new capabilities. Construction of Fort Greely's Missile Field 4 is scheduled to be complete in June 2022 and will provide additional capacity and flexibility by the end of the calendar year. The Next Generation Interceptor (NGI), once developed, will be a significant upgrade compared to the current interceptor fleet, providing the warfighter with improved system performance and greater reliability.

**"Missile defense endures as a critical component for comprehensive strategic and tailored regional deterrence."**  
- USSTRATCOM SASC Posture Statement  
April 2021

*Space Support to Missile Early Warning:* Space-enabled capabilities are essential for missile defense operations. They provide and enable communications; positioning, navigation, and timing; intelligence, surveillance, and ACECOM's National Space Defense Center to ensure that space assets are poised reconnaissance; and early warning. We routinely coordinate and collaborate with USSPACECOM's National Space Defense Center to ensure that space assets are poised to support missile defense.

In support of joint force commanders, USASMDC continues to provide missile warning within the U.S. European Command (USEUCOM), U.S. Central Command (USCENTCOM), and U.S. Indo-Pacific Command (USINDOPACOM) theaters of operations. The 1st Space Brigade's Joint Tactical Ground Station (JTAGS) detachments, which are essential for USSPACECOM's assured missile warning mission, are operated by USASMDC Soldiers who monitor launch activity and other events observed by infrared sensor platforms and quickly provide information to members of the AMD and operational communities. Our JTAGS detachments are forward stationed around the globe, providing continuous, dedicated, assured missile warning to USSPACECOM and CDRs in support of deployed and forward-stationed

forces. JTAG's forward stationing reduces the risks of solely relying on long-haul communications and ensures the resilience of USSPACECOM's comprehensive missile warning system.

The relocation of the JTAGS Europe detachment from Stuttgart, Germany, to Sigonella Naval Air Station, Italy, and the installation of the Korea detachment into a new facility on Osan Air Base, Korea, have been completed, increasing our operational missile warning capability. Future capability development will enhance missile warning and modernize air and missile defense by providing the means to detect and track new missiles in an increasingly electronic warfare and cyber contested environment.

**"The American way of life depends on reliable access to the space-based capabilities that provide the foundation of our economic security and enable our Joint Force to conduct sustained military operations in all domains."**

- USSPACECOM SASC Posture Statement  
April 2021

Extended ranges needed to enhance early warning to ground forces and defend U.S. and our allies' infrastructure while supporting Army Long Range Precision Fires (LRPF) and enabling sensor-to-shooter capabilities as part of Army Multi-Domain Operations (MDO) will be realized.

USASMDC's second major task is to develop future missile

defense forces and mature current capabilities. The Space and Missile Defense Center of Excellence (SMD CoE) represents Army equities across the joint community. Within the capabilities of Army and joint space, missile defense, and high altitude, the SMD CoE trains and educates agile, adaptive, and ready Soldiers and leaders; executes lifecycle management for U.S. Army space operations officers; develops Army Space Soldiers; and enables informed decision making.

To carry out its mission, the SMD CoE executes U.S. Army Training and Doctrine Command and Army Futures Command established practices to meet force management and Army modernization enterprise responsibilities. This includes performing concept development, capabilities determination, and capabilities integration relative to doctrine, organization, training, materiel, leadership and education,



personnel, facilities, and policy for process change, integration, and transition for materiel development. Additionally, the organization executes the Army's institutional training and education for space and global missile defense mission areas.

In 2020, USASMDC established the Office of the Commandant within the SMD CoE. This office provides a single point of focus for the education and training of skilled military and civilian space personnel and also provides doctrinal support for space and missile defense operations to enable Army forces to support the full range of multi-domain operations. As the proponent for Army space training and Army space doctrine, the commandant's office manages the eight personnel life-cycle management functions for all Army space personnel in both the active and reserve components.

Also this past year, SMD CoE's Space and Missile Defense School earned TRADOC's highest accreditation rating. The school executes the Army's institutional training and education for space and GMD mission areas. It currently conducts 20 space and missile defense courses that serve to develop all individual training tasks and necessary products to conduct Soldier-focused education and mission qualifications training. Despite the challenges of the pandemic, the school is projected to train approximately 12,000 Army Soldiers, Space Cadre, and missile defense operators this year through 120 formal course offerings and support training for 25 brigade combat teams, six divisions, and four corps. The SMD School continues to expand its current mission to educate, train, and develop world-class, highly skilled Army space and missile defense professionals to support Army and joint multi-domain operations at the strategic, operational, and tactical levels. Additionally, in support of the Army Space Training Strategy, the school coordinates directly across every Army proponent school to integrate space education and training in Army professional military education and functional qualification training.

The SMD CoE's Army Space Personnel Development Office (ASPDO) executes Functional Area 40 Space Operations Officer life-cycle management. The ASPDO conducts strategic planning, ensuring Space Cadre billets are identified, created, and tracked to support space-related missions. Successfully filling Space Cadre billets enables the Army to fulfill mission requirements in the eight codified joint space capabilities: space situational awareness; positioning, navigation, and timing; space

control; satellite communications; satellite operations; missile warning; environmental monitoring; and space-based intelligence, surveillance, and reconnaissance.

USASMDC's third major task is to provide critical technologies to address future needs that will enhance warfighter effectiveness. USASMDC's Technical Center supports the joint warfighter by providing science, technology, and test and evaluation expertise to enable warfighter dominance today and in the future. As part of the Army science and technology enterprise, the Technical Center contributes to the current fight and enables the next generation to prevail in conflicts to come. The Technical Center focuses on three essential tasks: executing science and technology research and development, test, and evaluation; managing and operating the Ronald Reagan Ballistic Missile Defense Test Site; and conducting space operations and space domain awareness.

The following are a few summaries of our science and technology research and development efforts, as well as an overview of the capabilities and recent accomplishments of an essential Army testing range.

*Directed Energy (DE)*: The Technical Center is the Army lead for HEL technology development. This technology can be effectively employed in a variety of mission areas and offers unique performance attributes that will contribute directly to addressing existing operational capability gaps. High energy lasers are a low-cost, effective complement to kinetic energy to address rocket, artillery, and mortar (RAM) threats; unmanned aircraft systems; and cruise missiles. Additionally, the Technical Center is exploring the use of high power microwave technology for use in interdicting UAS and defeating improvised explosive devices and other improvised threats. DE work and advancements contributes directly to the development of the next generation of directed energy scientists and engineers.

The Army is leveraging DE technologies that presently exist and integrating them with Army platforms to provide additional warfighter capacity.

*Tactical Space and High Altitude Technologies:* As the Army lead for space and high altitude research, development, and engineering, our Technical Center identifies, develops, demonstrates, and integrates technologies in the areas of responsive space, space superiority, and high altitude. To meet Army operational needs using small satellites and high altitude platforms, focus areas include persistent beyond line-of-sight communications for forces deployed in remote areas; functionally effective resolution imagery; solutions for assured positioning, navigation, and timing; ground C2 systems to reduce operator burden; and direct downlink of tactical data feeds. Promising technologies are transitioned to the Army RCCTO, program executive officers, program managers, and users to provide for current and future Army and joint warfighter capabilities.

*Systems Engineering:* In mid-2020, USASMDC established a Systems Engineering Directorate within the Technical Center. The goal was to intensify the focus on in-house research and expand laboratory capability. Also last year, USASMDC initiated construction on a research, development, test and evaluation facility—the Directed Energy Systems Integration Lab. The future lab will provide opportunities for early warfighter involvement and be equipped with specialized equipment to enhance research, modeling, simulation, and testing of DE applications. In the years ahead, integration labs focused on small satellites, hypersonic aerothermal, and AMD systems are planned.

*Missile Defense Testing Assets and Range:* USASMDC's Technical Center is an invaluable part of the Army Test and Evaluation Enterprise and provides a suite of low-cost ballistic missile targets for use in developmental and operational AMD testing, transportable and configurable launchers, and test support. Additionally, the Technical Center is providing hypersonic flight test support from the test planning and design phase through mission execution and post-flight analysis for the Army, Navy, and Air Force. The Ronald Reagan Ballistic Missile Test Site (RTS) at the U.S. Army Garrison-Kwajalein Atoll in the Republic of the Marshall Islands provides test support to the MDA, the U.S. Air Force, NASA, and others. The strategically located, remote site 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 continues to support the developmental and operational testing of both homeland and regional missile defense systems as well offensive ballistic missile testing for the Air Force Global Strike Command. During 2020, RTS supported four Minuteman III test launches (Glory Trips) to successfully validate and verify the effectiveness, readiness, and accuracy of the weapon system. This past November, RTS supported MDA's successful FTM-44 test through the launch of an ICBM-representative target as well as providing range safety support. Hypersonic system testing has become a significant element of test planning at RTS. Because of its geographic remoteness and available complex sensor suite, RTS has seen a significant upswing in hypersonic systems test planning. There are currently two hypersonic operational tests scheduled for calendar year 2021.

In concert with its testing mission and using a suite of four of the world's most sophisticated radar systems, RTS also supports the command's space object identification and space domain awareness missions in support of USSPACECOM. This mission includes space object tracking and characterization, providing critical

**Reagan Ballistic Missile  
Defense Test Site: A  
Vital National Asset**

orbital information on new foreign launches, and providing high-resolution images in support of space situational awareness. RTS supports this mission 24/7/365. The U.S. Air Force's Space Fence is a new and important capability in this mission. Last spring, the Space Fence became

operational, and now provides proactive space domain awareness while complementing existing systems at the RTS. Finally, RTS works in conjunction with DoD customers to develop and demonstrate space testing capabilities. These emerging capabilities and test missions provide essential data and feedback to the space enterprise and support customers concerning spacecraft and operational performance.

### Army Contributions to the Nation's Missile Defense Capabilities

Army Air and Missile Defense 2028 meets the directives of the 2018 National Defense Strategy and the Army Vision to enable MDO. To achieve the AMD force of 2028, we must continue to modernize and develop AMD capabilities, build sufficient AMD capacity for MDO, and ensure AMD forces are trained and ready. MDO requires that our capabilities and associated C2 systems are resilient and interoperable with joint and allied forces. Accomplishing these essential tasks will allow us to provide deterrence through deployments and forward stationing and enable a more robust, comprehensive defense by coordinating and integrating with our partners and allies. AMD is one of six Army modernization priorities in which the Army has significantly increased investment. The Army AMD CFT is the Army's modernization lead for these capabilities and works closely with the other Services, the Joint Staff, and MDA toward joint IAMD capabilities. The Program Executive Office for Missiles and Space is the Army's materiel developer for these capabilities and works closely with the AMD CFT and the U.S. Army Aviation and Missile Command. A summary of the Army's AMD strategic direction and major programs follows:

**The AMD force must be agile, rapidly tailorable, scalable, and able to fight multiple, complex, integrated attacks.**

*Air and Missile Defense Readiness:* A convergence of factors impacts the AMD force's readiness, to include the enduring operational demand of the CCMDs, the transition to great power competition and its associated complex threat set, and the overdue and critical need to modernize the Army's AMD force. The operational demand to meet the requirements of joint warfighters continues to stress the Army AMD force, impacting current and future readiness, as well as modernization initiatives and air defense artillery (ADA) Soldiers. The enduring high operational tempo combined with limited deployment predictability, negatively impacts Soldier readiness and family well-being. Currently, more than twice the number of ADA Soldiers are dwell restricted as compared to the overall Army. In an effort to improve Soldier predictability and readiness, the Army has established a new Unit Life Cycle Modernization Model known

as the Regionally Aligned Readiness and Modernization Model (ReARMM). It is critical that the ADA force leverage ReARMM to inform force availability to the Joint Staff and Office of the Secretary of Defense (OSD) to improve deployment predictability for AMD Soldiers. The implementation of ReARMM nests neatly with the near term Patriot modernization efforts including IBCS and LTAMDS and will help to provide balance across readiness, predictability, modernization, and Soldier quality of life.

*Mission Command:* Closely linked to AMD readiness is the ability to provide low density, high demand AMD mission command elements. The mission command elements are pivotal to laying the foundation and creating an environment that supports the integration of Army AMD forces into joint C2 architectures. Over the past few years, the Army has activated an additional Active Component air defense artillery brigade headquarters in USINDOPACOM, rotated a National Guard air defense artillery brigade headquarters to USEUCOM, and elevated the command of the 10<sup>th</sup> Army Air and Missile Defense Command in USEUCOM to a general officer.

*Integrated AMD Battle Control System:* The IBCS program is a top Army AMD modernization priority. IBCS combines current and future AMD sensors and weapons into a common integrated fire control capability that allows the warfighter to integrate AMD capabilities fully across all echelons. IBCS is the direct replacement for the mission command nodes for the Patriot weapon system, the THAAD weapon system, the headquarter elements, and the airspace management cells. It allows rapid convergence of sensors, shooters, and mission command components on an integrated fire control network. Once fully fielded, IBCS will provide a game-changing capability, allowing AMD forces to be tailored and scaled appropriately to meet the given threat. The quantity and mix of capabilities can be dynamically retasked into a formation with an inherent, integrated mission command system to build tiered and layered defenses. The IBCS open architecture enables rapid integration of legacy and developmental sensors and shooters providing capabilities to defeat emerging threats in MDO. This year the IBCS program passed the Milestone C decision and will progress to low-rate initial production. Training is currently underway with an air defense battalion in preparation for the IBCS initial operational test and evaluation scheduled to begin in the coming months.



The program will field common mission command nodes for Army AMD forces to defend against manned aircraft, UAS, air-to-ground missiles, tactical ballistic missiles, cruise missiles, and RAM attacks. Ultimately, the IBCS will operate with air surveillance and fire control capabilities across the Army, Air Force, Navy, and with joint and multinational AMD forces at all echelons. It will enhance the lethality of the AMD force. By dismantling the current system-centric mission command paradigm, it will dramatically increase systems capability and facilitate open industry competition in support of the AMD community. IBCS is one of the Army's contributions to Combined Joint All Domain Command and Control (CJADC2) under development between the Army and Air Force, and there is continued experimentation to link with C2 systems for Army and joint fires. Additional efforts are currently underway to fully support IBCS interoperability with MDA's Ballistic Missile Defense System (BMDS). The efforts explore the feasibility and potential benefits of integrating IBCS with MDA's Command and Control, Battle Management, and Communications (C2BMC).

*Terminal High Altitude Area Defense System:* THAAD is a key component of the missile defense system architecture. It 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. THAAD has a unique endo- and exo-atmospheric intercept capability using proven hit-to-kill technology. There are currently seven operational THAAD batteries. THAAD batteries are forward stationed to Guam and the Republic of Korea in response to the North Korean nuclear and missile threat, as well as forward deployed to USCENTCOM. The development efforts associated with U.S. Forces Korea (USFK) Joint Emergent Operational Needs JEON) improve Patriot and THAAD interoperability and brings a Patriot launch-on-remote capability and a THAAD Missile Segment Enhancement (MSE) Integration in Fiscal Year 2021. As directed in the 2019 Missile Defense Review, the Army, in conjunction with OSD and MDA, reassessed the THAAD requirement as eight batteries.

*Patriot/Patriot Advanced Capability-3 Missile Segment Enhancement (PAC-3 MSE):* The Army Patriot force remains the cornerstone of AMD protection for our deployed forces, friends, and allies. The Patriot force is 53 percent forward stationed or

deployed as CDRs' increasing AMD requirements drive the operational tempo, stress the Patriot force, and have resulted in modernization challenges. The PAC-3 and PAC-3 MSE interceptors employ a hit-to-kill capability. PAC-3 MSE fills the engagement gap between the THAAD and the PAC-3 missiles while also defeating advanced threats earlier, at greater range, with increased lethality. The PAC-3 MSE is in full-rate production and is the latest generation hit-to-kill PAC-3 interceptor in the Patriot force to meet global capability requirements. Annual PAC-3 MSE production capability has increased by approximately 30 percent to address U.S. requirements and demand from our international partners.

Patriot must continually modernize through software and hardware upgrades to address obsolescence and the evolving threat, and to best utilize the extended battlespace performance afforded by the PAC-3 MSE interceptor. Modernization efforts provide combat identification enhancements, address upper-tier debris mitigation, improve performance of the PAC-3 MSE interceptor, and enable increased Army and joint interoperability. The Army has modernized 12 of 15 Patriot battalions with the latest software and hardware capabilities to counter new emerging and evolving threats. The other three Patriot battalions will complete modernization this year. Ongoing development efforts include the enhanced interoperability of Patriot and THAAD systems. This new integrated capability expands Patriot's battlespace by enabling it to leverage THAAD's AN/TPY-2 radar together with the Patriot radar to detect threat targets at greater ranges. Originally developed for USFK, where it will be fielded this summer, this capability will be pure-fleeted across all Patriot battalions beginning in Fiscal Year 2023. To overmatch the near-term evolving threat, the Army is continuously improving Patriot capability while moving toward the IBCS architecture including a new sensor and fire protection capability.

*Lower Tier Air and Missile Defense Sensor:* Replacing the current Patriot radar, LTAMDS will provide networked sensing capabilities in the lower-tier portion of the missile defense battlespace and enable the full capabilities of the PAC-3 MSE missile. LTAMDS significantly expands capabilities over legacy Patriot radars by enabling full capabilities of the MSE and all of the benefits of being a networked sensor on the IBCS. The modern technology will reduce the current Patriot radar operations and sustainment



costs by enhancing reliability and maintainability. The Army plans to begin testing the initial LTAMDS prototypes with IBCS and PAC-3 in early Fiscal Year 2022 with the objective of fielding four sensors to one battalion during the upcoming calendar year.

Indirect Fire Protection Capability: The IFPC is a ground-based weapon system designed to acquire, track, engage, and defeat cruise missile, UAS, and RAM threats. The Army requires an IFPC that integrates with the IBCS as its C2. This will enable a MDO-ready Army by 2035. The Army awarded a contract to the Israel Missile Defense Organization for two batteries of the Iron Dome system as an interim cruise missile defense capability in accordance with the Fiscal Year 2019 National Defense Authorization Act. The first Iron Dome battery arrived in the U.S. in December 2020 and will be ready to deploy before the end of this fiscal year. In February 2021, the second battery arrived in the U.S. and will be prepared to deploy in the first quarter of Fiscal Year 2022.

The Army is currently executing a competitive acquisition strategy to develop and field an enduring IFPC capability integrated with IBCS. The approved competitive acquisition includes a shoot-off demonstration this summer, a follow-on performance assessment using vendor models and simulations, hardware-in-the-loop activities, and industry proposals leading to a contract award later this year. Delivery is scheduled in Fiscal Year 2023, which will lead to the first battalion fielding by Fiscal Year 2026. The Army continues to mature HEL and HPM to increase IFPC capabilities in support of the maneuver force. The Army will begin to integrate DE by fielding four HEL and HPM prototypes in Fiscal Year 2024. Ultimately, IFPC battalions will contain a mix of complementary DE and kinetic intercept systems to protect the maneuver force.

Counter-Small Unmanned Aircraft Systems: Technological advances and the proliferation of commercial and tactical UAS in both reconnaissance and attack capabilities have matured to the point where they represent a significant threat to Army operations from both state and non-state actors. To address these threats, the Army, at the direction of the Secretary of Defense, assumed executive agent responsibilities for countering UASs and established the Joint Counter-Small UAS Office (JCO). Key focus areas for the JCO include developing joint requirements and materiel solutions, as well as joint training and doctrine. C-sUAS efforts are critical to defeat the rapid proliferation

of small, commercially available, UAS technology on the battlefield. In response to a warfighter Joint Urgent Operational Needs Statement (JUONS), the Army deployed over 500 man-portable, expeditionary, and mobile C-sUAS systems and continues to adapt to changes in-theater UAS threats. The JCO continues to work across the DoD to synchronize and coordinate the development of C-sUAS technologies that meet service specific and joint requirements. Developmental efforts such as HPM and DE are critical to ensure that we maintain pace with both commercial and state developed UAS.

*Maneuver-Short Range Air Defense:* In response to identified operational needs, M-SHORAD will provide maneuver forces a dedicated air defense capability on a Stryker-based platform against fixed-wing, rotary-wing, and UAS threats. In Fiscal Year 2018, the Army approved and began developing initial M-SHORAD systems that integrate existing Army capabilities onto a Stryker combat vehicle. Developmental testing was conducted over the past year and an operational assessment was accomplished last fall. Four M-SHORAD battalions are planned for fielding in Fiscal Years 2022 and 2023. The Army continues to mature HEL and electronic warfare technologies to increase M-SHORAD capabilities in support of the maneuver force. The Army will begin to integrate DE by fielding four DE M-SHORAD prototypes in Fiscal Year 2022. Ultimately, M-SHORAD battalions will contain a mix of complementary DE and kinetic intercept systems to protect the maneuver force.

**Joint Functional Component Command for Integrated Missile Defense  
(JFCC IMD)—Integrating and Synchronizing Missile Defense**

JFCC IMD is USSTRATCOM's missile defense integrating element. USSTRATCOM formed JFCC IMD to execute its UCP assigned missile defense responsibility, enabling the headquarters to focus on integration and advocacy. Established in 2005 and headquartered at Schriever Air Force Base in Colorado Springs, Colorado, JFCC IMD is manned by a cohesive team of Army, Navy, Air Force, Space Force, Marine Corps, Civilian, and Contractor personnel. The headquarters location at MDA's Missile Defense Integration and Operations Center allows JFCC IMD to leverage MDA's existing infrastructure and ensures a continuing strong partnership with the materiel developer in the execution of the command's assigned responsibilities.

As outlined in previous testimonies, warfighters remain confident in our ability to protect the Nation against missile attacks. However, given the transregional nature of the threat and the low-density, high-demand nature of missile defense platforms and increasing complex architecture of sensors, shooters, and command and control nodes spanning multiple areas of responsibility, CCDRs must approach missile defense from a global perspective. To meet this challenge, we must invest in holistic approaches to defeat adversary missiles before launch or during all phases of flight (boost, midcourse, and terminal phases). Additionally, we must continue to invest in capabilities that limit or mitigate the effects of an attack that could possibly penetrate our defenses. JFCC IMD provides direct support to these efforts.

JFCC IMD is the recognized subject matter expert across the missile defense enterprise in matters of operational support, policy, strategy, training and education, and advocacy. The command's principal mission is to coordinate with, and operationally support, joint warfighters from the regional CCDRs, and advocate for their requirements with the materiel developers at MDA and the Services. On behalf of the USSTRATCOM and other CCDRs, JFCC IMD champions warfighter priorities and capability needs, including continued development of a robust sensor network, integrated discrimination capabilities, redundant and resilient C2 networks with enhanced cybersecurity defenses, and improved interceptors for both homeland and regional missile defenses.

JFCC IMD works across the 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 supports 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 and education, exercises, and experimentation.
- Advocating for and recommending acceptance of global missile defense capabilities, conducting analysis and assessments of current and future capabilities, and support tests.

To accomplish these efforts, we maintain close collaborative relationships with the CCDRs, the MDA, the Services, the 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 the Aegis Ashore in Poland; the Standard Missile-3 Block IIA; the Long Range Discrimination Radar at Clear Air Force Station, Alaska; Spacebased Kill Assessment; Hypersonic and Ballistic Tracking Space Sensor; Next Generation Interceptor for homeland defense; hypersonic defense; and various other new capabilities such as incorporating DE technologies. Given the many challenges associated with implementation of these architectures, JFCC IMD, in support of USSTRATCOM's responsibilities for global missile defense, collaborates with the CCDRs to assess and address cross-regional gaps in the areas of planning, policy, capabilities, and operations. As an example of collaboration, JFCC IMD is leading a new effort to document the comprehensive, warfighter top-level capability attributes for the hypersonic defense mission enabling early warfighter involvement with MDA in the development of new capabilities to meet the advanced threat.

*Multi-Regional Missile Defense Asset Management:* JFCC IMD, in coordination with USSTRATCOM and the CCDRs, manages missile defense operational readiness posture, coordinates missile defense system maintenance, and supports MDA and

Service tests. The asset management process allows us to continually assess our readiness to defend against missile attacks and to recommend adjustments to optimize the overall missile defense architecture.

Cybersecurity of the Ballistic Missile Defense System: JFCC IMD, in coordination with USSTRATCOM and MDA, conducts the Cybersecurity Service Provider mission for the missile defense architecture 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. We are working with the National Security Agency's Cybersecurity Directorate to use their insights on threat analysis and mitigations to continue to harden our internal networks against adversary intrusion and attack. JFCC IMD also works closely with the Joint Staff, CCMDs, and MDA to educate, train, and exercise cybersecurity protocols to ensure the highest levels of readiness.

Global Planning Integration and Support: JFCC IMD works with the missile defense community to refine processes that synchronize transregional global missile defense planning and operations. Consistent with the Department's transition to planning based on adversary problem sets, JFCC IMD supports the CCDRs in refining their adversary-centric missile defense plans with objective analysis of missile defense risks across multiple problem sets. This assessment methodology identifies systemic risk, informs recommendations for shortfall mitigation, and increases effectiveness in future missile defense planning efforts. This analysis informs bundled plans assessments across the missile defense enterprise, which shape recommendations for global force management and future capability advocacy. Looking forward, we will work with the warfighter community to increase integration, enabling a more holistic approach to missile defense.

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 risk-informed sourcing of missile defense requirements. Due to the low density/high demand nature of missile defense assets, all sourcing decisions have a

direct and significant impact on other CCDRs' campaign and contingency plans. We continue to refine our approach, ensuring integrated capabilities are appropriately postured to counter transregional threats in accordance with the 2018 National Defense Strategy, the 2019 Missile Defense Review, and Department steady-state priorities. This globally integrated approach serves as the baseline for our risk-based recommendation into 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 our allies and partners into a common and mutually supportive architecture is a critical warfighter priority. One venue aimed at promoting increased cooperation is the Nimble Titan Campaign of Experimentation—a biennial series of multinational missile defense experiments. Nimble Titan brings together policy and military subject matter experts from allied and partner nations to explore the national policy and military interfaces and dynamics involved in collaborative coalition and alliance missile defense planning. Meeting this intent is necessary to develop regional defense designs, C2 relationships, and collective, bilateral, and multilateral policy. Today, ministries of foreign affairs and defense representatives from 24 nations, the North Atlantic Treaty Organization (NATO), and three additional multinational organizations, as well as the Department of State, OSD, Joint Staff, CCMDs, and MDA convene to exchange views and insights and collectively explore policy and operational concepts. The current Nimble Titan 20 campaign incorporates recent guidance from senior leaders and lessons learned to experiment with the future use of space sensors for missile defense, advanced weapon systems, deterrence, de-escalation, and non-kinetic effects as part of IAMD. Implementing a hybrid framework for virtual and in-person during the COVID-19 pandemic, the

**“USSTRATCOM’s NIMBLE TITAN wargame...continues to advance multinational collaboration and operational integration efforts aimed at enhancing deterrence and defense concepts against potential attack.”**

- USSTRATCOM SASC Posture Statement  
April 2021



campaign continues to address the challenges of intelligence and information sharing in a multinational coalition as well as some of the operational considerations involved in integration and countering specific threats such as cruise missiles and unmanned aerial systems. The campaign also added a “peer excursion” element in 2019 to explore how national perspectives would change with the introduction of a major peer-level state in a conceptual “what-if” construct. Nimble Titan continues to be 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. Nimble Titan events 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.

JFCC IMD, in coordination with CCMDs and selected allied and partner militaries, is developing a multilateral information sharing and modeling and simulation construct to enable collaborative planning and provide a better assessment of allied and partner nations’ missile defense systems and capabilities. It also participates in regular multilateral tabletop exercises and events to help partner nations identify and close capability gaps. Additionally, we have successfully integrated allies directly into the JFCC IMD staff through the Foreign Liaison Officer (FLO) Program. Our current FLOs include a German Air Force and a Danish Army officer. Both have been integrated into Nimble Titan, NATO ballistic missile defense training, and allied and partner modeling and simulation efforts resulting in an increased understanding of multinational missile defense policy, capabilities, and planning initiatives in the European region.

*Joint Missile Defense Training and Education:* Even with COVID-19 creating obstacles during the past year, in coordination with USSTRATCOM, the Joint Staff, CCMDs, 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. In 2018, OSD designated JFCC IMD’s Joint Ballistic Missile Defense Training and Education Center (JBTEC) as the first Joint Center of Excellence. The JBTEC now offers 16 mission-oriented resident, online, and mobile training team courses to include orientation, asset management, C2BMC situational awareness, and general officer/flag officer seminar training. In 2020, JFCC IMD instructors executed

162 courses, training over 8,000 students worldwide. The significant increase in the number of students trained over past years was a result of the rise of students using online training during the COVID-19 pandemic. Additionally, JFCC IMD provided training courses to our allies and partners through military-to-military and Foreign Military Sales training venues. Earlier this year, our instructors conducted a four day Joint IAMD course for Sweden's Headquarters Military Staff. In 2019, we provided training to the Japan Self Defense Force Joint Staff, the Republic of Korea Armed Forces, and the United Arab Emirates. We anticipate additional foreign training as COVID-19 restrictions are rescinded in allied countries.

*Warfighter Support and Advocacy:* We need to continue streamlining and speeding MDA's efforts to provide capabilities to our warfighters as quickly as possible to meet accelerated threat developments. JFCC IMD collaborates with the CDRs, MDA, and Services as well as their respective test agencies to leverage emerging technology to enhance existing systems, explore innovative operational concepts, and prioritize maturing technological advancements with the most promising near-term potential. To that end, we continue to optimize the collaboration inherent in the Warfighter Involvement Process to advocate for required missile defense capabilities and performance enhancements on behalf of the warfighter. Sustaining our competitive advantage through innovation and expedience depends on well-resourced and operationally relevant test campaigns as well as high fidelity modeling and simulation infrastructure and forward looking wargaming to challenge our assumptions regarding our future missile defense readiness and posture. In testing over the past year, JFCC IMD supported the first Aegis SM-3 Block IIA remote engagement of an ICBM-class target utilizing forward-based sensors; an interoperability test of THAAD and PATRIOT where a PATRIOT MSE interceptor successfully intercepted the target with data provided by THAAD, and several data collections of hypersonic vehicle flight tests to characterize sensor performance.



Offense-Defense Integration: An optimal missile defense requires an offensive capability. By retaining a capability to attack the adversary's ability to launch missiles in addition to a capability to destroy them after launch, JFCC IMD can lower the overall cost of missile defense and reduce the risks of failure. The 2019 Missile Defense Review highlighted this and directed that our future missile defense integrates offense-defense capabilities in a comprehensive posture. Creating a comprehensive approach will require balancing a variety of offensive approaches within our deterrence calculus.

**"Strategic deterrence is the foundation of our national defense policy..."**

- USSTRATCOM SASC Posture Statement  
April 2021

Methods that could be used to attack the adversary's ability to launch include kinetic attack, cyber, the electromagnetic spectrum, or DE. Each provides opportunities to reduce the burden on active defense; however, there is no "silver bullet" to defeating the threat. As we continue to

develop increased range and lethality in our precision strike capability, we need to consider how this fits within our deterrence calculus, how we should organize to operationalize the capability, and its contribution to missile defense. Our future offensive materiel solutions to address the adversary's strike capabilities will likely be a mix of guns, missiles, electronic warfare, cyber, space, and DE. To this end, we must understand how they complement each other and strive for a balance that includes left-of-launch and offense-defense integration capabilities.

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. Our 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, expansion of collaboration with our allies and partners, and the speed of innovation and fielding to get capability in the hands of our warfighters.

### Conclusion

Chairman King and Ranking Member Fischer, as members of the joint missile defense community, the Army and USSTRATCOM continue to pursue enhancements to the Nation's IAMD systems, from the tactical to the strategic levels of warfare. As outlined here, USASMDC 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 our adversaries. 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 CCDRs, we provide essential regional sensor capabilities, ballistic missile early warning, and space-enabled 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 JFCC IMD, continues to integrate missile defense system 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, Guardians, 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 KING. Thank you very much. Admiral Hill.

**STATEMENT OF VICE ADMIRAL JON A. HILL, USN, DIRECTOR,  
MISSILE DEFENSE AGENCY**

Vice Admiral HILL. Good afternoon, Chairman King, Ranking Member Fischer, and distinguished Members of the Subcommittee. Thank you for your time today to discuss the important topic of missile defense. For present budget 2022, MDA is requesting \$8.9 billion to develop and deploy homeland defenses against the rogue state threat, improve regional defenses against the existing and the emerging threats.

The threat can be summed up, as Senator Fischer mentioned earlier, much less predictable today, but they come with counter-measures and multiple warheads, potentially with nuclear payloads. The hypersonic and cruise missile threats present high speeds and global maneuvering challenges. So despite the pandemic restrictions, that General Karbler mentioned now, we have advanced the program on several fronts this past year, and I would like to walk you through some of those.

From command and control and battle management, we call that program C2BMC, we continue with our spiral upgrades to integrate across the missile defense system, supporting the combatant commands and the Services with tracking, queueing, and discrimination data. "Discrimination" is our fancy word for picking out the lethal object in the complex, and we will come back to that in just a bit.

From a space-sensing perspective, improving our detection and our tracking and discrimination, the Hypersonic Ballistic Tracking Space Sensor, mentioned earlier, that development continues with two competitive awards, focus on an on-orbit demo in fiscal year 2023, and we will track dim boosting targets and we will track hyper glide vehicles. We need to do that soon so we can leverage that capability in the INDOPACOM theater where we will first put out our hypersonic defenses in the hypersonic missile defense kill chain, and I will come back to that in just a moment.

The other space capability I would like to talk about is the Space-Based Kill Assessment, the SKA system. We deployed that a couple of years ago. We have a full constellation up. What we are doing now is taking what we see as the flashes when we get intercept and bringing that to an operational hit assessment for the combatant commander, specifically for General VanHerck, so that he can control the homeland defense war.

Switching over to land-based sensors, it was mentioned earlier the Long Range Discrimination Radar that we have up in Alaska, that is being built now. We did have some pandemic delays. The Clear Air Force Base closed. We had radar equipment shipping there. We had to stop it and hold it up. But the team stayed on path, building that radar, and we have both panels completed this year. We are now doing radiation, which means the radar is up and running, doing low-power calibration, and we are going to learn a lot. It started off at a very small-scale radar out in Morristown, New Jersey. It is now at its full array size, and we expect to have government acceptance by the end of this year.

From a homeland defense perspective, we did not talk much about GBI fleet reliability efforts, the Service Life Extension Program, and I want to thank Congress for their support there. You

cannot have a weapons system deployed in 2004 and not maintain it, not take those rounds out of the ground and upgrade them. We are doing that now, in coordination with NORTHCOM and NORAD. Those missiles come out of the ground, we change out the boosters, we update the software in them, we update the seekers, we update the threat libraries. That builds capacity and capability now, so that we can close the gap between now and when we actually deploy the first NGI.

What is also important about that is that hardware that has been in the silos for all those years now becomes the basis for the analysis that we do to determine reliability. Last year when we had this conversation, it was purely analytical based, because we did not have that hardware available. So the Service Life Extension Program extends the life of the current GMD fleet, increases its capability and capacity, but also gives us the hardware ability to go and really assess reliability, to build the confidence of the warfighter.

We are also expanding at Missile Field 4. We had some fallbacks during COVID, but we leveraged the waterways. We have all 20 silos installed and now we are doing integration.

The next test for GMD, the boost vehicle test 03, BVT-03. We are developing the capability to not just fully burn full kinematics of the GBI system, you fly it and only burn up to the second stage. Why is that important? It allows you to engage more and more into the battle space. So there is a lot of activity going on with the current GMD fleet that is providing the warfighter higher confidence, higher capability for the future.

NGI development, that was mentioned earlier. We are underway today with two competitive contracts, and I think that is really important, the fact that the Department has stepped forward to award those contracts and to have two really great teams all the way through critical design review. That is unusual, and I am telling you, it is going to be hard. But we have the teams that are in place there. They are perfectly OCI'd, so no conflicts of interest, as we work that important competition. But what did we do that? So that we can manage the technical risk in the program and so that we can get to emplacement earlier than the government estimate of 2028, and both of our contractors are showing that they are going to come in earlier, and that is good thing for General VanHerck and the warfighters.

Let me switch to the Aegis program, Aegis integrated air missile defense, continues to advance. We are delivering the SM-3 Block IB missiles on a multiyear procurement, the Block IIA missile, which was a cooperative development with Japan. I am very proud of what we have done with that missile. We are in production now. The Secretary of Defense just recently gave us permission to take the first 11 rounds that were built out of RDT&E and deploy those today. So that capability is out in the fleet now, and through Global Force Management it will go to the right places.

We are increasing our ability with sea-based terminal—I will talk about that in just a second—and continue improvements within the combat systems on the ships and with the missiles in total alignment with the Navy.

FTM-44 was mentioned already, executed at the end of last year. Another great COVID story. Another great Department all-hands-on-deck story. We had it originally planned in May. We executed in November, due to the pandemic. We had to do a lot of deconfliction on the range. Dan helped me keep the target in place on Kwajalein. That is a tough area to have a target go into shut-down mode. But we charged the batteries, charged the batteries. We made sure that the ship crew stayed safe. We worked very closely with the Navy. So the USS *John Finn*, a new construction, integrated and air missile defense ship, could go out and execute that mission. That same ship participated in the last GMD test and tracked the ICBM.

So we are all about risk reduction, making sure that we do things right, and that was a threat-representative target. It was a defense-of-Hawaii scenario, from North Korea to Hawaii. That is what it is. If you look at the geography, that is what we did. So that was a threat-representative, approved by DOT&E. Worked very closely with the intelligence community to ensure that we were threat-representative and that we were testing like we fight.

Let me shift out to Europe, Aegis Ashore Poland. This has been a tough one. For the last couple of years we have told you we were at 90 percent construction completion. Today I going to tell you we are at 90 percent or more construction completion. But the great news, within the last couple of months, through the pandemic, you saw that in Europe, we managed to raise the four spy radar rays, put them in place as a forcing function to construction. We also put up the fire control director. That is really great. Now we are ready to do install and checkout for the Aegis Combat System. Very important work.

We also took the Aegis Combat System out of the CONEX boxes they had been sitting in for 2 or 3 years, and we ran full digital signal analysis on it to make sure that that system works, and we are going to upgrade that system to make sure there are no obsolescence. We are in tight coordination with the Army Corps, and Aegis Ashore Poland is on track to complete its construction.

A little bit on Aegis Sea-Based Terminal. That is the first regional hypersonic missile defense capability that is deployed with the aircraft carrier strike groups today, and it is important that we have that capability now, because the hypersonic threat is there now. What we want to do is move further back into that trajectory, engage earlier, make the terminal defense even better, and so the glide phase interceptor is under acceleration in the President's Budget 2022, and that is an important capability for the country. It ties right into HBTSS. Ties right into the land-based sensors and sea-based sensors that can give us the fuse track that we need to take a hypersonic maneuvering capability out in the glide phase, and then we hit it again in terminal.

Let me switch to Guam. President's Budget 2022 includes funds for the initial development of a survivable and operationally effective IMD for Guam, and those capabilities that I have talked about, regional from Aegis, and what I am going to talk about in just a second in THAAD, are all part of that architecture consideration today, and we are working that hard so that we can come forward

and tell you exactly what we are going to do on Guam. Staying very close to INDOPACOM.

THAAD, we have continued the Interceptor procurement, production, and training support, and we are developing the capabilities to address the evolving threat in very close coordination with the U.S. Army. THAAD and Patriot integration, we have been working that for the last 2 or 3 years. We completed the first phase, where we separate the launchers from the THAAD battery for flexibility for the combatant commander. We have done Patriot launch on remote from THAAD data. Pretty impressive. Also flexibility for the warfighter. Our next test this year is to control the Patriot battery using THAAD. That may not all make sense to you but what that means is full flexibility where the combatant commands need it, and the Army will be working its urgent material release once we finish that test.

So I will wrap up by saying a little bit about technology, investing in innovative and disruptive technologies to address the emerging threats, including regional, layered hypersonic and cruise missile defense capabilities. Space sensors, land- and sea-based sensors, networked through the Command and Control Battle Management System set the stage for hypersonic and cruise missile defense capabilities, and thank you. I appreciate everything that you do for this Committee, and thank you for your time today.

[The prepared statement of Vice Admiral Jon A. Hill follows:]

#### PREPARED STATEMENT BY VICE ADMIRAL JON A. HILL

Good morning, Chairman King, Ranking Member Fischer and distinguished Members of the Subcommittee. The Missile Defense Agency budget request of \$8.917 billion for fiscal year 2022 will enable the continued execution of the MDA mission to design, develop and deploy a layered Missile Defense System to defend the United States, deployed forces, allies, and friends from missile attacks in all phases of flight. I look forward to your continued support of this mission and this opportunity to testify before you today on Missile Defense Agency (MDA) programs and activities.

U.S. adversaries are developing more capable ballistic, hypersonic, and cruise missiles, systems with global reach, increased speed and maneuverability, greater accuracy, and improved countermeasures. North Korea is developing long-range ballistic missiles that threaten the United States and our allies in the Indo-Pacific region while also testing shorter-range maneuvering missiles. Iran continues to develop more sophisticated missiles with improved accuracy, range, and lethality. Iran is also fielding an array of increasingly accurate short- and medium-range ballistic missiles. Iran has demonstrated the ability to combine ballistic or cruise missiles with unmanned aerial vehicles in complex attacks. Russia and China operate advanced ballistic and cruise missile forces, and they are developing and deploying advanced air- and surface-launched long-range cruise and hypersonic missile capabilities.

Hypersonic missiles are being developed to bypass perceived U.S. missile defense capabilities. Regional hypersonic missiles are capable of holding deployed U.S. Forces, allies, and partners at risk. Hypersonic glide vehicles delivered by ballistic missile boosters will pose new challenges to our regional missile defenses. Moreover, U.S. adversaries and strategic competitors will increasingly use cyber capabilities to seek political, economic, and military advantage over the United States and its allies and partners, including intelligence gathering on and disruption of U.S. missile defense systems.

#### IMPROVING WARFIGHTER READINESS

While the United States relies on nuclear deterrence to protect against large and technically sophisticated Russian and Chinese intercontinental missile threats to the United States Homeland because defending against these missiles is cost-prohibitive and not technically feasible, MDA is developing and deploying homeland mis-

sile defense capabilities to address the limited but growing rogue-state offensive missile threats. At the same time, in order to address regional missile threats from any adversary, MDA is developing and deploying credible capabilities for regional defense. Rapidly advancing missile threats require MDA to employ streamlined and agile acquisition approaches to pace the threat. The Warfighter Involvement Process (WIP), led by U.S. Strategic Command, is essential for cross-coordination with all Combatant Commands and Services and results in a single set of prioritized Warfighter requirements to drive MDA investment. The WIP, coupled with the Department's missile-defense governance process, has enabled MDA's ongoing and collaborative relationships with Combatant Commands with strong partnerships across the Services and Military Departments.

Over the past year, MDA responded to and supported the Combatant Commanders and Services by delivering and sustaining sensors, battle management, engagement systems, and sustainment, all while adhering to DOD pandemic measures. MDA provides sustainment support to the Lead Services around the clock for virtually every individual component of the Missile Defense System, including testing, integration, system, and software certification, missile maintenance and recertification, and technical and logistics support.

MDA continues to make significant progress in cybersecurity by incorporating system-level requirements into system specifications and then implementing rigorous evaluation-based testing and assessments. We established a Defensive Cyberspace Operations organization, augmented the workforce with certified cyber teams to evaluate the effectiveness of cyber capabilities and implement structures to enhance our cybersecurity posture. MDA is building cybersecurity into next-generation software processes by leveraging proven secure software development, security, and operations, and establishing continuous integration. We are also closely collaborating with our Defense Industrial Base partners to protect MDA and supplier information.

#### DELIVERING CAPABILITY TO BUILD COMBATANT COMMAND AND SERVICE CAPACITY

MDA remains committed to developing, delivering, sustaining, and improving the nation's missile defenses and delivering capability to the Warfighter.

#### SPACE AND TERRESTRIAL SENSORS

We must continue to improve sensor, and discrimination capabilities. Space is a critical domain for addressing rapidly advancing missile threats across multiple regions. SKA uses a network of infrared sensors hosted on commercial satellites to deliver a hit and kill assessment capability for homeland defense. On-orbit SKA sensors have participated successfully in a variety of MDA flight tests and engineering activities. SKA collected hit assessment data during the 2019 GMD salvo intercept test Flight Test GMD Weapon System (FTG)-11. The effectiveness of SKA during FTG-11 drove the decision to accelerate SKA as an operational asset. SKA is currently providing situational awareness to USNORTHCOM during declared Periods of Heightened Activity. In fiscal year 2022, MDA plans to complete development of the operational hit-assessment software code, continue developing kill-assessment algorithms and threat models, and finalize integration of SKA into the C2BMC operational interface. This will deliver an operational hit assessment capability in 2023 and a follow-on kill assessment capability.

MDA is developing a Hypersonic and Ballistic Tracking Space Sensor (HBTSS) capability to meet critical Warfighter requirements in collaboration with industry partners, United States Space Force, USNORTHCOM, USSTRATCOM, USSPACECOM, and the Space Development Agency. Once deployed, HBTSS will be a key missile defense element by providing a persistent, global capability to detect and track dim boosting ballistic missiles, hypersonic glide vehicles, including raids. HBTSS will be integrated into the Overhead Persistent Infrared (OPIR) Enterprise Architecture and provide increased sensitivity for missile warning. HBTSS will contribute to regional missile defense against stressing threats, providing fire-control quality tracking data on hypersonic and ballistic threats for hand-over to missile defense sensors for engagement. MDA awarded two agreements earlier this year to continue the design efforts initiated in previous phases of the HBTSS program. Each performer will build an on-orbit prototype-demonstration satellite for a planned launch in 2023. In fiscal year 2022, as we continue tracking algorithm maturation and commence flight infrared sensor payload assembly and integration, MDA also will acquire launch services through the United States Space Force's National Security Space Launch.

After over a decade of service, the Space Tracking and Surveillance System (STSS) satellites will be decommissioned in March 2022. STSS will have supported MDA Space Research and Development for over 12 years, eight years past its design

life. The program surpassed all its technical objectives, demonstrating the value of space-based missile tracking and serving as the vanguard for the next generation of missile defense space systems.

MDA is developing, deploying, and sustaining ground-based radars to counter current and future missile threats, build Warfighter confidence, and increase force structure. We are also investing in a robust sensor architecture that supports missile defense weapon systems by providing highly accurate midcourse tracking, discrimination, and battle damage assessment. MDA continues to provide software updates to the fleet of TPY-2 radars, the Sea-Based X-band (SBX) radar, five Upgraded Early Warning Radars (UEWRs), the COBRA DANE radar, and mobile Aegis Integrated Air and Missile Defense ships equipped with the SPY-1 family of radars.

Construction continues on the most advanced ground-based radar in the world, the Long Range Discrimination Radar at Clear Air Force Station, Alaska. Construction continued this year, despite a work stoppage over several months and steps to mitigate the spread of the Coronavirus. We completed installation of the primary array panel on November 30, 2020 and the secondary array earlier last year, and work is ongoing to complete the integration of critical radar components. The programmatic impacts of the work stoppage have caused the Congressional mandate of Initial Fielding to be delayed until first quarter fiscal year 2022. Following operational acceptance in second quarter fiscal year 2023, the radar will provide precision tracking, persistent long-range midcourse discrimination, and hit assessment to support a capability against long-range missile threats in the Pacific theater to the U.S. Homeland and conserve the number of Ground Based Interceptors (GBIs) required for threat engagement. LRDR also supports space domain awareness.

SBX is an advanced sea-mobile radar that provides precision midcourse tracking and discrimination capabilities. This past year the vessel supported operations, testing, and data collection while receiving numerous resupply and refueling missions on-station in the Pacific Ocean. SBX collected critical data from MDA and Air Force flight tests, which we use to improve sensor discrimination and demonstrate debris mitigation improvements. This capability enables higher precision target viewing, especially in highly cluttered scenes. SBX remained at-sea for 350 consecutive days prior to entering a maintenance period at Pearl Harbor, Hawaii in September 2020. In fiscal year 2022, plans are for SBX to spend approximately 305 days at-sea to collect flight test data and conduct contingency operations for defense of the Homeland. We plan to replace the processors to address obsolescence and increase processing capabilities.

MDA will continue to sustain and provide updates to the Upgraded Early Warning Radars (UEWRs). This past year MDA completed upgrades at Clear Air Force Station (AFS), Alaska and Cape Cod AFS, Massachusetts, joining the UEWRs at Royal Air Force (RAF) Fylingdales, England, Thule Air Base, Greenland, and Beale Air Force Base, California. These radars support missile defense of the Homeland, detection of ballistic missile attacks, and conduct general space surveillance and satellite tracking. U.S. Space Force operationally accepted Cape Cod AFS on November 3, 2020, and Clear AFS is scheduled to be presented to U.S. Space Force for operational acceptance by May 2021. Additionally, we completed the Digital Signal Processor Upgrade operational testing at RAF Fylingdales in March 2021 and will complete the same at Thule Air Base in June 2021.

MDA supports operation of two TPY-2 (Forward Based Mode) radars in Japan and in Israel, Turkey, and USCENCOM. We continue to support the TPY-2 radar (Terminal Mode) as part of forward-deployed Terminal High Altitude Area Defense (THAAD) batteries in USINDOPACOM. Plans in fiscal year 2022 include developing TPY-2 advanced discrimination algorithms to identify and track advanced threats to support operations and ground testing.

#### COMMAND AND CONTROL, BATTLE MANAGEMENT AND COMMUNICATIONS (C2BMC)

C2BMC integrates the Missile Defense System and provides multiple Combatant Commanders with global, persistent, space-based infrared, land-, and sea-sensor acquisition, tracking, cueing, discrimination, and fire-control quality data to support U.S. and coalition-partner missile defense operations. C2BMC supports Homeland and regional missile defense operations as well as space domain awareness. As the “brain” of the integrated Missile Defense System, C2BMC operates in a joint, multi-domain environment, interfacing with Army, Navy, Air Force, Space Force, NATO, and international systems. C2BMC provides decision makers a common operating missile defense picture capable of distributing integrated fire control quality data for external launch- and engage-on-Remote sensor operations. This capability supports global missile defense situational awareness, coalition operations, weapons re-



lease authority for homeland defense, and provides the capability to control and task a variety of sensors.

In fiscal year 2022, MDA will continue to sustain the C2BMC fielded capability in U.S. Northern Command (USNORTHCOM), U.S. Indo-Pacific Command (USINDOPACOM), U.S. European Command (USEUCOM), U.S. Central Command (USCENTCOM), U.S. Strategic Command (USSTRATCOM), and U.S. Space Command (USSPACECOM) Areas of Responsibility. The next C2BMC upgrade, Spiral 8.2-5, builds on the currently fielded spiral to provide the integrated missile defense system and the U.S. Space Force the capability to command and control the Long Range Discrimination Radar (LRDR). LRDR enhances discrimination and fire control tracks for Ground-based Midcourse Defense (GMD). Additionally, this spiral upgrade to C2BMC adds advanced threat tracking and reporting while providing an initial space sensor tasking capability by tasking TPY-2 radars, Aegis SPY radars, and the LRDR for the critical space domain awareness mission. Our plans for future C2BMC spiral upgrades will provide initial integration with the Army's Integrated Battle Command System (IBCS), a Space-based Kill Assessment (SKA) hit assessment feature, and a debris-filtering feature from external sensors. C2BMC is also expanding support to space domain awareness by partnering with the U.S. Space Force to integrate key Space Surveillance Network sensors with missile defense sensors and communications architecture, providing USSPACECOM with an enhanced, near-real time, satellite tracking capability. We will continue risk assessments to identify and mitigate vulnerabilities.

#### HOMELAND DEFENSE

The Department is committed to improving U.S. Homeland missile defenses to counter limited missile threats from rogue states. The GMD system serves as the continuously available backbone of homeland missile defenses and is capable of defending against today's rogue state ballistic missile threat to the Homeland. We plan to upgrade and replace ground system infrastructure, fire control, and kill vehicle software to improve reliability, capability, availability, and cybersecurity. The entire GMD weapon system is currently undergoing a Service Life Extension Program (SLEP), with focus on GBI reliability and availability. We will incorporate flight-test lessons-learned in future GBI fleet upgrades while modernizing key components of the ground systems.

MDA also is developing the capability to provide the Warfighter the option of either flying the GBI using a 3-stage burn trajectory or not igniting the third-stage to provide performance similar to a 2-stage boost vehicle. This approach will improve homeland defense performance by optimizing engagement times. We plan to demonstrate this capability in the next GMD flight test, GM Booster Vehicle Test (BVT)-03, in fourth quarter fiscal year 2021, and subsequently field it on all boost vehicle configurations. The initiation of the Next Generation Interceptor (NGI) program and SLEP activities will extend the existing GBI fleet service life beyond 2030.

MDA will improve the interceptor fleet with NGI development, with deliveries starting no later than 2028. The program will leverage the valuable technical information developed under previous MDA technology initiatives. NGI development allows trades between boost vehicle and payload, improves system survivability, and increases performance against projected rogue-state threats. Pursuing two industry approaches through Critical Design Review will reduce technical risk, secure competitive production pricing, and create incentives for early delivery to the Warfighter. MDA also is pursuing multiple contracts to support the growth and sustainment of the GMD Weapon System. As replacement for the current sole-source Development and Sustainment Contract, MDA is pursuing a competitive acquisition strategy to satisfy future GMD weapon system requirements for future, integrated increments, enhancing GMD system engineering, integration, test, and readiness.

#### REGIONAL DEFENSE

We continue to develop new capabilities for regional missile defense.

Globally deployed and land-based Aegis BMD capabilities are critical to the Nation's integrated defense for our deployed forces, allies, and partners. Aegis BMD is designed to intercept SRBMs and MRBMs in the midcourse and terminal phases of flight and IRBMs in midcourse. We will continue advancement of Aegis BMD, including continued delivery of Standard Missile (SM)-3 Block IB and Block IIA missiles, improved sea-based terminal defense, improvements in system and missile reliability, and increases in Aegis BMD engagement capacity and lethality in alignment with Navy requirements.

MDA will continue design, development, and integration of the Aegis Weapon System (AWS) with the SM-3 Block IB, Block IIA, and SM-6 missiles. This includes continued spiral development to pace increasingly complex threats in more stressing operational environments. Utilizing improved radar discrimination, we will increase Aegis performance against longer range and more sophisticated threats. We will continue adding advanced algorithms to increase lethality to our air and missile defense capabilities and developing Aegis BMD weapon system software to enhance functionality and leverage more-capable radars. MDA is also working with the U.S. Navy to refurbish existing shipboard SPY-1 radar arrays to provide increased radar sensitivity and discrimination improvements. We also plan to integrate missile defense capability with delivery of the Navy's Air and Missile Defense Radar, the SPY-6, for enhanced engagement capability and increased raid capacity.

In November 2020, together with the U.S. Navy, MDA conducted Flight Test Aegis Weapon System (FTM)-44. During this test, the Aegis Weapons System launched a SM-3 Block IIA interceptor from the USS *John Finn* (DDG-113) and successfully intercepted a simple rogue state threat-representative ICBM-class target. While the AWS and SM-3 Block IIA interceptors were not designed to defeat an ICBM-class target, this test demonstrated some potential limited capability. This Congressionally directed flight test leveraged residual capability in Aegis and SM-3 Block IIA using engage-on-remote sensor capabilities through the C2BMC network. We continue to improve layered defense robustness. MDA is testing Aegis BMD with all Standard Missile interceptor variants, THAAD weapon system improvements, and continued C2BMC spiral upgrades. Test results and upcoming Departmental decisions will inform the future of these assessments.

MDA supports the European Phased Adaptive Approach as the U.S. contribution NATO's missile defense capability, providing coverage and protection of NATO's European territory, populations, and forces against the ballistic missile threat from outside the Euro-Atlantic region. Currently, there is a fully operational Aegis Ashore site in Romania and a second and final European site under construction in Poland. With fiscal year 2022 funding, MDA will continue to support operations at the site in Romania and completion of construction at the site in Poland.

Aegis Ashore Poland is currently over 90 percent complete site-wide and over 95 percent complete for the critical elements of military construction required for the Aegis Weapon System. Progress remains slow but steady despite the challenges that COVID-19 has presented. MDA continues to work closely with the U.S. Army Corps of Engineers (USACE) to address the remaining challenges to complete the military construction and start the follow-on MDA efforts to deliver Aegis Ashore Poland to the Navy, European command, and NATO. In June 2020, we achieved the Beneficial Occupancy Date for the Naval Support Facility buildings, which we turned over to the Navy. Military construction of the Deckhouse Facility continues and the Aegis combat system installation efforts may begin as early as spring 2021. MDA and USACE continue to monitor site conditions and partner with industry to integrate portions of the combat system equipment installation with ongoing construction where possible. The combat system installation is the first in a series of events leading to operational acceptance of the Aegis Ashore Missile Defense System Complex in Poland in fiscal year 2022.

MDA activities under the increase joint force lethality category include funding for initial development of survivable and operationally effective integrated air and missile defenses for Guam to defend Guam from ballistic, hypersonic, and cruise missile threats. Funding includes development activities, such as additional integration between Army and Navy assets, designed to support a range of architecture options, pending upcoming Departmental decisions.

MDA also is furthering the ability of partner nations to operate seamlessly with U.S. air and missile defense forces to augment our international cooperative and FMS efforts. In May 2021, MDA and the U.S. Navy will participate in Formidable Shield-21, a joint NATO exercise with multiple BMD and IAMD events at the U.K. Ministry of Defense Hebrides Test Range, along with allied participants from Belgium, Canada, Denmark, Germany, Spain, France, Italy, the Netherlands, Norway, and the United Kingdom. In the Indo-Pacific region, we continue to exercise strong bilateral alliances with Japan, South Korea, and Australia to improve our collective security in the Indo-Pacific. MDA is continuing our longstanding cooperative efforts with Japan as it seek to improve its existing missile defense capabilities, including acquisition of the SM-3 Block IIA missile, the result of United States-Japan cooperative development. MDA continues to support Japan's decision to re-align the Aegis Ashore Japan FMS case to an Aegis Equipped Surface Vessel. In August 2022, MDA will participate in Pacific Dragon-22, a multilateral international exercise at the U.S. PMRF in Hawaii, along with allied participants from Japan, South Korea, and Australia.

The THAAD weapon system is a globally transportable, ground-based missile defense system that is highly effective against SRBM, MRBM, and IRBM threats inside and outside the atmosphere in the terminal phase of flight. MDA currently supports forward-deployment of two batteries stationed in the USINDOPACOM area of responsibility. THAAD has proven increasingly integral to the Defense Department's regional defense architecture. MDA received a congressional increase in fiscal year 2021 for an additional THAAD battery and 30 Heavy Expanded Mobility Tactical Trucks. This congressional action expands the Army capacity to eight THAAD batteries. We will continue THAAD interceptor procurement, obsolescence mitigation efforts, production and training support, the THAAD Stockpile Reliability Program, and the initial procurement of required THAAD Battery Ground Component enhancement modifications to meet growing cybersecurity threats. MDA will continue development and integration of multiple, independent THAAD software builds to address the evolving threat, improve the Warfighter's defense planning, and improve system capability.

MDA is providing a more robust integrated air and missile defense capability, one that integrates THAAD, Patriot, and at-sea Aegis ships into a seamless network. One focus area is the integration of THAAD and Patriot weapon systems. Patriot Launch-on-Remote (THAAD) capability will increase Patriot-defended area and engagement opportunities by allowing the Patriot Advanced Capability-3 Missile Segment Enhancement (MSE) interceptor to launch using the THAAD radar information, prior to the Patriot radar acquiring the threat. On February 20, 2020 we demonstrated, with the U.S. Army, functionality required for Patriot Launch-on-Remote (THAAD) capability in Flight Test Patriot Weapon System-27 (FTP)-27 Event (E)2. We executed FTP-27 E1 on October 1, 2020, at White Sands Missile Range, NM, demonstrating Patriot Launch-on-Remote engagement of a SRBM target using MSE interceptors and THAAD radar track and discrimination data. This improved integration demonstrated the ability to expand the Patriot battery defended area.

As the Foreign Military Sales (FMS) Implementing Agency for THAAD, MDA is executing FMS THAAD cases with the United Arab Emirates (UAE) and the Kingdom of Saudi Arabia (KSA). We continue to work the KSA FMS case, which includes seven THAAD batteries, 44 launchers, 360 interceptors, and associated equipment and support. MDA will work with the KSA to commence delivery of the THAAD capability by the middle of this decade. MDA also will continue work with the UAE to maintain and sustain its two THAAD batteries.

We have a valuable cooperative missile defense relationship with Israel. Not only can we help our partner develop systems to strengthen its missile defenses and increase interoperability with U.S. Forces, but we also learn a great deal from a battle-hardened nation experienced in defeating missile threats. MDA and the Israel Missile Defense Organization (IMDO) continue to cooperate on engineering, development, co-production, testing, and fielding of the Arrow Weapon System (AWS), the David's Sling Weapon System (DSWS), and co-production for the Iron Dome Defense System (IDDS). In 2020, MDA and IMDO cooperatively planned and successfully executed two critical flight tests. On August 12, 2020, Arrow System Test-18a (AST)-18a, an Arrow-2 interceptor flight test, demonstrated system processes, collected data for the next upgrades, and allowed for risk reduction testing of the DSWS through live intercept of the MRBM target. In December 2020, we successfully completed a series of DSWS intercept tests in an advanced system configuration against threats simulating cruise missiles and theater ballistic missiles. David's Sling Test 7 (DST)-7 proved DSWS capability against cruise and theater ballistic missiles, allowed for risk reduction testing of the AWS and IDDS, and was a key milestone in DSWS development. In fiscal year 2022, MDA will support several flight tests across the Israeli portfolio.

#### DEVELOPING TECHNOLOGY FOR THE FUTURE

MDA is investing in innovative and disruptive technologies to address the emergence of new and more advanced threats. MDA's previous missile defense technology investments have transitioned into weapon systems and vastly improved interceptor seeker capability, increased the speed and range of intercept with advances in propulsion, and increased the probability of single-shot kill using multifaceted tracking and discrimination algorithms. To be responsive to evolving missile threats, we must continue to sustain, modernize, and expand missile defenses by pursuing rapid, yet measured, development of advanced missile defense concepts and technologies for homeland and regional defense.

Potential adversaries such as Russia and China continue to expand the capability and capacity of their regional offensive missile inventories, to include regional hypersonic missile capabilities. The altitude at which these weapons fly, coupled

with their aerodynamic maneuverability, make them a challenge for existing air and missile defense systems. We are investing in technology to counter these new and emerging threats by upgrading sensors and C2BMC for early warning, identification, and tracking of regional and strategic hypersonic threats, leveraging existing systems where possible to develop a layered defensive architecture against regional hypersonic threats, and making technology investments for increasing hypersonic defensive capabilities. Consistent with long-standing U.S. policy, MDA is not developing or deploying capabilities to defend the U.S. Homeland against near-peer strategic hypersonic missile threats, as we rely on nuclear deterrence to address these more complex threats.

A layered hypersonic defense architecture is the most effective way to address the regional hypersonic threat. As with ballistic missile threats, the more opportunities to neutralize hypersonic threats, the better. MDA is taking steps to deliver regional, layered hypersonic defense capability to the U.S. warfighter incrementally. We are working closely with the Department of the Navy to develop and field SBT to provide the U.S. Warfighter terminal phase defense against regional maneuvering and hypersonic threats. MDA demonstrated SBT capability at-sea utilizing the AWS with SM-6 for defense against advanced ballistic missile threats during FTM-27, demonstration events conducted in December 2016 and August 2017. Upcoming flight test FTM-31 Event 1 will further demonstrate this SBT capability. MDA is anticipating SBT Increment 3 upgrade and delivery in 2024, including terminal defense capability against some regional hypersonic threats. MDA also is augmenting data on hypersonic threats provided by the intelligence community by collecting and analyzing data from various sensors participating in U.S. hypersonic flight-testing.

To complement this terminal capability, MDA is taking steps to develop an initial glide phase intercept capability leveraging the Aegis weapon system to provide the U.S. warfighter with increasingly capable and layered regional defensive capabilities over time. In fiscal year 2022 MDA will accelerate the development of an operational demonstration of a glide phase defense capability against regional hypersonic threats using the Aegis Weapon System. We are also developing hypersonic target systems to support robust testing.

MDA is investing in the technology development necessary for the next increment of capability, including internally-cooled seeker technology, axial upper stage capability, robust and resilient materials for hypersonic flight, and novel guidance and control capability. We will continue to strengthen efforts to deter and counter these rapidly advancing missile threats.

In response to USNORTHCOM requirements, MDA will analyze the current systems architecture for cruise missile defense of the Homeland and conduct a demonstration of cruise missile defense capabilities using the Joint Tactical Integrated Fire Control (JTIFC) capability within the National Capital Region. JTIFC enhances integrated fire control capabilities across the Services by connecting existing sensors, command and control systems, and weapons at the tactical level through real-time sensor networks.

MDA continually assesses emerging and disruptive technology for potential applications to missile defense utilization. We are pursuing efforts in artificial intelligence, machine learning, nanosat technology, Left-through-Right Integration, cybersecurity, and quantum science. Key to this assessment has been the development of testbeds that allow us to exercise and demonstrate capabilities and test new concepts, algorithms, simulations, and software. We are also expanding technology opportunities through cooperative, collaborative engagements with DOD partners and our allies.

#### MDA WORKFORCE

During this unprecedented global health crisis, the MDA workforce continues to execute the missile defense mission in spite of pandemic challenges and restrictions. We were able to ensure the health and safety of the workforce while providing tools and platforms enabling continued mission success. In line with the 2020 Federal Employee Viewpoint Survey results and our initiatives to improve our culture of excellence, the MDA workforce has become even more engaged, committed, satisfied and confident in our leadership and mission.

#### CONCLUSION

Chairman King, Ranking Member Fischer, Members of the Subcommittee, we will continue to increase the readiness as well as the capability and capacity of fielded homeland and regional missile defense systems while investing in advanced technology to counter adversary ballistic and non-ballistic missile threats. MDA will continue to execute a robust and aggressive test program critical to system develop-

ment to outpace future offensive missile systems in order to defend the U.S. Homeland, U.S. deployed forces, and our allies and international partners. We also will continue to work closely with the Intelligence Community, the Services, and the Combatant Commands to ensure MDA is meeting the demand of the Warfighter.

Finally, I would like to recognize the men and women who serve in our Armed Forces at home and abroad and who operate the integrated Missile Defense System. Our Nation benefits greatly from such a highly skilled and dedicated fighting force.

I appreciate your continued support for MDA and the missile defense mission, and I look forward to answering the Committee's questions. Thank you.

Senator KING. Thank you very much, Admiral. This subject gets more and more complicated the more we get into it, because I think when we talk about missile defense it is important to emphasize we are not only talking about Fort Greely and Vandenburg. We are talking about THAAD, Patriot, and Aegis.

You have to understand that from the point of view of this Committee, one of the important considerations we have is opportunity cost. This is a tight budget year that we are looking at, and so when you spend money on one thing, that means you do not have money to spend on something else, and that is something that we have to look at.

You mentioned something very important, and that is we are developing hypersonic defense. Could you expand upon that, being aware that this is a nonclassified setting? Can we defend a carrier against a hypersonic glide missile today?

Vice Admiral HILL. We have terminal capability today.

Senator KING. "Terminal" means in the last stages before it hits the ship.

Vice Admiral HILL. That is typically where you will start on taking on that kind of threat. It happens to be in the hardest environment. You are in the atmosphere. You are maneuvering. But we do have that capability deployed today, and we are continuing to improve it.

Where we need to go is to take it out in that glide phase, and that is the Glide Phase Interceptor that you will see in the President's Budget 2022.

Senator KING. We are all talking about hitting bullets with bullets. What is the role of directed energy, and are we putting sufficient resources into directed energy as an alternative, and frankly, a cheaper alternative, and perhaps a more effective one to deal with a maneuverable incoming missile?

Vice Admiral HILL. Thank, Senator. That is a very tough one to discuss in this environment. I would love to come see you on that one. There are initiatives there. I just can't talk about here, at this session.

Senator KING. Thank you. It is being considered.

Vice Admiral HILL. Yes, sir.

Senator KING. General VanHerck, I think you used a term, and I wrote it down. You talked about "prying the data" out of someplace. Am I correct? Is that what you said?

General VANHERCK. Chairman, that is correct. I did say that. There are lots of data from domain awareness sensors around the globe that all too often is not shared to develop a globally integrated picture that would give us the ability to get further left and give decision space to our senior leaders.

Senator KING. I completely agree, and as you know, Goldwater-Nichols was a landmark statute which led us to joint commands. But we do not necessarily have joint data access and capability development. So I hope that is something we might be able to address. But when one of our generals says he has to pry the data out of another agency in order to do his job, I think that tells us we have got a problem we should address.

General VANHERCK. Chairman, I am encouraged with the Department. The Secretary just signed the Joint All-Domain Command and Control Strategy. We are moving forward going down that path. I would also say that we are going to have to look at policy and laws as well, especially within the intel community, of sharing data to ensure that we get a full global picture.

Senator KING. Admiral, are you persuaded that the accuracy and the ability of the Ground-Based Interceptors is sufficient to justify the cost? Let me put it in a more difficult question. Which would you rather have—the Ground-Based Interceptors or five additional Aegis destroyers?

Vice Admiral HILL. Well, for the ballistic threat, the GBIs today and the NGIs tomorrow go after that threat. They are spec'ed for that. NGI, as you know, it has got a hard requirement on it. It is to cover all 50 states. That is why it is a 50-foot missile and 50-foot in diameter. It has got a hard requirement on it. I would rather have more GBIs and NGIs against that threat.

The Aegis ships and what they do, for a totally different mission, and they are multi-mission ships. They have a lot of different missions that they are excellent for.

Senator KING. But THAAD, Aegis, and Patriot have a higher success rate, do they not?

Vice Admiral HILL. The way the success rate was mentioned earlier, it has always entertained me. If you have a failure in a program, you are going to learn from that failure. Talk about it all the time. You learn from your failures, right?

Senator KING. Yeah, but if there is an incoming missile from North Korea and we miss it, learning from the failure is not going to make people feel better.

Vice Admiral HILL. Absolutely not, and so that is why, over time, you want to improve the program, and then your math really needs to take a look at the current configuration that is in the ground, and the current configuration that has been tested against realistic targets. If you add up failures from 1998 into the number, of course you are going to have a lower reliability number, using that right-world information. I will tell you that the reliability is much higher, and I think that the confidence of the warfighter is based on that.

Senator KING. Final question, and my wife says I say “finally” too much and it gets people’s hopes up.

[Laughter.]

Senator KING. But in this case, final question. You heard Mr. Panda talk about more transparency, clarity on testing, clearer reporting on what exactly the targets are. I could be in a classified setting, but would you support that suggestion, because it seems to me we have a responsibility, as the people who are funding and using the taxpayers’ money, to ensure that these things are going

to work. So would you support additional clarity and transparency with regard to testing?

Vice Admiral HILL. Absolutely, Senator. If someone has got a security clearance I will happily talk to them about that, and I will tell you, we have got a great test record that I am very proud of. You can't just look at live fire. That is one shot, right, in a broad battle space. We have got to look at the ground test data. That is where your real numbers and your statistics come from. So I would be happy to show that to anybody that is interested and has the appropriate clearance.

Senator KING. I think that is something we can follow up on. Thank you very much.

Vice Admiral HILL. Yes, sir.

Senator KING. Thank you all. Senator Fischer.

Senator FISCHER. Thank you, Mr. Chairman. Admiral Hill, a number of news reports have indicated that the Government of Israel plans to submit a request for additional assistance so that they can replenish their Iron Dome system following the recent conflict that we have seen there with Hamas. Has the Department received such a request?

Vice Admiral HILL. I am going to defer that question over to Policy, but before I do that I will say they are a great partner. We work very closely with Israel on all layers of what they do. But beyond that, in terms of the emergency acquisition, I will send that over to Policy.

Senator FISCHER. Ms. Tomero, it is good to see you again. You are going to be a regular here, I think, from now on.

Ms. TOMERO. I am looking forward to it.

Senator FISCHER. Thank you so much for being here. Can you answer that question for me, please?

Ms. TOMERO. Yes, absolutely. The Department is working that request, and as Admiral Hill said, we look forward to working very closely with Israel as one of our closest partners, and so the Department is working that request. What I can do is, because it crosses over several departments within DOD, to come back to you and give you more detail.

Senator FISCHER. Okay. I would like to know if it is going to be a request for supplemental appropriations or if it is going to reprogram resources.

Ms. TOMERO. I think if you could allow me to come back and give you a better answer for the record on that. But again, the Department is looking at that request for \$1 billion.

[The information referred to follows:]

Ms. TOMERO. The Department of Defense remains committed to working with Israel to ensure that the Iron Dome Defense System is capable of protecting Israeli civilians. The Department supports Israel's request for additional support for its Iron Dome Defense System. The Department of Defense has provided Congress with information in support of Israel's request, and stands ready to answer any questions, as needed. The Department also continues to consult closely with the Israeli Ministry of Defense on Israel's security needs.

Senator FISCHER. Okay. Great. Thank you. Also, what are the Department's plans with respect to conducting a missile defense review? Has that begun? What organizations are involved in it? First of all, are you going to have a missile defense review, and what is the process going to look like on that?

Ms. TOMERO. Thank you, Senator. We are planning to start a missile defense review imminently, in the next few weeks, and look forward to working across the Department with Admiral Hill's organization, with General VanHerck in NORTHCOM, with the acquisition community within the Department. So it will be done in a coordinated way across the Department, and we are planning to start very soon. We will look at the threat and the changing security environment, you know, how do we improve and have effective and affordable missile defense for both the homeland and regional defense.

As I mentioned in the opening remarks, we will do that as part of the National Defense Strategy, and it will also feed into our integrated deterrence review.

Senator FISCHER. Will it be standalone?

Ms. TOMERO. That decision has not been made yet.

Senator FISCHER. Okay. Section 1684 of the Fiscal Year 2017 NDAA requires the Department to designate a single entity as the lead acquisition organization for defending the Homeland from cruise missiles. To my knowledge, that designation has not been made. Can you update us on what the status of that is?

Ms. TOMERO. Yes, Senator, you are correct. That designation has not been made, and is still being worked within the Department.

Senator FISCHER. Okay. Thank you. Do you think we need it? Do we need that designation?

Ms. TOMERO. This is something that the Department is still looking at, and I would ask for your indulgence in allowing me to look across and work with my colleagues on what the best way forward on this is. I know the previous administration also did a lot of work on this too.

Senator FISCHER. I am going to put General VanHerck on the spot, and Admiral Hill. What do you think? Do we need a designation like that?

General VANHERCK. Senator Fischer, I do believe it would be best to have a single entity designated within the Department for cruise missile defense of the Homeland.

Senator FISCHER. Thank you. Admiral?

Vice Admiral HILL. Great, great question. I also agree we need a single agency involved.

Senator FISCHER. Good. Thank you. I will try to get another one in. Admiral Hill, does the budget support delivery of the next-generation Interceptor in 2028, and can you describe the life extension program MDA has developed to ensure the current Interceptor fleet remains viable until NGI is deployed?

Vice Admiral HILL. Thank you, Senator. When I mentioned the Service Life Extension Program earlier, based on congressional support there we kick-started that program, working very closely with General VanHerck and his team, and that is going really well, and it will increase capacity and capability. I mentioned that we will have the old hardware that we can assess, and our assessments' reliability are going to bump up, and we are going to have a lot more confidence in that.

So what we are doing—I do not like to live off of plus-ups. I always appreciate when Congress does that, but then now we are committed to include that in the budget, so you will see us includ-



ing that in President's Budget 2022 as we move forward, and that President's Budget 2022 look into NGI, absolutely. We are in a good place with both contractors moving out to beat the government estimate of first emplacement in 2028.

That is going to come to the left. I am going to stay very close to General VanHerck. I am going to stay very close with all the stakeholders in the building, because what that means is flight testing will happen earlier, which means we are going to prepare those threat-representative targets and then we will be ready to go.

Senator FISCHER. Good to hear. Thank you.

Vice Admiral HILL. Yes, ma'am. Thank you.

Senator KING. Senator Rosen, via Webex.

Senator ROSEN. Well, thank you, Chair King and Ranking Member Fischer, for holding these hearings today. I would like to thank all witnesses for their service and for testifying, and General VanHerck, always great to see you and spend some time with you like we did yesterday. That was wonderful.

I would like to go right into some missile defense cybersecurity issues. As MDA works to rapidly deploy missile defense systems to, of course, stay ahead of threats, I am concerned that we may not be taking potential cyber vulnerabilities seriously enough before we field new systems, when the 2019 *Missile Defense Review* software is mentioned, only once, and even more alarming, Government Accountability Office (GAO) May 2021 report highlights that none of MDA's 17 operational cybersecurity tests planned for fiscal year 2020 were conducted, and that cybersecurity testing since 2017 has revealed several vulnerabilities.

So Admiral Hill, in light of recent significant cyberattacks, of course I do not have to tell you what they are out in the public space, what steps is MDA taking to address cybersecurity vulnerabilities, and are you conducting cybersecurity testing on all deployed and planned capabilities?

Vice Admiral HILL. Yes, thanks, Senator Rosen. Part of the difficulty of cyber testing with missile defense systems is often you have to creep into the networks that are operational. So it does require a lot of coordination with the combatant commands. When you look at what it takes to execute a cyber test in a pandemic, no surprise that there were delays in executing those test in 2020. But I will tell you, we have conducted a number of adversarial assessments. Those are called the AAs. We have also moved out and done the PCO, which is the persistent cyber operations. We have an agreement with DOT&E to start executing that this next year, so we have the team in place and ready to roll.

I absolutely agree with you that it is something we should worry about. When you look at a system as networked as missile defense is, 18 time zones, tying all the sensors together, fusing data, absolutely. I want to know where those vulnerabilities are, so when we execute those tests we take action on them. You can see it in our budget exhibits. You will see cybersecurity across every single element of the missile defense system, and you will see that we are martialing the best people on the planet to execute those adversarial assessments and the persistent cyber operations.

Senator ROSEN. Well, I appreciate that, and it is a large operation. It is difficult to test. I would argue that a lot of those tests

are also done remotely, in the privacy of offices. As we do some of those treat assessments it is important that we get back on a regular schedule, because the complexity also means it is more vulnerable, because there are many points of entry.

I would like to move on now and build on Senator Fischer's question about the Iron Dome. So Ms. Tomero, given the U.S. Army's acquisition, of course, of the Iron Dome technology, what lessons do you think that you have learned, or we have learned from the recent Israel-Hamas conflict, and more specifically, are you concerned about the ability of hostile actors to launch a massive barrage of rockets designed to overwhelm these short-range missile systems? Ms. Tomero and General Karbler, you can both respond. Ms. Tomero, you can go first, please.

Ms. TOMERO. Thank you. Again, there has been a lot of continuity and support for cooperative missile defense with Israel and supporting Israel's ability and capacity to defend itself, and we will continue to do so. My understanding is, according to Israel, their success rate is very high.

Senator ROSEN. Well, and maybe, General, you could talk about the lessons learned, because we know, and maybe we are still analyzing what just recently happened, but there are lessons to be taken from the most recent conflict. So can you speak to that?

Lieutenant General KARBLES. Ma'am, I had the opportunity to go visit the Army soldiers who are out at White Sands Missile Range as we field the new Iron Dome batteries. They are training on the systems. I do not know specifically if the lessons learned have been shared, but I know that the instructors out there, as they go through their certification and training, are providing threat-representative scenarios to those soldiers as they go through their training. We expect that that first battery will be ready for deployment at the end of September of this year.

Senator ROSEN. Thank you. I appreciate that. I have toured those batteries myself, and they are quite impressive, and I think there will be a lot of things that we learn, going forward.

I believe my time is up, Mr. Chairman. Thank you.

Senator KING. Thank you, Senator. Senator Cramer.

Senator CRAMER. Thank you, Mr. Chairman. Thanks to all of our witnesses. I think all but one of my questions has been already thoroughly discussed, although I will just add that I look forward to an update on Israel's request for emergency military aid as well, and more details regarding that.

But I do have a question for you, General VanHerck, and I really appreciated our time together, our discussions about over-the-horizon radar, the importance of all-domain awareness, and, of course, the hugely successful test of the over-the-horizon radar at Camp Grafton a few years ago. I would just ask if you could further explain the importance of over-the-horizon radar and how it increases the capability to defend the Homeland, and why you need the resources, frankly, to fast-track some procurement?

General VANHERCK. Senator, thank you. As we look at our competitors and potential adversaries, they have developed capabilities to hold the Homeland at risk, below the nuclear threshold. Those capabilities that they have developed now are extremely long range. So, for example, Russian capabilities to launch cruise mis-

siles now extend to over Russia, that can threaten North America. They can also do that from very far ranges, from our 2:00 towards Europe, and the same thing in the Northwest as well.

Today's legacy North Warning System has served its purpose and done well, and we are using a system called Pathfinder to give us some additional capability. But, you know, physically, the system cannot see over the horizon or long distances. So over-the-horizon radar gives us the capability to have domain awareness much further than we do today, which increases decision space for our senior leaders, and that is a top priority for me.

It is also my number one unfunded priority list, is to fast-track the site survey, the additional development, so that we can get this domain awareness capability of over-the-horizon radar sooner.

Senator CRAMER. I noticed that on the unfunded priority list, which is why I asked the question, and given, of course, my personal interest, what would be the next steps then for testing and production?

General VANHERCK. I would have to defer to the Service on that one. I am not sure what those next steps are. For us it would be to get the additional funding here, which is \$25 million, to move forward to fast-track site development and those kinds of things. As far as test of the actual system, I would defer to the acquisition authority on that one.

Senator CRAMER. All right. Thank you. That is everything, Mr. Chairman. Thank you.

Senator KING. Senator Kelly.

Senator KELLY. Thank you, Mr. Chairman. Admiral Hill, earlier we were talking about terminal phase, protecting the aircraft carriers with an Aegis system. My understanding is you talked about a terminal-phase intercept. Does that change? I mean, this is a relatively new capability. I assume SM-2, SM-6—

Vice Admiral HILL. SM-6 based.

Senator KELLY. SM-6 based. So to get this capability with the Aegis system in an SM-6, does that change the ability for the battle group, how it is going to operate, the range of the Aegis destroyer/cruiser has to be from the carrier? Does this have other operational considerations, and how long have we been in this mode, because the hypersonic threat, as we understand, is real.

Vice Admiral HILL. Yes, sir, and it is probably a difficult answer. I will say that, you know, all carrier strike groups are very dynamic, so you are not going to tether a destroyer to an aircraft carrier. The destroyer is going to go do its business and it will stay in contact with the destroyer, and the strike group commander will determine the positioning of those ships.

Remember, I am the technical developer. There is nothing that I see that causes a constraint on where the destroyer or the cruiser might operate in order to protect the carrier. It is just part of the other many missions that that strike group is going to carry out.

Senator KELLY. Current the fire control solution comes from the Aegis system. We were talking a little bit about HBTSS and the test in 2023. Once that system is fully developed, with regards to our carrier battle groups, does this change the way the fire control solution—does it then come from the HBTSS system down to the cruiser to launch the SM-2?

Vice Admiral HILL. So the way Aegis works, and you sound very familiar with this, is that the ship is going to control the missile. So typically for an organic engagement where it is using its own sensor, it is going to drive the missile, because you want to give updates to the missile. When you have got a maneuvering target there is a lot of uncertainty in that flight path, and so the help from the larger, smarter ship to the smaller, less capable sensor on the front end, you want to drive that missile to get to the collision, or get it within what we call "Region R," within its lethal radius.

When you bring in offboard sensors, which is a proven fact with Aegis, we have done launch on remote, which means we are launching on that remote sensor, and we have done engage on remote, where the ship never sees it with its own organic sensors. It is just controlling the missile and giving in maneuver commands as it is taking data from another radar.

HBTS will follow a very similar pathway. So being able to see down from space, warm tracks going over warm Earth, that is really tough science, but we have got that licked. We have shown that we can do data on the ground. That sort of capability gives us that global coverage. But it is going to work the same way. That data will come down and come through C2BMC to the ship, and then ship is driving the missile based on what it is seeing from HBTS. So it does give you more dynamic maneuver within that larger picture, but no big major change.

Now in the future, it would be great to launch the missile from the ship and have a space asset take it over. We are not there yet, so we are going to crawl, walk, run on that.

Senator KELLY. All right. Well, I am interested to see how the test goes in 2023.

Vice Admiral HILL. Yes, sir.

Senator KELLY. General VanHerck, yesterday we were talking a little bit about cruise missile defense of the Homeland, and in the \$247.9 million budget to support development of hypersonic defense capabilities, I believe there is about \$14 million in there, or there is a requested \$14 million for cruise missile defense of the Homeland.

So General, what progress can we expect to see if that money is approved by Congress in the coming fiscal year?

General VANHERCK. I believe that is money that he is taking internally in the Missile Defense Agency, that was not actually dedicated towards cruise missile defense, but he is taking that. Is that correct, Admiral Hill?

Vice Admiral HILL. That is correct. So I am not the designated agent for cruise missile defense of the Homeland, but I recognize the need. That threat is real. We stay very close with NORAD and NORTHCOM, and so we have learned forward to put funding into the budget so we could help with that architecture work, do the spectrum analysis, get the radars in place. So it is our way to put the foot forward, even though I am not the designated agent.

General VANHERCK. I would point out, on my unfunded priority list I do have a request for elevated radar here in the National Capital region, which would give domain awareness for potential cruise missile threats, much beyond what we have today. It also

gives a warning awareness for a movement of senior officials and those kinds of things. That funding is \$27 million.

Vice Admiral HILL. You will see that same issue in the unfunded priority list from the Missile Defense Agency.

Senator KELLY. Thank you.

Senator KING. Thank you, Senator Kelly. Senator Sullivan, we are delighted you are here, and we reached a consensus to close Fort Greely.

[Laughter.]

Senator SULLIVAN. Well, Mr. Chairman, I am glad to be here, and I was actually watching the first panel, so I am sorry I did not get down here in time. But I actually do have a comment or two. I agree with Senator Fischer on that, the one witness who was making the argument that somehow the China-Russia nuclear modernization program was driven in part by the GBIs at Fort Greely, I think, no offense to our esteemed witnesses, was one of the more ridiculous arguments I have heard in quite a while.

But, Admiral Hill, can you just mention—it is not just North Korea that we are looking at with regard to our missile defense. It is other rogue nations. We have the capability, given our location, with regard to rogue nations like Iran, don't we?

Vice Admiral HILL. Absolutely. So when I say rogue nations, I mean North Korea and Iran, and so NGI and the GBI fleet today was geared to protect us against North Korea and Iran.

Senator SULLIVAN. Correct, and I also watched the Chairman's discussion of deterrence, and I think it is questionable whether Kim Jong-un is a rational actor. I definitely think it is questionable whether the Ayatollah is a rational actor. I think it is the responsibility of this Congress to make sure we do not place that bet on deterrence. The whole idea is if either of them want to go out in a blaze of glory, we shoot down all their missiles, and then we destroy their countries. But we don't get destroyed first. Isn't that the whole point of our missile defense?

Vice Admiral HILL. I will defer to Policy.

Senator SULLIVAN. We don't take the punch. We deliver the punch, we parry the punch, and then we deliver the punch.

Ms. TOMERO. Right. There has been long consistency that we have missile defense against a limited attack against the Homeland, but, you know, as—

Senator SULLIVAN. We shouldn't take the risk, though, that Kim Jong-un and the Ayatollah are rational actors and would be deterred by deterrence.

Ms. TOMERO. Again, correct. If they were to launch a limited attack against the United States, that is the mission of missile defense, and we strongly support continuing that—

Senator SULLIVAN. Let me ask another question. So the history, unfortunately, of missile defense—and I do not want to be too partisan here, but typically Republican administrations have supported it, Democratic administrations have not. We made a good breakthrough in this Committee. In 2017, my bill, the Advancing America's Missile Defense Act, had 20 Republican co-sponsors, 10 Democratic co-sponsors. So missile defense has become bipartisan, which is really, really important to make it sustainable.

But I will tell you, I am a little bit worried, and Admiral Hill, here is why I am worried. There are some Senators who are now starting to ask the question, “Hey, do we need it at all?” That is their prerogative, but I think that is indicative of kind of trying to back, hey, now that the other party is in charge we are going to get rid of it. I am also very concerned about the President’s budget, which reflects a 15 percent cut in the MDA’s budget, notably 50-plus programs that the MDA administers, over 70 percent are expected to realize a cut, including the Ground-Based Midcourse Defense program.

So, Admiral Hill, do you have concerns that the requested level of funding will result in reduced readiness and reliability to defend our Nation?

Vice Admiral HILL. Senator, thanks. Great question. First, I will agree with you that missile defense should always be a bipartisan issue.

Senator SULLIVAN. Yep, and we have made good strides in that regard.

Vice Admiral HILL. Yes, sir. For me and my team—I always call them the stellar team, and we have a noble mission—our mission is plain and simple: protect the American people, protect our forward deployed forces and our allies and friends. So straight on that.

Senator SULLIVAN. So the budget.

Vice Admiral HILL. Yes, sir. So over to the budget. You know, like all—and we talked about this before you arrived, sir, is there is a top-line reduction, and so we had to prioritize, and I think we did it right. So when you see our unfunded priority list, where we had to take our risk was in production. So you will see at the top of that list the need to procure more interceptors, because that is where I had to take risk in order to not see the falloff of availability, reliability of the current GBI fleet. In fact, we make sure that program is rock solid and moving forward with the Service Life Extension Program.

Senator SULLIVAN. But you would prefer not to have a 15 percent cut.

Vice Admiral HILL. I always prefer to be able to have a full balance of science, technology, development, testing, and sustainment support to the services. Absolutely.

Senator SULLIVAN. Thank you. Mr. Chairman, can I ask one final question—I know I am running out of time—and it is one that I am going to depart a little bit from the primary purpose of today’s engagement. It will not surprise you. General VanHerck, as the advocate for the Arctic in terms of the military’s capability, you may have seen the Secretary of Defense and the DepSec, in their confirmation hearings, said that they were going to fully resource the different Service strategies, Arctic strategies. I remain concerned that those strategies are not being effectively implemented by the Army, Navy, and Air Force.

How do you see the Services implementing their respective Arctic strategies as part of this budget’s mission, given your overall role as the Arctic military advocate as the NORTHCOM commander?

General VANHERCK. Senator, I think when I look at the fiscal year 2022 budget, I see an inching along in all of the Service. I am

encouraged they all have strategies, and the Department has a strategy, and my strategy heavily relies on the Arctic. But we did not move the ball very far down the field this year in the budget, with regards to resourcing the Arctic.

Senator SULLIVAN. Thank you. Thank you, Mr. Chairman.

Senator KING. Thank you. Senator Tuberville.

Senator TUBERVILLE. Thank you. General VanHerck, if the NGI development is delayed, do we have a good backup plan, or are we going to fall so far behind we cannot catch up?

General VANHERCK. Senator, there is not a backup to NGI. As I said in my statement, I remain concerned about my capability and capacity to defend against a ballistic missile threat from DPRK, or even if Iran developed one, and slipping longer than 2028 would increase my concern and risk to be able to meet the mission I have been given.

Senator TUBERVILLE. Thank you. General Karbler, have you got anything to follow up on that?

Lieutenant General KARBLER. Just with respect to I provide the soldiers that do the missile defense mission. We train to the threat scenarios. We work very closely with MDA through software development, the testing, et cetera, so as the threat evolves, as the software evolves, our soldiers stay trained and ready for it.

Senator Tuberville. Thank you. Admiral Hill, for the second or third year in a row our number one unfunded priority is a defensive system for Guam. If our number one commander and our number one command is saying that is his number one priority, I believe the best offense is a good defense, and you need both. In your opinion, would a defense system for Guam save the American people money and free up ships for the Navy?

Vice Admiral HILL. Senator, thank you. You sound like a coach. [Laughter.]

Vice Admiral HILL. Absolutely, right. So when I look at the defense of Guam, and anybody looks at it, you have to have a sensor architecture, you have the fire control network, and you have to have weapons to protect it. If you are going to base there, if you are going to leverage offensive power and to power projection from Guam, you have to protect it.

So yes, I believe that we do save money. If there was a way for us to free up the ship station so we could give those ships back to the maneuver force of the Navy, that is what we want to go do. So we are looking at regional system. We are in the middle of that study now, and as soon as we have that architecture laid down we will come and see you.

Senator TUBERVILLE. How many ships does it take, moving in and out, to protect?

Vice Admiral HILL. So generally, if you are going to have one station, you are going to need four ships. You have got one coming, you have got one going, you have got one in the training cycle, and one under repair.

Senator TUBERVILLE. Wow. Does NGI involved with the threats we are seeing build from North Korea and other malign actors, will we be prepared?

Vice Admiral HILL. With NGI I believe we will be prepared, and I think the reason why, if you take a look at what the intelligence

sources tell us, the first intelligence, we know that those threats are not going to just be unitary, single-shot devices. They are flying with countermeasures, they are flying with multiple re-entry vehicles, multiple maneuver vehicles. So the NGI answer to that, and having two companies, two great American companies, moving forward and competing against each other to beat the timeline and to reduce the risk in the program, we are going to come forward with a capability that has multiple warheads on it, that can reduce the shot doctrine.

That is our goal. I want to make the job for General VanHerck and his reliefs downstream much easier, to where they do not have worry about numbers of missiles in the arsenal, that they have the capability they need to take on what is coming at us. We know, by looking at the threat projections and where they are going, that we have got to take on that higher complexity threat.

Senator Tuberville. Thank you. That is all.

Senator KING. I want to thank you all very much. Thank you for your service and for your dedication to this complex, difficult, and important mission. Thank you for your testimony here today, and I will make the same statement I did to the prior panel. If there are thoughts that you have that you think would be helpful to us, please supply them to the Committee between now and the beginning of next week.

Thank you again all for your service, and we will look forward to working with you in the defense of our Nation.

Thank you. The hearing is adjourned.

[Whereupon, at 6:07 p.m., the Subcommittee adjourned.]

[Questions for the record with answers supplied follow:]

#### QUESTIONS SUBMITTED BY SENATOR DAN SULLIVAN

##### ARCTIC COMMUNICATIONS

1. Senator SULLIVAN. General VanHerck, as part of this year's budget process your command, USNORTHCOM and NORAD, submitted four unfunded priorities totaling \$135 million. One of those requirements is a carry-over from last year to provide Arctic communications above 65 degrees north latitude. Last year, \$130 million was included in the USNORTHCOM and NORAD Unfunded Priority List to support Arctic communications, of which \$50 million was authorized and appropriated in fiscal year 2021, leaving \$80 million unfunded. Can you highlight the progress made to date on the Arctic communications initiative and explain why Congress should fully fund the remainder of this priority? What risks will USNORTHCOM/NORAD be accepting if this capability is not resourced appropriately?

General VANHERCK. The \$50 million appropriated in fiscal year 2021 enabled the Air Force Research Laboratory (AFRL) to purchase 51 satellite communications terminals, activate space internet service contracts with Starlink and OneWeb, and begin testing and experimentation with NORAD and USNORTHCOM terminals. These terminals will be deployed this summer to various North Warning System sites and Thule Air Base, both Arctic based, for system resiliency and terminal operations experiments, as well as data fusion experiments conducted with NORAD control centers. Additionally, the U.S. Coast Guard will perform system mobility tests while underway on the icebreaker USS *Healy*. While DOD is not buying launches or satellites, the planned SpaceX launch schedule will provide a total of 500 polar-orbit spacecraft accessible under the AFRL contract by June 2022.

Congressional support for the fiscal year 2022 \$80 million unfunded priority would enable development of mobile and fixed-site user terminals compatible with current and planned future commercial systems. The fiscal year 2022 funding would also allow AFRL to scale up its data fusion and C2 system integration efforts, and test advanced analytics to maximize the capability of Arctic sensors. Access to reli-



able communications in the high North is key to maintaining a persistent presence in the Arctic. Without the improved communications provided by this unfunded priority, USNORTHCOM and NORAD will incur increased risk to air sovereignty operations due to insufficient communications capacity and bandwidth as competitors increase their presence and capability in the Arctic. This risk will hinder effective command and control of operational missions, complicate search and rescue operations, and decrease senior leaders' decision space.

#### MISSILE DEFENSE AND STRATEGIC DETERRENCE

2. Senator SULLIVAN. General VanHerck, Vice Admiral Hill, and Ms. Tomero, how does our ballistic missile defense system provide flexibility in our strategic deterrence posture and complicate an adversary's calculus?

General VANHERCK. The United States ballistic missile defense system (BMDS) provides deterrence by denial by causing rogue state leaders to doubt their ability to successfully strike the United States with a ballistic missile. The deterrent effect generated by the BMDS allows U.S. strategic assets to maintain a more flexible and sustainable alert posture and complicates potential adversaries' calculus by giving them reason to question their own planning and the capability of their weapons systems. Deterrence by denial is underpinned by the U.S. policy of deterrence by punishment, through which the United States possesses the capability and reserves the option to respond to a ballistic missile attack by retaliating with strategic weapons.

Vice Admiral HILL. United States (U.S.) missile defenses support a comprehensive and layered approach to prevent and defeat adversary missile attacks. Currently deployed U.S. missile defenses complicate the calculus of rogue states by undermining confidence in the likelihood of success of a strike against the U.S. homeland. The U.S. relies on nuclear deterrence to address the large and sophisticated intercontinental-range nuclear missile threat from strategic competitors.

Ms. TOMERO. In a regional context, missile defense is one component of the U.S. capability to counter anti-access/area denial (A2/AD) missile centric strategies that seek to impede the United States from supporting allies and partners in contested regions. In this role, effective missile defense provides a critical tool for shaping an adversary's risk-benefit decision calculus. It can undermine an adversary's confidence in its ability to achieve its intended political or military objectives through missile threats or attacks, and provide incentives for restraint. If an adversary miscalculates and deterrence fails, integrated air and missile defense, along with offensive capabilities and passive defense measures, can limit an adversary's capabilities to disrupt U.S. regional military operations through missile attacks on U.S. forces and infrastructure.

#### RUSSIAN AND CHINESE NUCLEAR MODERNIZATION

3. Senator SULLIVAN. Dr. Soofer, Ms. Tomero. General VanHerck, Vice Admiral Hill, and Lieutenant Karbler, do you believe that Russian and Chinese nuclear modernization is the result of the US fielding Ground Based Interceptors as part of its ballistic missile defense system?

Dr. SOOFER. Russian and Chinese nuclear modernization is not the result of the US withdrawal from the 1972 ABM treaty and the fielding of GBIs. In 2014, Russian Foreign Minister Sergei Lavrov stated, "I don't think we are on the verge of a new arms race. At least, Russia definitely won't be part of it. In our case, it's just that the time has come for us to modernize our nuclear and conventional arsenals."

Some suggest that Russia's development of a nuclear-powered cruise missile and nuclear-powered long-range underwater torpedo is a response to United States missile defense plans, but I tend to agree with Rose Gottemoeller, former Obama New START negotiator, who says that Putin "is after nuclear weapons for another reason—to show that Russia is still a great power to be reckoned with. These exotic systems have more of a political function than a strategic or security one."

Finally, if United States missile defense was truly a driver for Russian nuclear modernization, then we would have expected Russia to increase the size of its strategic nuclear arsenal after the United States withdrew from the ABM Treaty in 2002. As it turns out, the United States withdrawal announcement coincided with the Moscow Treaty, which reduced United States and Russian strategic nuclear arsenals from 6,000 to 2,200 deployed warheads. The initial deployment of GBIs did not lead to Russian nuclear modernization or expansion, but rather the reduction of Russian strategic nuclear forces.

Ms. TOMERO. United States Homeland defenses are designed against a limited threat from North Korea or Iran. We rely on strategic nuclear deterrence to address the larger and more sophisticated arsenals of China and Russia. The size and sophistication of Russian and Chinese strategic systems could easily overwhelm the

capacity of U.S. homeland missile defenses. Both China and Russia have stated their claimed the need for novel systems, including hypersonic glide vehicles, to improve missile penetration and counter missile defense systems. However, many factors, other than missile defense concerns, also shape Russian and Chinese nuclear modernization efforts, including their perceptions of their national interests and strategic objectives. Section 1692 of the National Defense Authorization Act for Fiscal Year 2020 required an independent study on other States' reactions to U.S. homeland defenses. This report, delivered to Congress in January 2021, made similar observations. We will remain cognizant of adversaries' potential perceptions of our missile defenses that could impact strategic stability while we protect our capacity to defend against missile threats from North Korea and Iran.

General VANHERCK. I believe United States Ground-Based Interceptors are one of several factors contributing to Russian and Chinese nuclear modernization. Based on their public statements, Moscow and Beijing fear that United States cyber and precision strike capabilities could be used to attack their regimes during a future conflict. They worry that U.S. missile defenses incentivize such a strike by degrading their ability to retaliate, even though U.S. missile defenses are not designed against a peer competitor threat. Another major factor in Russian and Chinese modernization efforts is an effort to maintain a flexible and survivable nuclear force and replace Cold War-era systems that are approaching the end of their service lives.

Vice Admiral HILL. The Missile Defense Agency (MDA) defers to OSD(Policy), but recognizes that current and planned missile defense capabilities are not designed to negate or undermine the strategic nuclear capabilities of Russia and China. The United States relies on nuclear deterrence to address those threats.

Lieutenant General KARBLE. No. I concur with the Intelligence Community (IC) assessment; they do not believe the Russian and Chinese nuclear modernization is a direct result of United States fielding Ground Based Interceptors, only an attempt to modernize an aging nuclear missile capability. According to the IC, ballistic missile proliferation continues to grow as countries acquire a greater number of ballistic missiles, including increasing their range, incorporating BMD countermeasures and making them more complex, survivable, reliable, and accurate.

#### NORTH KOREAN MISSILE CAPABILITIES

4. Senator SULLIVAN. General VanHerck and Vice Admiral Hill, at the INDOPACOM posture hearing earlier this year, then-INDOPACOM Commander ADM Davidson's statement for the record noted that, "... North Korea will remain our most immediate threat." ADM Davison went on to state, "Pyongyang maintains a diverse and growing missile inventory, and North Korea unveiled several new ballistic systems ... including two SLBMs and an ICBM." He concluded that, "Pyongyang's missile research and development efforts ... are consistent with the regime's stated objective of being able to strike the U.S. Homeland." How has North Korea's missile program advanced over the course of your respective command assignments?

General VANHERCK. Since I assumed command last summer, North Korea has unveiled a new ICBM design that is probably even more capable than the homeland-threatening ICBMs it successfully tested in 2017. It has also unveiled two submarine-launched ballistic missiles that—if fielded—may be able to threaten portions of North America. Although North Korea has not tested nuclear weapons or ICBMs since 2017, its continued tests of short-range ballistic missiles provide experience with technologies applicable to its long-range missile program. Finally, Kim Jong Un has announced his intent to develop solid-propellant ICBMs, hypersonic weapons, and nuclear-propelled submarines. If successfully fielded, each of these capabilities would pose new challenges to my homeland defense mission.

Vice Admiral HILL. Since mid-2019, North Korea has tested dozens of missiles, including three types of new short-range ballistic missiles and a new submarine-launched ballistic missile (SLBM). It unveiled several new ballistic systems during military parades in late 2020 and early 2021, including two SLBMs and a new Intercontinental Ballistic Missile (ICBM) considerably larger and presumably more capable than the systems they tested in 2017. North Korea also identified several new weapon modernization goals in early 2021, to include developing tactical nuclear weapons and hypersonic glide vehicles and improving the readiness and accuracy of North Korea's ICBMs. Pyongyang's missile research and development efforts, coupled with its ongoing pursuit of nuclear material and technology, are consistent with the regime's stated objective of being able to strike the United States Homeland.

## ARCTIC STRATEGY IMPLEMENTATION

5. Senator SULLIVAN. General VanHerck, as you know, the Department of Defense and each of the military departments have now published their respective Arctic strategies. During their confirmation process, I received commitments from SECDEF Austin and DEPSECDEF Hicks that they would resource those strategies. During the hearing we discussed the progress that has been made on implementation of these Arctic strategies and our shared concern that it is not happening at a quick enough pace. Can you elaborate on your assessment of the DOD's implementation of the Service's Arctic strategies?

General VANHERCK. I am encouraged by the attention the Department is paying to strategic competition and homeland defense challenges in the Arctic. However, the small resource allocation adjustments the Services made in their fiscal year 2022 budgets will not achieve the objectives laid out in their Arctic strategies or those of the USNORTHCOM and NORAD Strategy. If the Joint Force does not prioritize resourcing for Arctic initiatives, the Department will continue to cede advantages in operational capability and strategic influence to our competitors. I believe the Department must provide clear direction to the Services to make substantive annual increases in Arctic-focused resourcing in order to re-establish the Joint Force's ability to operate persistently in the region and outpace potential adversaries across all domains and warfighting functions.

