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HEARING

ON

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2021

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED SIXTEENTH CONGRESS

SECOND SESSION

SUBCOMMITTEE ON STRATEGIC FORCES HEARING

ON

FISCAL YEAR 2021 PRIORITIES FOR MISSILE DEFENSE AND MISSILE DEFEAT PROGRAMS

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FISCAL YEAR 2021 PRIORITIES FOR MISSILE DEFENSE AND MISSILE DEFEAT PROGRAMS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON STRATEGIC FORCES,
Washington, DC, Thursday, March 12, 2020.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2212, Rayburn House Office Building, Hon. Jim Cooper (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. JIM COOPER, A REPRESENTATIVE FROM TENNESSEE, CHAIRMAN, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. COOPER. The subcommittee will come to order. The purpose of this hearing will be to receive testimony on DOD's [Department of Defense's] fiscal 2021 budget request for missile defense programs.

Before I welcome the witnesses, I would like to note that this will be the final hearing for two people; one is our wonderful staffer, actually the minority staffer, Sarah Mineiro, who has done a superb job over her tenure here, and she will be sorely missed. Also, it is my understanding that Christina Chaplain will maybe only be appearing one more time but she has done a great job with GAO [Government Accountability Office]. So we are deeply appreciative for both of your services.

The witnesses today are General O'Shaughnessy, Vice Admiral Hill, Lieutenant General Karbler, Dr. Soofer, and Ms. Chaplain. Thank you all for participating.

There are many things I could go into. I will just ask unanimous consent that my statement be inserted for the record and turn to Mr. Turner, the ranking member, for his remarks.

[The prepared statement of Mr. Cooper can be found in the Appendix on page 31.]

STATEMENT OF HON. MICHAEL R. TURNER, A REPRESENTATIVE FROM OHIO, RANKING MEMBER, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. TURNER. Thank you, Mr. Chairman. I, too, I want to thank Sarah for all of her hard work and dedication. It has been wonderful to work with her. And what has been exciting I think has not just been her work for all of the members but, really, all of the agencies and all of the organizations that interface with our committee has always given you incredibly high marks and has appreciated your professionalism and your substantive knowledge.

Mr. Chairman, this year has been marked by tremendous success and disappointment across the missile defense enterprise. In March of 2019, the Department successfully conducted its first ground-based intercept of a complex threat-representative salvo launch.

As part of that test, MDA [Missile Defense Agency] also used their space-based kill assessment system to confirm the intercept. They have used data at their C2BMC [Command, Control, Battle Management, and Communications] system and then it did it again with a second interceptor. It was an impressive feat. Even you, Ms. Chaplain, acknowledge that it may be the most challenging test in the program's near 30-year history.

Unfortunately, just a few months later, in August of 2019, the Department of Defense terminated the Redesigned Kill Vehicle [RKV] program, which was supposed to address reliability issues in our existing fleet of interceptors. That cancellation incurred $1.2 billion worth of sunk costs and declared a 10-year delay in a critically needed upgrade to our homeland missile defense capabilities. Perhaps the most disappointing part of this cancellation is that the failures leading to this action, both on the contractor and the government side, have eroded our confidence in the agency.

The President's budget request for fiscal year 2021 across the missile defense and missile defeat enterprise totals $20.3 billion. The majority of that money is for the Missile Defense Agency, which represents $9.2 billion; $7.9 billion in regional and strategic missile defense capabilities across the services and the DOD; and $3.2 billion in left-of-launch activities.

While $20.3 billion is an admirable amount, missile defense still managed to take significant cuts to their program this year. Notably, this year's budget cancels the Homeland Defense Radar-Hawaii and the Pacific Radar. It zeroed out all funding of high-powered lasers for unique missile defense requirements. It zeroed out MDA's budget of hypersonic and ballistic space sensors and reallocated it somewhere in the Space Development Agency.

These kinds of budget choices indicated significant lack of judgment in determining which requirements are being pursued in our missile defense enterprise, coupled with the acquisition failure of the RKV. I remain skeptical of the near-term programmatic direction of missile defense.

While I anticipate significant challenges in the direction, priority, and scope of this year's missile defense budget request, there are some opportunities that I fully support. This year's budget request includes $206.8 million for hypersonic defense. It is a time of great power competition, with the Russians fielding strategic hypersonic weapons and the Chinese developing regional hypersonic weapons. We need to actively develop the capacity to defend ourselves from these threats.

With this year's budget request, the Aegis Ballistic Missile Defense fleet will grow to 48 deployable ships to provide forward-deployed regional missile defense, and supportive partners, and allies. The fiscal year 2021 budget request includes $495 million for the procurement of THAAD [Terminal High Altitude Area Defense] interceptors. By fiscal year 2021, the THAAD program will have delivered 7 THAAD batteries and 351 interceptors, which have deployed globally to support our troops, partners, and allies.

Lastly, the budget request attempts to address the problems caused by the cancellation of RKV. It funds the Next-Generation Interceptor, which is meant to be an All-Up-Round replacement for GBI [Ground-Based Interceptor].

There are still a lot of programmatic and requirements-based uncertainty about that program. General O'Shaughnessy, I look forward to hearing your testimony on the requirements for this system. And Admiral Hill, I want to hear how you will balance those requirements with an acquisition strategy that produces capability for this Nation within a reasonable timeframe.

From all of our witnesses, I am interested in your perspectives on how the DOD will provide Congress the ability to perform its oversight responsibilities rigorously.

This budget also funds the Department's new architectural approach to filling the gap in homeland missile defense capabilities caused by RKV cancellation by an approach called Underlayer, this idea to use modified Aegis and THAAD systems to augment homeland missile defense capabilities where feasible.

MDA's fiscal year 2021 budget request asks for $39.2 million for exploring the possibility of modifying the Aegis Weapon System for layered homeland defense. MDA also requested $139 million to develop an extended-range THAAD.

It is my sincere hope that these capabilities can rapidly be developed and fielded to help address the very real capability gaps we will experience in our homeland missile defense system in near to mid term.

This year's missile defense budget is important, not only because of what it chooses to fund but also what it chooses to zero out. It serves as a testament to the policies and priorities of the Department of Defense. While I have always been a strong supporter of this mission, I have deep and justified skepticism of the program's direction, transparency, and accountability of the current enterprise.

To all the witnesses, thank you for being with us today. I look forward to your testimony and continued dialogue on these critically important issues.

Mr. COOPER. I thank the gentleman.

Now, I would like to ask unanimous consent that non-subcommittee members, like Ms. Stefanik, be able to ask questions as well.

And then I would like to ask unanimous consent that the written testimony of all the witnesses be inserted for the record and we would ask you to do a 5-minute summary of your written testimony.

So without further ado, General O'Shaughnessy.

STATEMENT OF GEN TERRENCE J. O'SHAUGHNESSY, USAF, COMMANDER, UNITED STATES NORTHERN COMMAND AND NORTH AMERICAN AEROSPACE DEFENSE COMMAND

General O'SHAUGHNESSY. Well, thank you, and Chairman Cooper, Ranking Member Turner, and distinguished members of the committee, I am truly honored to be here today as the Commander of U.S. Northern Command, as well as the North American Aerospace Defense Command. And I am also pleased to testify alongside

Dr. Soofer, Admiral Hill, General Karbler, and Ms. Chaplain. And thank you for allowing us to submit our written testimony for the record, sir.

USNORTHCOM [United States Northern Command] and NORAD [North American Aerospace Defense Command] are charged with executing the National Defense Strategy's number one objective, defend the homeland. Our adversaries have watched, they have learned, they have invested to offset our strengths, while exploiting our weaknesses. They have demonstrated patterns of behavior that indicate their capability, their capacity, and their intent to hold the homeland at risk below the nuclear threshold. And the changing security environment makes it clear that the Arctic is no longer a wall, the oceans are no longer protective moats; they are now avenues of approach to our great homeland and this highlights the increase in our adversaries' presence in the Arctic as well.

To meet this challenge, we need to invest in a capable and persistent defense that can deter adversaries, protect our critical infrastructure, enable power projection forward, and prevent homeland vulnerabilities from being exploited. And to deter, detect, and defeat the threats arrayed against our homeland today, USNORTHCOM and NORAD are transforming our commands and our way of thinking.

We cannot defend the Nation against 21st century threats with 20th century technology. We must be able to outpace our adversaries using a layered defense infused with our latest technology. To do so and secure our competitive military advantage, we will continue to partner with our Nation's defense and commercial industry to transform rapidly evolving science into leading-edge digital-age technology.

The Strategic Homeland Integrated Ecosystem for Layered Defense, or what we are calling SHIELD, is the architecture we need to defend our homeland against adversary threats. As such, our layered defense needs to establish awareness in all domains, from below the oceans to the highest level of space, including the unseen cyber domain, which are all at risk. We need a layered sensing grid with Ground-Based Interceptor now and Next-Generation Interceptor in the future, as well as an underlayer lined with sensors that deliver domain awareness, and the command and control systems that drive engagements, long before approaching our sovereign territory. We need the ability to deploy defeat mechanisms capable of neutralizing advanced weapon systems in order to defend the homeland.

We have put great effort into these areas, such as a ballistic missile defense, along with the need to aggressively defeat additional threats, to include the ever-growing cyber and cruise missile threats. The Next-Generation Interceptor, underlayer, and a layered homeland defense architecture will give us the capability we need to counter tomorrow's ballistic threat.

We have worked closely with the Missile Defense Agency to identify and incorporate trade space and bring the timeline left. The Joint Requirements Oversight Council met earlier this week to discuss all aspects of the program and everyone in the Department is

shoulder to shoulder with the plan to proceed to include time as a key factor.

The pending release of the NGI request for proposal will look to further incentivize industry to deliver this capability to the warfighter as soon as possible.

We are also addressing another priority to achieve synergy between ballistic missile defense and cruise missile defense. This will allow us to take advantage of inherent capabilities that can apply to both efforts and open up opportunities for smarter funding and technical decisions across both programs.

We are mindful of the gravity of our mission and the trust you have placed in us. Aligned with the NDS [National Defense Strategy] in capturing our sense of urgency, we at USNORTHCOM and NORAD have declared 2020 as the year of homeland defense and are moving forward with the implementation of SHIELD. You in the committee should have great faith in the men and women at USNORTHCOM and NORAD because together we have the watch.

Thank you for your support and I look forward to your questions.

[The prepared statement of General O'Shaughnessy can be found in the Appendix on page 32.]

Mr. COOPER. Thank you, General.

Now, Vice Admiral Hill.

STATEMENT OF VADM JON A. HILL, USN, DIRECTOR, MISSILE DEFENSE AGENCY

Admiral HILL. Chairman Cooper, Ranking Member Turner, and distinguished members of the subcommittee, thank you for your continued strong support for the missile defense mission. I welcome this opportunity to testify before you today, side by side with the warfighter, policy, and GAO.

The Missile Defense Agency continues to deliver missile defense capability and capacity to the warfighter, while supporting warfighter readiness to defend our homeland, forward-deployed forces, allies, and partners against existing and emerging threats. I am happy to report, this past year, we advanced the missile defense program on several fronts. And as you know, and as mentioned earlier, 1 year ago, our homeland missile defense system, the Ground-Based Midcourse Defense, passed a significant milestone when we successfully executed the first salvo intercept-flight test against a threat-representative intercontinental ballistic missile with countermeasures. We successfully intercepted the re-entry vehicle with a Lead Ground-Based Interceptor and the next most lethal object with a Trail interceptor.

Along with integration and testing later this year, we are preparing for initial fielding of the Long-Range Discrimination Radar [LRDR] in 2021. The LRDR in Clear, Alaska, is our most advanced ground-based radar and, once operational, it will provide a persistent tracking and discrimination capability to improve defense of the homeland against long-range ballistic missiles.

We are making progress on the Aegis Ashore Poland site. However, significant work does remain to complete military construction activities before we can begin installing the Aegis Weapon System. Completion of this work will delay NATO [North Atlantic Treaty Organization] acceptance to no earlier than 2022.

In close coordination with the Army Corps of Engineers, we recently implemented additional contractual measures to guide the prime construction contractor towards completion of prioritized tasks. MDA and the Corps are working closely with European Command to minimize the operational impact of the Poland Site delay by accelerating the upgrade of the Aegis Ashore Romania Site, operational today, to support SM–3 Block IIA operations, which is now complete.

Today's operational missile defense system meets the current threat. 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.

When I fleeted up as the director last June, it was clear that a major reorganization of the Agency and realignment of talent was required. It remains a priority for me to structure the Agency to increase responsiveness, speed, and efficiency in an increasingly complex all-domain threat environment.

We intend to improve business practices, resource stewardship, and talent management. There is more work to be done but we are on solid ground.

This new organization is postured to take on the development, engineering, testing, and delivery of the Next-Generation Interceptor, or the NGI. We are leveraging investments made in both the RKV and MOKV [Multi-Object Kill Vehicle] programs to begin development of this new homeland defense interceptor. We are working closely with the intelligence community and combatant commands to finalize the right set of requirements for NGI to counter a projected threat in the Aleutians. General O'Shaughnessy mentioned we completed the JROC [Joint Requirements Oversight Council] this week and that is a positive move forward.

The Department plans to award two competitive NGI development efforts this year and, based on the government's 75 percent confidence schedule, we anticipate emplacing the first NGI All Up Round, after sufficient intercept testing, as early as 2028.

Now NGI represents significant investment, time, and effort but is the first holistic assessment of all warfighter top-level and technical requirements the Department has conducted since the initial system operations began in 2004. This will work to ensure NGI paces the threat for years to come.

Now working closely with Strategic Command, Northern Command, and Indo-Pacific Command, we are also undertaking architectural work in advanced technology development needed to support hypersonic missile defense and cruise missile defense of the homeland. A critical part of this architecture is a persistent space-based global sensor capability to provide full track custody supporting fire control engagements. We are also pursuing advances in joint all-domain and global command and control to support Northern Command in countering cruise missiles.

Finally, MDA is investing the development of a layered homeland defense capability by adding sensors and modifying the Aegis Weapon System, the SM–3 Block IIA missile, and the THAAD Weapon System, and communications, command, and control.

Later this year, we will conduct the first Aegis/SM–3 Block IIA intercept of a simple ICBM [intercontinental ballistic missile]. We are also assessing upgrades to the THAAD interceptor for testing against an ICBM. I want to emphasize that these regional missile defense systems are not replacements for the long-range missile defense capability provided by GMD. However, these capabilities within a layered homeland defense architecture provides flexibility and options for the Nation to increase the effectiveness of our defenses.

Thank you and I look forward to answering the committee's questions.

[The prepared statement of Admiral Hill can be found in the Appendix on page 52.]

Mr. COOPER. Thank you, Admiral.

Now, Lieutenant General Karbler.

STATEMENT OF LTG DANIEL R. KARBLER, USA, COMMANDING GENERAL, U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND AND COMMANDER, JOINT FUNCTIONAL COMPONENT COMMAND FOR INTEGRATED MISSILE DEFENSE

General KARBLER. Chairman Cooper, Ranking Member Turner, and distinguished members of the subcommittee, I am honored to testify before you today. Thank you for supporting our service members, our civilians, contractors, and their families, and your continued support to Army air and missile defense.

I am here today as the Army's proponent for air and missile defense, its forces and capabilities, and as the commanding general responsible for 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 competitors worldwide, the Army air and missile defense enterprise is working hard to ensure our warfighters and our homeland are protected.

Air and missile defense is one of the Army's six modernization priorities and the Army continues to accelerate delivery of capabilities and capacity, as outlined in the enterprise framework for modernization, Army Air and Missile Defense 2028.

For example, the first five prototype systems of interim, mobile, short-range air defense are in government testing. And per the fiscal year 2019 National Defense Authorization Act, the Army selected Iron Dome as the Indirect Fire Protection Capability's interim cruise missile defense solution.

We also continue to explore high-energy lasers, which have great potential as a low-cost effective complement to kinetic energy to counter rockets, artillery, mortars, cruise missiles, and unmanned aircraft systems. The Army continues to press towards interoperability among sensors and shooters, as well as further integrating space capabilities into multi-domain operations.

Critically important systems include the Army's five TPY–2 forward-based mobile radars and four joint tactical ground stations providing missile warning from space-based sensors. In all of its air and missile defense missions, the Army seeks the balance of capa-

bilities, both offensive and defensive, to counter threats left of launch and throughout all phases of flight in any weather in a denied, degraded, or contested environment.

Finally, let me emphasize that people are our greatest strength. The dedicated service members, civilians, and contractors who develop, deploy, and operate our Nation's air and missile defense systems, as well as their families who are just as much a part of our team. The continued support of Congress is critical to our ability to develop and retain our highly qualified and mission-ready team.

I look forward to addressing your questions.

Thank you.

[The prepared statement of General Karbler can be found in the Appendix on page 74.]

Mr. COOPER. Thank you, General.

Dr. Soofer.

STATEMENT OF DR. ROBERT SOOFER, DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR NUCLEAR AND MISSILE DEFENSE POLICY

Dr. SOOFER. Chairman Cooper, Ranking Member Turner, and distinguished members of the Strategic Forces Subcommittee, thank you for the opportunity to testify on U.S. missile defense plans and programs in support of the fiscal year 2021 budget request.

The United States missile defense policy supports the National Defense Strategy. It is driven by the evolving missile threat and continues to be guided by the 2019 Missile Defense Review. Our Nation's first priority remains defense of the homeland against rogue nation ICBM threats, while we rely on nuclear deterrence to address the more numerous and complex nuclear threats posed by China and Russia.

To pace the North Korean ICBM threat, the administration has announced the fielding of an additional 20 Ground-Based Interceptors for the protection of the homeland. I will say more about this in a moment.

Our second priority is to provide missile defense protection for our deployed forces and allies against increasingly complex regional missile threats. Integrated air and missile defenses support our freedom of maneuver and ensure the United States can reinforce allies and coalition partners during times of crisis and conflict, which serves to deter conflict at the outset. We continue to prioritize cooperation with allies and partners, some of which have come under missile attacks recently.

Finally, we seek to hedge against evolving missile threats and unexpected adversary developments by investing in advanced missile defense technology, the most important of which is space-based sensors for tracking.

Recent changes in the Department of Defense plans to field an additional 20 Ground-Based Interceptors for the defense of the homeland have been of keen interest to the subcommittee. Like General O'Shaughnessy, OSD [Office of the Secretary of Defense] Policy leadership is concerned with the resulting delay but concur with the chosen course of action as a best means to address the rogue-state missile threat, as it evolves.

The specific concern is that such delay could create security risks for the United States, should the North Korean ICBM threat mature faster than we can field new Ground-Based Interceptors. This is a difficult judgment to make because, while we are well-protected today, there is uncertainty about how quickly the threat will evolve.

In this regard, the Department is taking a number of steps to move towards a more effective layered approach to homeland defense. As you have heard, we are improving the reliability of the existing GMD system through a service life extension program. We are fielding additional advance discrimination radar in Alaska, developing a new space-based system to track more sophisticated missiles, such as hypersonics, and exploring options for a layered homeland missile defense capability, which could be available mid-decade and would complement the fielding of the Next-Generation Interceptor planned for the end of the decade.

Building out this layered architecture, combined with strike operations to counter mobile missiles prior to launch, once deterrence fails, provides a prudent strategic approach to defeating missile attacks against the United States from rogue states over the decade.

I look forward to your questions and I thank you for your time.

[The prepared statement of Dr. Soofer can be found in the Appendix on page 103.]

Mr. COOPER. Thank you, Doctor.

Ms. Chaplain.

STATEMENT OF CRISTINA T. CHAPLAIN, DIRECTOR, CONTRACTING AND NATIONAL SECURITY ACQUISITIONS TEAM, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Ms. CHAPLAIN. Chairman Cooper, Ranking Member Turner, and members of the subcommittee, thank you for asking me to discuss the GAO's findings and recommendations on the Missile Defense Agency's acquisition practices.

In the 16 years that we have been mandated to review MDA's progress, we have considered its acquisition programs to be high risk. This is partly due to the sheer technical design and engineering challenge of developing an integrated ballistic defense system but also due to the schedule pressures MDA faces, the changing nature of the threat, and practices that exacerbate the risks already inherent in the mission.

These high-risk practices have included too much overlapping of acquisition activities, which we refer to as concurrency. Very simply, this might mean beginning to fabricate systems before designs are fully known or going into production before completing flight testing. While concurrency can help speed up the acquisition process, it also means our problems come with greater consequences.

In the past, we have also found that MDA reports to the Congress did not provide sufficient insight into costs, schedule, and progress. In addition, new programs were initiated without fully assessing alternatives or effectively consulting with warfighters or stakeholders, such as the intelligence community.

MDA was still able to develop and field a limited homeland and regional ballistic defense capability but there were also program cancellations, delays, added costs, and gaps in knowledge about

performance that could have been avoided using sounder approaches.

In recent years, MDA has taken important steps to reduce acquisition risk. For example, it has improved oversight reporting, increased its outreach to stakeholders, and increased the accuracy of its models and simulations. Importantly, it has also taken steps to reduce concurrency. For example, full-rate production was postponed until problems with the SM–3 Block IB were corrected.

While these and other changes are significant, more can be done, as illustrated with the recent cancellation of the RKV program. First, MDA can take additional actions to incorporate knowledge and perspectives of stakeholders. In the early stages of the RKV program, for example, concerns raised by warfighters and independent experts about the design of the RKV went unheeded. In the end, the same design issues were the principal reasons for the program's cancellation.

As it plans its Next-Generation Interceptor, we are seeing that MDA is taking actions to work better with stakeholders and, more broadly, it is assessing how to better engage the intelligence community.

Second, as was the case with RKV, MDA still resorts to tests, reducing tests, or adding concurrency when experiencing developmental delays or schedule pressures. Both practices tend to be harmful; one reduces knowledge about performance, the other increases the cost and time needed to deal with any performance problems that are discovered. The pressure to go fast has also resulted in entering contracts without finalizing their terms, which makes it more difficult to oversee contractor performance.

We recognize the threats are real and the need to broaden missile defense capabilities is, indeed, urgent but there are also other ways to help speed the process, such as on-ramping new technologies only when they are matured, developing additional suppliers so there is more competition and more alternatives, rigorously assessing the range of alternatives before initiating new programs, taking swift action to stop or redirect efforts when they are not working, and strengthening systems engineering capacity and the government's knowledge about a program's technical baselines. Such actions put the programs on a better footing but they do require more resources and focus up front.

Again, we see MDA is working on these challenges but they will not be easy to overcome. We also recognize that Congress and DOD are looking at different facets of missile defense, including acquisition, the transfer of systems to the military services, and MDA oversight. These studies are important as MDA is at a pivotal crossroads, needing to balance its ability to pursue new missions, while also maintaining its existing portfolio.

We look forward to working with the agency as it addresses any recommendations from these studies, as well as our own, and moves forward with its new programs.

Thank you. And also thank you to Sarah Mineiro for her support with GAO.

I am happy to answer any questions you have.

[The prepared statement of Ms. Chaplain can be found in the Appendix on page 115.]

Mr. COOPER. Thank you very much.

It is my understanding that the first series of votes will be about 10:30. So, I am hoping we can conclude the public portion of this hearing by then.

I am going to forego my public questions and save most of my time for the closed session but I would like to yield my time now to Ms. Stefanik.

Ms. STEFANIK. Thank you, Chairman Cooper. I appreciate you yielding your time. I also want to echo my colleagues' comments about Sarah Mineiro. You have been a tremendous asset to this committee, and we are grateful for your service, and wish you the best on your next steps.

I wanted to start off by asking you, General O'Shaughnessy, with the cancellation of the RKV, coupled with emerging threats that we face, I would like your comments and assessment on the critical need for an east coast missile defense to ensure that we do, indeed, have a layered defense, specifically, the Next-Generation Interceptor.

General O'SHAUGHNESSY. Yes, ma'am, thank you for the opportunity because I do think it is important that we do consider that we have to be able to respond to the threats. In other words, we don't own the timeline. Our adversaries own the timeline in the sense that they develop capabilities and we have to maintain the ability to defend against them.

I can tell you today I can defend against the rogue-nation threats that are current, for example North Korea. I also have the ability with our current system to defend against, for example, in Iran, if they were able to develop said capability.

My biggest challenge now going forward will be, as we do look at NGI and the follow-on versions thereof, that we maintain that competitive advantage.

Things that we need to consider: We have Fort Greely. We have holes that have literally already been dug that we need to fill with capability with the NGI. Following that, we would probably need to continue to assess the capacity, as well as the geography, of where we think threats would be coming from. I think that assessment has been happening. The continental interceptor site work that has been done is certainly going to inform that, as we go forward, to how do we maintain our ability to defend against these threats.

Ms. STEFANIK. And Mr. Soofer, I want to go to you.

As you know, it was—Fort Drum has been released publicly by the Secretary of Defense as the preferred location for any potential east coast missile defense. Is that your understanding?

Dr. SOOFER. Yes, it is, Congresswoman.

Ms. STEFANIK. Thank you.

With that, I am going to yield back to Mr. Cooper.

Mr. COOPER. Thank you.

Mr. Turner.

Mr. TURNER. Thank you.

Admiral Hill, we were able to have a conversation yesterday about the cancelled RKV and the opportunity to pick up time. Could you tell me about that process?

As you know, all of us on this committee have been very disappointed at the projection of the time period for getting that program back on track. I am very fond of saying we put a person on the moon in a shorter period of time than we are being told that the RKV will be redesigned. Could you tell us of your efforts in that and give us any hope that we might actually be able to have capability within what would be a reasonable time?

Admiral HILL. Yes, sir. Thanks for the opportunity to respond to the question.

As I sit here, I feel the pressure of two warfighters on either side of me. They have been very clear that the time and schedule is priority one, in fact it is requirement one that was approved by the JROC this week.

So what we have done is we have taken a holistic look at not just the development timelines, not just going flight test, but we have backed that in to the evaluation of the bids. So once we release the request for proposal and we go into the evaluation period of the bids when those are delivered to the government, within that process, we intend to have the warfighter as a part of that effort.

And to give you an example, normally what you would do in any competition, if one of the proposals does not meet one or several requirements, you would typically just dismiss that contractor from play. We are going to take a very close assessment and if there is the inability to meet a requirement, let's just say, instead of over by two points you are under by two points, we don't want to remove that contract. We want to take an assessment to see if there is schedule that we can buy from not meeting that requirement and then we will go to the warfighter who is participating in that process to get approval to adjust the requirements so that we can keep that contractor in play to buy that schedule. So that is one example within the evaluation process of the bids.

So it is very important for me. One of my highest priorities right now working within the Department is to get the request for proposal on the street so that we can get bids on the table. You know we have mentioned before the 75 percent schedule and that is just kind of lingo from our side in the acquisition world, where you would have a 50 percent confidence of what you would normally go with. We wanted to really dig into the schedule. So we are at a 75 percent, which gives you that 2028 timeframe. We know that working with industry through the evaluation process we can have opportunities to pull in schedule. So, there is the evaluation period.

When you get into development, we have a series of knowledge points. We have a series of milestones as we track through each major event. And again, we are going to keep the warfighter engaged.

I am very happy, even though the JROC is not an MDA process, that General Hyten has stepped in. He has told me, personally, he wants to help. And the help of having the four-star-level service chiefs engaged in how we are doing through a development is unusual but I think it is necessary in order for us to capitalize on any schedule advantage we can get through the development, sir.

Mr. TURNER. We are currently coming to the test of an SM–3 Block IIA against an ICBM target. It has been somewhat controversial in this committee. Could you please describe how impor-

tant this test is, what we intend to accomplish, and what you think the outcome might be?

Admiral HILL. Yes, sir. I agree that it is a very important test, just so that we can understand what we see in ground testing, and modeling and simulation. Does that realize itself in an actual flight in the most closely operationally realist event that we can do?

So we are going to launch the same target that was used during the successful FTG–11. That was a salvage shot with GMD. We are going to launch that target—we are calling it a simple ICBM because that was the congressional direction—do a defense of Hawaii scenario. So defense of Hawaii very important but understanding how the SM–3 responds in that very stressing end game is going to be important data that you can't get from models or from ground testing.

So we will launch the ICBM. It will fly through the field of view of the sensor coverage. And then we will fly that long range and we will have the ship mission planning, putting herself in the proper position, and shoot the SM–3. We have two onsite that we are preparing. So we have a primary and a backup. So we brought in everything that we need to do to be successful in that test.

The modeling simulation shows us today that we are going to have a very high PK [probability of kill] but it is going to be very stressful on the front end of the missile because it wasn't designed to do this. So we are operating outside the design space, not just for the SM–3 but also for the Aegis Combat System. But based on the analysis, we are very confident we are going to succeed in that test, which is coming up here soon.

Mr. TURNER. General Karbler, we have sustained casualties, again, in Iraq from rocket attacks. People have been very concerned about our lack of missile defense that protects our troops there. Could you please speak about what needs to be done to provide some type of coverage for our troops in Iraq?

General KARBLER. Yes, sir. Thanks for those questions.

I have been a career air defender for 32-plus years and defense of our forward deployed forces, and allies, and assets is a critical priority.

As you know, there is a significant number of air and missile defense assets that are deployed to the CENTCOM AOR [United States Central Command area of responsibility] right now. And I do know that General McKenzie is in the process of bringing those air and missile defense assets into Iraq.

The COCOMs [combatant commands], they determine the posture and how they will employ their AMD assets to best meet their intent and to minimize risk. We can also further minimize risk, not just through active defense but also through passive defense measures, such as the early warning that was provided to our soldiers in Iraq during the Iranian launches in January, as well as the hardened sites and dispersion.

I will tell you the PRES BUD [President's budget] 2021 does provide continued funding to our critical air and missile defense capabilities. So Patriot, Indirect Fire Protection Capability, and Maneuver-Short-Range Air Defense, which gives us that multi-layered, multi-threat air and missile defense capability, again, to reduce the risk to U.S. forces and our allies.

We talk a lot about countering UAS [unmanned aircraft systems], the SECDEF—Secretary of Defense designated the Secretary of the Army as the DOD Executive Agent for the Joint Counter Small UAS Office, headed up by Major General Sean Gainey. They will look at developing the joint doctrine requirements, training, and material solutions to get after the current and emerging small UASs as part of the threat set.

Mr. TURNER. I yield back. Thank you.

Mr. COOPER. Thank you.

Mr. Carbajal.

Mr. CARBAJAL. Thank you, Mr. Chair, and welcome to all of you today.

Admiral Hill and Ms. Chaplain, what steps are being taken to ensure that the Next-Generation Interceptor does not have the same fate as the GBI and the RKV? The GMD program has cost more than $40 billion, an enormous amount of money spent on the EKV [Exoatmospheric Kill Vehicle] program, which has produced a system with a very poor record. The RKV program wasted $1.2 billion trying to fix the kill vehicle. Are you convinced things will be different this time?

And let me just say that this is my second term in Congress and I have sat on HASC [House Armed Services Committee] all of this time. It is very difficult to go back to my constituents and just continue to justify all that we allocate in the NDAA [National Defense Authorization Act] for the Department of Defense, when time and time again we have these wastes. We have systems that don't work. We don't have the checks and balances that correct the course. And quite frankly, I have got to tell you, it just, it is frustrating.

I am a Marine and I want us to have the best national defense possible but it sure is alarming and disconcerting when we have a waste of money that consistently comes up in the DOD. And it is extremely difficult to go back to my constituents and yet again vote for another NDAA that we want to make sure shores up our military readiness and our national defense but this just happens time and time again. And quite frankly, for me, it is a broken record.

And so I am very curious about your reactions.

Admiral HILL. Sir, thanks for the question.

I will tell you that I am laser-focused on the fact that the country has invested and continues to support defense against long-range rogue threats. I remain concerned about that. The whole reason why we have a GMD system is to protect this country, protect your backyard, protect my backyard, protect our children. I have high confidence in that but we can turn to the warfighter to get a confidence check from them.

I look back at the data from FTG–11 and one of the newest missiles flying one of the oldest missiles. That was a dual salvo. To me, it builds a lot of confidence in today's GMD fleet. The Aegis fleet, strong. The THAAD fleet, strong. What we do with Patriot and how we bring those all together and link them, whether it is regional and in the future for homeland defense, to me, I think that is a very good path to be on, particularly against today's threat and then where we are going.

For NGI specifically, some things that we are doing different, and it may sound a little geekish to you, but it is very important that you get the requirements right. So we started there by working closely with the intelligence community. And I want to tell you it was a little bit of a rough ride, as you come through assessing what the threat would be and all of the uncertainties. But based on our best knowledge and the best people sitting around the table, we set those threat requirements and we had those approved through the JROC. The operators approved those requirements. So that is very important to me.

And then you look at the kind of contract approach that we are taking here. What we are going to do is compete. So we are going to have a competition at the All-Up-Round level. This is not just the kill vehicle. It is the All-Up-Round level because it is so important that we address all technical and warfighting requirements at the All-Up-Round level. Because it is operating within a larger system, we need to make sure that we have got the whole missile right.

We are funded to take two contractors through preliminary design. And if there are enough resources in the program, we are going to go all the way through critical design. And if I had it my way, we would go all the way to flight testing and have ourselves a dual production line. Competition is key and then rigorous technical evaluation all the way through.

So I think we have set this up to do it right. We have learned a lot. You know, as frustrated as I am and as you are with the RKV program, we learned a lot from that and we are making sure that we have laid down the right requirements working with the warfighter, working with threat community, and then getting into the development and the contract approach.

Thank you, sir.

Mr. CARBAJAL. Ms. Chaplain, thank you.

Ms. CHAPLAIN. So I would agree with the actions that he has already cited and we concur they are very positive. We also see the MDA as trying to make sure there are some key flight tests before they do go into production, which is a good sign. And then they are also emphasizing early parts testing, which was an issue in the last program.

On the other hand, RKV itself started out with good intentions and good practices as a foundation. And it was just later in the program when things started going—when they started experiencing delays and problems, that they went back to some of these high-risk practices.

So we are hopeful that things will be better. We are very encouraged by the interaction with stakeholders this time, and the intention to get Department-wide buy-in, and to adopt some better acquisition practices, but still cautiously optimistic because we have seen other programs start out with good intentions, too.

Mr. CARBAJAL. Thank you, Mr. Chair. I yield back.

Mr. COOPER. Thank you. The gentleman's time has expired.

Before we move to the next question or let me note that Admiral Hill mentioned the term laser-focused in his oral reply and General O'Shaughnessy had mentioned it twice in his written testimony. I

would suggest that is an inappropriate term, since the laser activities have been zeroed out of the NDAA budget this time.

Mr. Rogers.

Mr. ROGERS. That is why I like him.

Dr. Soofer, we have heard General O'Shaughnessy and Admiral Hill both talk about the importance—and you talk about the importance of this space-based sensor for both ballistic and hypersonic missiles.

In the last NDAA, we instructed, Congress instructed that that development take place in the NDAA. It was, as we understand, moved over to the Space Development Agency. And then in this year's PB–21 [President's budget for fiscal year 2021], it says that it has been transferred to SDA.

Who is working on this sensor capability?

Dr. SOOFER. Congressman, may I defer the answer to Admiral Hill, who works closely with the Space Development Agency and——

Mr. ROGERS. I am all for whoever can answer my question.

Admiral HILL. Sir, thanks for the question.

As you know, MDA had been plussed up over the years to start the development and initiate the hypersonic ballistic tracking sensor system. That was always meant to augment the systems we have today, so we can handle the evolution of the ballistic threat, dim targets, and to track the unpredictable maneuvers globally for the hypersonic threat.

A decision was made during the budget formulation of PB–21 to take those dollars out of the Missile Defense Agency and place them within the Space Development Agency.

Mr. ROGERS. Who made that decision?

Admiral HILL. I——

Mr. ROGERS. Congress directed it to be done in MDA.

Admiral HILL. Yes, sir. It was made within the Department.

Mr. ROGERS. Who made that decision?

Admiral HILL. I believe it was recommended by Dr. Griffin. He mentioned that recently in public.

What he was trying to do—he is trying to consolidate the dollars for space because it is such an important capability that we need. And so by having it run by, basically, the architect for the proliferated capability, Dr. Tournear, as the Director of SDA. There is no light between us. We are working very, very close.

What I do recognize as a concern for the Congress is visibility into how those dollars are leveraged and making sure that MDA is in charge of building that sensor. There has been no change in that strategy for MDA to remain the developer for that sensor and to provide that to SDA as part of their architecture.

Mr. ROGERS. Well, I like Dr. Griffin but he should have come back to us and talked to us about that before that decision was made.

So tell me now. Who is doing the development? Is it you or SDA?

Admiral HILL. It is the Missile Defense Agency for HBTSS [Hypersonic and Ballistic Tracking Space Sensor], as part of an SDA architecture.

Mr. ROGERS. Okay. Do you feel like you are making substantial or significant progress?

Admiral HILL. I think we are. We have been very focused in, first, on we did the AOA [analysis of alternatives]. We came through our concept of operations. We have worked very closely on what we consider to be the highest risk, which is, you know, how do you deal with clutter, when you are looking down from space and you are trying to track things that are maneuvering globally. That was the highest risk for us and remains that highest risk. And we are moving towards a demo of what we call signal chain processing.

So we are on track.

Mr. ROGERS. I want to go back to your last answer. I want to understand how you are doing the development of the space-based sensor but the money has been moved to SDA.

Admiral HILL. Yes, the intent is for SDA to provide funding back to MDA to continue the development work and provide those sensors to the SDA architecture.

Mr. ROGERS. Okay.

General O'Shaughnessy, what is your requirement for a space-based sensor?

General O'SHAUGHNESSY. Sir, we are very much aligned with Admiral Hill in the sense of urgency to be able to take advantage of all sensors, both terrestrial sensors and then, ultimately, space-based sensors. Why I think that is so critical now is we see the advancement of things like hypersonic glide vehicles, where it is no longer a trajectory flying in a ballistic manner that you can have a radar contact, a radar vector that then you can translate into the impact area.

Now with the hypersonic glide vehicles, you need to maintain custody of that vehicle to be able to give the appropriate warnings for our Strategic Command as well.

And so to me, it is not just about using it from the defeat side but it is also the warning side. And to me, the only way you are going to get that is with space-based sensors.

Mr. ROGERS. In your best military judgment, do you believe that we have adequately funded or the Presidential budget is adequately funding your requirement?

General O'SHAUGHNESSY. Sir, I would say we need to continue to invest in this, as critically important going forward. I think we have the initial funding but I do think we need to maintain a focus on this because this is going to be key going forward to our overall homeland defense design.

Mr. ROGERS. I will take that as a no.

Admiral, Poland Aegis Ashore, what a nightmare that has turned into. Tell me the contractor is eating the cost for these overruns and not the government.

Admiral HILL. Sir, thanks for asking that question.

I recently met with General Semonite and it was a tough meeting because we were looking for a way to get more predictability into that schedule. I will tell you, for as long as I have been onboard, that has just been very hard to measure. You know so when you have a construction contract that is a firm fixed price and how you check to see that work is being done, it is not the way you would do it in another kind of a contracting scheme.

And so we work very closely with the Army Corps to say let's do two things and we have done this in the last 2 weeks. The Army Corps has refused to offer payment to submittals that are coming in from the company today, from the construction contractor. That is sending a message. In fact, their surety company is onsite. So we know the message is being heard.

We have prioritized very specific items within the contract now. We are no longer giving them the freedom to just go work on what they want to work on. That is not predictable. So we have said these are the priority areas that support the Aegis Combat System install and check. And as you know, the Aegis system is boxed up in temperature-controlled boxes onsite, ready to be installed.

And so we are very impatient and so we are working very closely with the Army Corps to really leverage and pressurize the contractor.

It could move into the direction where none of us really wants to be, but for now we are giving them a chance but it is kind of a carrot-and-stick approach.

Mr. ROGERS. Thank you.

Admiral HILL. Here are the priorities and we are not going to pay you until we get those done.

Mr. ROGERS. Thank you very much.

I yield back.

Admiral HILL. Yes, sir.

Mr. COOPER. Now, Mr. Garamendi.

Mr. GARAMENDI. The surety agent is at the site?

Admiral HILL. Yes, sir, on ground doing an assessment for the company.

Mr. GARAMENDI. Which basically means what?

Admiral HILL. What that means is they are preparing to either move out and complete as fast as they can or preparing for the government to terminate.

Mr. GARAMENDI. That is what I thought it meant. In other words, deep, deep trouble, correct?

Admiral HILL. I would say that we have a go path——

Mr. GARAMENDI. When the surety arrives, there is trouble.

Admiral HILL. Not always. I think this is actually a positive.

Mr. GARAMENDI. The insurance policy is about to be in place.

Moving on, I guess this goes to Admiral Hill and Ms. Chaplain: What specific steps are being taken to make sure that the Next-Generation Interceptor does not follow the same problematic development process that the GBI and RKV followed?

The GMD program has cost more than $40 billion—I should have been paying attention. Well, thank you very much. The question is asked. I was reading ahead. My apologies.

Admiral HILL. Well, sir, could I ask to add just a little bit because Ms. Chaplain has spoke to it?

Flight testing and fly before you buy is really important and I neglected to mention that before. Within that plan, we intend to go to a quick series of two intercepts before we go to production. And I will tell you the coordination that we are doing in the building is just important. The fact that DOT&E [Director Operational Test and Evaluation] has approved that strategy for moving forward in NGI is just one of the many things that we are doing differently.

And I am not sure if you heard the prior answer. So, I will stop there.

Mr. GARAMENDI. I think I have been caught not paying attention. That sometimes happens.

There is a whole lot of questions here and the one I really would like to go to is a comment made by the Russian Deputy Foreign Minister saying that the planned U.S. test of the SM–3 IIA against an ICBM can only mean one thing—the United States has started to develop a system that is to be used against us, Russia, and to build up a potential that can devalue the Russian means of nuclear deterrence.

How are we evaluating that and what does it mean with regard to New START [Strategic Arms Reduction Treaty] and other treaties?

Dr. SOOFER. Mr. Garamendi, as you know, over the years, Russia has made such comments. They hate U.S. missile defense. They have always hated missile defense and they always will.

I will just say that that comment represents a bit of hypocrisy. Russia already deploys 68 Ground-Based Interceptors, nuclear interceptors. They have more interceptors protecting Moscow than we have protecting the United States.

In addition, sir, they also field the S–400 and they are fielding, beginning to field the S–500, which has capabilities against ballistic missiles. So what I am suggesting is that they already understand the value of missile defense.

Now the second way I would address that question is we have gone to great pains, both in the context of the Aegis Ashore site in Europe and, potentially, with the SM–3 IIA underlay, to point out to Russia that their missiles are just too technically sophisticated for us to address with the SM–3 IIA missile and the numbers are just overwhelming.

For instance, you know they have—they are allowed 1,550 nuclear warheads under New START. Compare that to the number of GBIs that we have and the potential number of SM–3 IIAs and you know that the Russian concern is just one that is made up and meant to divide us from our allies.

Mr. GARAMENDI. I will let it go at that.

Dr. SOOFER. Thank you, sir.

Mr. COOPER. Thank you.

Mr. Brooks.

Mr. BROOKS. I apologize for being tardy. We had a briefing on COVID–19 by a number of individuals and it lasted over an hour. So, that is where I was spending a lot of my time.

If these questions have already been asked, please let me know, but, if not, then answer them.

The first one is to Lieutenant General Karbler. To meet future operational needs, especially against a peer adversary, the warfighter should be able to leverage space-based assets tactically. Can you speak to the committee on the need for the Army to have access to beyond-line-of-sight information collected by space-based assets and why it is important to have access to that information from theater?

General KARBLER. Yes, sir. As we know, back in January, when Iran launched its missiles into Iraq, the Army JTGS, the Joint Tac-

tical Ground Stations, those operators, they provided the direct downlink from satellites to that theater early warning architecture and were able to immediately provide early warning to the soldiers and joint forces that were deployed in Iraq to allow them to take cover and thus reduce potential killed in actions.

Mr. BROOKS. Vice Admiral Hill, the Department of Defense will be developing several major defense systems over the next decade, including but not limited to the Next-Generation Interceptor, the Ground Based Strategic Deterrent, and the W93 warhead. Frankly, I am worried that we will soon outstrip our capacity for conducting the required testing on the designs and the components of these systems.

In your opinion, where should we be investing today in order to avoid having the testing phase become a bottleneck for these programs?

Admiral HILL. Great question and thank you for that.

You know, part of the NGI strategy is to work closely with industry to strengthen the industrial base. Dr. Griffin has been pushing very hard for increased investment in the two areas that you are really asking about, and that is, you know, the parts that we require to operate in that environment, both from a natural environment and from a hostile environment, there are a limited number of those facilities that are available.

So if I were to say what is the choke point or the long pole in this sort of development, again, a very complex weapon system, a very important weapon system, it is those test facilities.

Mr. BROOKS. What should we be doing in order to help ensure that those test facilities are not a bottleneck?

Admiral HILL. We should continue to increase our investment in those areas and I will just give you an example of one of them.

The Michigan State University National Superconducting Cyclotron is one of the key areas where we test for operating in the space environment and it is closing this year. So that takes you down to a smaller number. And because the number is not that big—and I will save that for the other session, to give you a sense of the numbers of sites that we can go to.

So it is limited and there is competition, as you mentioned. There will be Next-Generation Interceptor parts and designs that are going through. There will be the Ground Based Strategic Deterrent. I am concerned about that as an industrial base issue.

Mr. BROOKS. Also for Vice Admiral Hill: In your written testimony, you state that you, quote, anticipate the first Next-Generation Interceptor round will be available to the warfighter as early as 2028, end quote.

Given the expected threat environment, is there any optimism within the Missile Defense Agency or the Department of Defense at large to accelerate this timeline?

Admiral HILL. Yes, sir, I think we have measures in place that will pull that in. You know, when you look at a government estimate, that is one thing. You need to get the request for proposal out on the streets, get the bids in by industry so we can evaluate.

And I mentioned earlier, sir, before you got in, but it is an important thing to go back to, the evaluation process will include the warfighter. If we see something in a proposal that buys us time,

I am going right to General O'Shaughnessy saying that we need to lower that requirement to meet that, to keep that industry partner in play. We want to take every opportunity throughout that evaluation process to buy time. And then once we get into development, we are going to take every opportunity to buy time.

We already know, by doing some smart things in our qualification process and in the testing process, that we can buy some time but we won't know until we get bids on the table.

Mr. BROOKS. Well, my questions were each directed at a particular person but that meant that there are four others who may have opinions that they would like to share. If any of the other panelists would like to share their insight with respect to any of those questions I have asked, please do so.

General O'Shaughnessy.

General O'SHAUGHNESSY. Thank you, sir. I would like to highlight the work that is being done right now and has been being done for 4 or 5 months now with MDA. And that is specific to the question you mentioned about the time.

And in the end you can't just say bang your spoon on the table and say I want it sooner. You end up having to have a discussion about trade space. And what is the trade space? And what are the long poles that are driving this long acquisition timeline from a technology standpoint? And ultimately, how does that intersect with requirements?

And so what I am really pleased with is Admiral Hill and his team, and his willingness to really roll up the sleeve with our warfighters to really have that discussion about trade space. What are the things that potentially we could relax a requirement that would give the timeline an ability to come left? And you actually end up with a less risk in the end state because you actually get the capability sooner.

And so it is a balance. It is a tradeoff. It is trade space. It is working with industry. It is working with MDA. Those are discussions that we are having and that is what we will have to have as we go continue on into the future.

Mr. BROOKS. I see my time has expired. Thank you, Mr. Chairman, for giving us an extended period.

Mr. COOPER. Thank you.

Mr. Moulton.

Mr. MOULTON. Just a couple questions and I will defer then to the classified hearing.

But, you know, if you look historically back to the 1980s with Star Wars, you can trace a lot of Russian missile developments to our development of missile defense. And I see a lot of nodding heads there.

How do we break that cycle? Admiral Hill, you want to take a stab at that?

Admiral HILL. Sure. I sort of like the Spy vs. Spy thing that I grew up watching.

Yes, so we did learn a lot from the days of SDIO [Strategic Defense Initiative Organization] and many of those technologies have been incorporated into the systems that we have today.

I mentioned earlier about the close coordination with the intelligence community. Ms. Chaplain brought that up. I read very care-

fully the reports that are coming from the GAO and we are taking those on. And one of the key things is is having a close coupling with DIA [Defense Intelligence Agency], NASIC [National Air and Space Intelligence Center], MSIC [Military and Space Intelligence Center], all the different intelligence community folks. And as we came through the threat assessment to present to NORTHCOM, and NORTHCOM did their own independent look at the intelligence, that is when you get out of this game of going back and forth. You have to project forward as far as you can without making an [inaudible], but you need to project forward with the best people you have got in the country. And I think that we brought them all to the table and we developed a solid set of requirements that will ensure that when we put that first NGI in the ground out there in the late 2020s, that it is ready to perform and can be upgraded along the way, through development and upgrade it once it is in the ground, to take on increasing threat sets.

Mr. MOULTON. But my understanding is that our, from a strategic perspective, missile defense program is not designed to go after the Russian threat.

Admiral HILL. That is correct. Our charter is for the rogue threat but, unfortunately, the rogue threat is increasing its capability.

Mr. MOULTON. But you answered my question in terms of Russian modernization, by saying that we are trying to modernize our——

Admiral HILL. I am sorry. I was talking about the modernization of the Next-Generation Interceptor and the GMD program, the U.S. defense side.

Mr. MOULTON. My question is more fundamental. Are we just in a never-ending escalatory cycle? Because every time we develop more advanced missile defense, the Russians develop more advanced architecture?

Admiral HILL. Let me—since Dr. Soofer is——

Mr. MOULTON. There are whispers from behind me that it is not true but it is true. It absolutely is true. This is how it has gone. And at some point, it is just not strategically stable to be headed down this path.

Dr. SOOFER. Sir, may I?

I would like to take question with your assumption that U.S. missile defenses have led to an expansion of Russian offensive, you know, an action-reaction type of phenomenon.

Mr. MOULTON. Well, you can take issue with that but I have heard this from the Department of Defense.

Dr. SOOFER. Well, let me give you an example, if I could, sir.

So under the Bush administration, the second Bush administration, we pulled out of the ABM [Anti-Ballistic Missile] Treaty, right, but we also initiated a massive reduction in offensive forces, from 6,000 to about 2,200. There was no arms buildup on behalf of the Russians. Even Ronald Reagan, when he announced his SDI [Strategic Defense Initiative] program, we managed to get the START Treaty offensive reduction.

So you have always had missile defense and offensive reductions. They are not inconsistent.

Mr. MOULTON. Yes, but they also don't necessarily go hand in hand. We got an offensive reduction because we pursued that treaty.

Dr. SOOFER. Even though we were also pursuing missile defenses.

Mr. MOULTON. That is not—that has nothing to do with the fact that Russia is modernizing their forces to beat our missile defenses. Those are—they are not connected.

Dr. SOOFER. We pursued both missile defense and offensive reduction.

Mr. MOULTON. I understand we pursued them and that is why we got both of them.

Dr. SOOFER. Right.

Mr. MOULTON. But that does not disprove the argument—there is a logical disconnect here. That does not disprove the argument that if we are pursuing missile defense, Russia is modernizing its forces. And so we are in this never-ending escalatory cycle, where the more that we pursue missile defense, no matter what we say about it being aimed for a rogue threat, Russia continues to modernize its forces.

Dr. SOOFER. I would just say, in response, Russia began its recent modernization of its nuclear forces well before we began deploying our 44 Ground-Based Interceptors.

Mr. MOULTON. When did they begin that?

Dr. SOOFER. They have been doing this for probably at least 15 years.

Mr. MOULTON. Exactly. It goes back to the SDI initiative in the 1980s. That is exactly where it goes back to.

So I just want to understand from a strategic perspective here where this goes.

Dr. SOOFER. If you look at our budget request, sir, we are not planning a major expansion of our missile defenses. We have 44 Ground-Based Interceptors. We are going to add 20 to 64. The Russians understand this.

Mr. MOULTON. If the Russians understand this, then why does the Defense Minister say something quite different—or the Deputy Foreign Minister, when he said that the planned test of an SM–3 IIA against an ICBM can only mean one thing: The United States has started to develop a system that is to be used against us and to build up a potential that can devalue the Russian means of nuclear deterrence?

Dr. SOOFER. Sir, they do that to influence our allies and to influence our Members of Congress.

Mr. MOULTON. Okay, so explain that a little further, since you are making a——

Dr. SOOFER. We are having this exchange here. You are using a statement by a Russian Foreign Minister to push back against our development of missile defenses.

Mr. MOULTON. But what does it matter to Russia if we can protect ourselves from a rogue missile?

Dr. SOOFER. It shouldn't. Exactly right.

Mr. MOULTON. It doesn't affect their nuclear deterrence.

Dr. SOOFER. Exactly right. You are exactly right, sir. And so they protest too loudly. They should not be protesting.

We are protecting ourselves against North Korea. We made that clear in policy terms. And in programmatic terms, that is obvious.

Mr. MOULTON. Okay, fine.

Dr. SOOFER. So why are they——

Mr. MOULTON. I will just say that the intelligence community has testified to us that they disagree with you.

Dr. SOOFER. It is more complicated than that, sir, and I look forward to showing you evidence on both sides of the equation.

Mr. MOULTON. Well, I look forward to sharing some more evidence with you, as well.

Dr. SOOFER. Thank you, sir.

Mr. COOPER. Thank you.

Now, our honorary member, Mr. Lamborn. We all look forward to his appearance.

Mr. LAMBORN. Thank you, Mr. Chairman.

And I was late getting here. I was in another HASC subcommittee until recently, a few minutes ago. So, tell me if you have already answered this question. I don't want to duplicate anything.

General O'Shaughnessy, it is always good to see you. Being that you are in close proximity to U.S. Space Command, the former Air Force Space Command, which is temporarily based, hopefully permanently based in Colorado Springs near you, what are the synergies that you have in working together as two major parts of our defense.

General O'SHAUGHNESSY. Well, clearly, the decision hasn't been fully made yet relative to the final basing of that. But what I can speak to is both when it was Air Force Space Command and then now as it is, as you mentioned, temporarily located there, there is, indeed synergy. In fact, General Raymond is literally my neighbor, as well as our buildings are co-located next to each other.

But we do find, especially with respect to the transitioning of some of the mission set from STRATCOM to Space Command, as well as Space Command has stood up, that there is a synergy between the ballistic missile defense and those that are providing the sensor capability, in order to give the attack warning as well.

And so our teams work closely together. There is a geographic advantage there but I will say some of that was based on the Air Force Space Command being there, originally, as well. But I will say our teams are very, very tight.

Mr. LAMBORN. Excellent. Okay, thank you.

General Karbler, a totally different subject, Iron Dome. In CENTCOM, are there opportunities to use Iron Dome, which is a proven anti-missile technology that the Israelis developed and have produced, partly, with our tax dollars, that we could be taking more advantage of to protect our assets and our people?

General KARBLER. Sir, specific to Iron Dome, the Army will field its first two batteries here at the end of the year. It will take some time for us to field those and train up the soldiers on those capabilities, before we are certified to be able to deploy it.

So in the near term, I would say no, not feasible yet. And we will have to do the assessment after we train up the soldiers on the Iron Dome systems when we get them.

To the broader piece, Iron Dome is a standalone system, not easily integrated into what we see as our future for air and missile

defense of the Integrated Battle Command System, which basically looks at any sensor best shooter to deal with the threats that are out there. Iron Dome being standalone, I can't take those separate components of Iron Dome to allow me to optimize our air and missile defense posture.

Mr. LAMBORN. What was that last statement? I didn't catch that.

General KARBLER. I can't take a separate component out of Iron Dome, like the missile or the radar, to be able to integrate into our broader integrated air and missile defense network to use, say the Sentinel radar for Army air defense in the Iron Dome missile using the Sentinel radar data to be able to do that engagement. And that is why—Iron Dome is a standalone system. It just does not fit in well for our future plans.

Mr. LAMBORN. Okay. I hear what you are saying but I don't want to see the perfect be the enemy of the good. I don't want to see a perfect hoped-for and expected capability deter us from using something that is available and usable right now and will save lives.

General KARBLER. Yes, sir.

Mr. GARAMENDI. Mr. Lamborn, would you yield for a moment?

Mr. LAMBORN. Yes.

Mr. GARAMENDI. Earlier today, we discussed in the earlier committee the two lives that were lost in Iraq to Katyusha missiles. Now the Iron Dome is specifically designed for that missile and it doesn't have to be integrated into your grand plan if it is, you know, within 300 miles from that site, where those two men died.

The Iron Dome is deployed, could have been available, but you have a grand plan of some great integration system.

Mr. Lamborn, you are on to something important. Don't give it up.

Mr. LAMBORN. Okay, let's give him a chance to respond.

General KARBLER. Yes, sir. And General McKenzie, right now, is in the process of moving air and missile defense capabilities up into Iraq to protect our soldiers.

Mr. GARAMENDI. And what is the system?

General KARBLER. We would have to go into the closed session to be able to talk about what systems that we are going to be using specifically.

Mr. GARAMENDI. It is reported in the——

General KARBLER. And again, Iron Dome, as we field it at the end of this year, we will look at its operational capability and make an assessment for its deployability, as well as its use in theater.

I agree, it is a combat-proven system. The Israelis have shown it is a very capable system. It is also a system that is used within Israel. So, again, we have to be able to look at how deployable is it. How well can we get it into theater and then operate it with the soldiers, given that it might not be as maneuverable as we might want it to be.

Mr. LAMBORN. Okay, thank you.

I yield back.

Mr. GARAMENDI. You know better.

Mr. COOPER. Mr. Turner.

Mr. TURNER. Thank you, Mr. Chairman.

I just want to go back to Mr. Moulton's question and try to give some clarity as to how Russia's protestation that the United States

missile defense is somehow the cause of their investment in what are new capable weapons and new capabilities.

Under New START, we are both limited to 1,550 warheads, 1,550. So Russia has 1,550 weapons, lethal weapons that are capable of hitting the United States. There are 40 Ground-Based Missile Defense missiles in Alaska. There are 4 in California—44 to 1,550.

So my question to the panel: Is there any—do we have any capability in our missile defense system to even address the least capable of Russia's missiles? Because that would, of course, suggest that they would need to get greater capabilities, if we are able to address their least capable.

Is there anything with those 44 that we are actually able to do in addressing the least capable of Russia's 1,550 warheads that are capable of hitting the United States and/or do we have anything that is currently funded or that you are currently working on that is planned to be deployed that would address the threat of the 1,550 nuclear warheads that Russia has capable of hitting the United States? Anyone.

I mean I believe the answer is no, right? I mean so someone should confirm for us that——

Admiral HILL. I will confirm, sir.

Mr. TURNER. Thank you.

Admiral HILL. It is outside of our charter to design against Russian and Chinese. There is a different strategy for dealing with Russia and China.

Mr. TURNER. And you don't have anything that is capable of addressing 1,550 nuclear warheads that Russia has.

Admiral HILL. The numbers and the capabilities, no.

Mr. TURNER. And there is nothing that you are developing, nothing the Missile Defense Agency has, nothing that is currently planned to be deployed.

So their least capable, meaning that they would have no need to seek additional capabilities, is still not addressed by what we have deployed or are planning on deploying through the Missile Defense Agency's work, correct, Admiral?

Admiral HILL. That is correct.

Mr. TURNER. All right, thank you.

Mr. COOPER. The committee will be in recess and reconvene almost immediately in 2337. It is my information that votes on the floor have been delayed. So there is a possibility we can conclude the closed session fairly soon. Thanks.

[Whereupon, at 10:41 a.m., the subcommittee proceeded in closed session.]

A P P E N D I X

March 12, 2020

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

MARCH 12, 2020

Opening Statement of Hon. Jim Cooper
Chairman, Subcommittee on Strategic Forces
"Fiscal Year 2021 Priorities for Missile Defense and Missile Defeat Programs"
March 12, 2020

Good afternoon. The subcommittee will come to order.

The purpose of today's hearing is to receive testimony on the 2021 budget request for missile defense and defeat programs.

Here today to testify are General O'Shaughnessy, Vice Admiral Hill, Lieutenant General Karbler, Dr. Soofer and Ms. Chaplain. We have a breadth of experience at the table, and I thank you for participating in today's hearing.

At this time, I would like to take a moment to thank Ms. Christina Chaplain, as I understand we will see you again at our PB21 Space hearing, but these engagements will be your last with the Government Accountability Office. In going through all the documentation provided by the Department on the Redesigned Kill Vehicle cancellation, it has become apparent to me that it would have been wise for Congress to have headed GAO's warnings and looked more closely at the RKV program and its flaws. You consistently raised the issues that eventually led to cancellation of the program, and perhaps if we would have listened, we would not have wasted $1.2 billion. I hope moving forward we do not repeat these past mistakes, as I know GAO will continue to review and assess the Next Generation Interceptor – and we must listen this time.

Now looking onto the PB21 budget request, unlike the exceptional cost growth we see across all other Strategic Forces areas, by the Department's own accounting, PB21 missile defense efforts are $1.6 billion less than last year. Now, I am not saying that this lesser number is not appropriate, but as the witness' testimonies note, missile threats to the United States are becoming more complex in both capability and quantity, and some of the reductions taken in missile defense are puzzling. Discrimination efforts have been cancelled. The space sensor layer is underfunded, and despite Congressional direction, was given to the nascent Space Development Agency. Funding for boost-phase intercept efforts has been zeroed.

Meanwhile, the Next Generation Interceptor, the program which emerged from the ashes of the Redesigned Kill Vehicle, looks like a ~$10 billion, ~10 year effort that has already experienced significant churn with regards to requirements, potentially setting up the conditions to have an RKV repeat. And lastly, this budget request's proposal to modify regional missile defense systems to conduct homeland defense missions presents not only significant technical challenges but is a shift in policy that does not appear to have been addressed.

Now, let me turn to my Ranking Member, Mr. Turner for his remarks.

STATEMENT OF

GENERAL TERRENCE J. O'SHAUGHNESSY, UNITED STATES AIR FORCE

COMMANDER

UNITED STATES NORTHERN COMMAND

AND

NORTH AMERICAN AEROSPACE DEFENSE COMMAND

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

SUBCOMMITTEE ON STRATEGIC FORCES

12 MARCH 2020

Introduction

Chairman Cooper, Ranking Member Turner, and distinguished members of the Committee: I am honored to appear before you today and to serve as the Commander of U.S. Northern Command (USNORTHCOM) and North American Aerospace Defense Command (NORAD).

Our commands are driven by a single unyielding priority: defending the homeland. In the years following the Cold War, our nation enjoyed the benefits of military dominance as well as geographic barriers that kept our homeland beyond the reach of most conventional threats. Our power projection capabilities and technological overmatch allowed us to fight forward, focusing our energy on the conduct of operations overseas.

However, our key adversaries watched and learned, invested in capabilities to offset our strengths while exploiting our weaknesses, and have demonstrated patterns of behavior that indicate they currently have the capability, capacity, and intent to hold our homeland at significant risk below the threshold of nuclear war. Eroding military advantage is undermining our ability to detect threats, defeat attacks, and therefore deter aggression against the homeland. This is emboldening competitors and adversaries to challenge us at home, holding at risk our people, our critical infrastructure, and our ability to project power forward.

The threats facing our nations are real and significant. The Arctic is no longer a fortress wall, and our oceans are no longer protective moats; they are now avenues of approach for advanced conventional weapons and the platforms that carry them. Our adversaries' capability to directly attack the homeland has leapt forward, and they are engaged in overt, concerted efforts to weaken our national technological, economic, and strategic advantage. To address this reality, our two distinct but complementary commands are taking significant, vigorous steps to ensure

our homeland defense enterprise is ready to deter, detect, and defeat threats now and well into the future.

Today, USNORTHCOM and NORAD stand more united than ever and are laser-focused on our vital mission to defend the homeland. Just as our adversaries have signaled their intent to hold the United States at risk, we are making it equally obvious that an attack against our country is destined to fail and will result in an unacceptable cost to our adversaries. Even so, we must be clear-eyed about the challenges ahead of us and steadfast in our resolve to defend our nation against committed and well-resourced adversaries.

Threats to the Homeland

The strategic threat to the homeland has entered a new era. Key adversaries Russia and China have deployed and continue to advance a range of capabilities to hold the homeland at risk with nuclear, conventional, and cyberspace weapons, believing it to be an effective means of offsetting Western military advantages and limiting our options in a crisis. These adversaries are also increasingly willing to challenge the United States in the international arena and take actions below the level of armed conflict to erode our global influence. While our adversaries seek to avoid a direct military conflict with the United States, their growing assertiveness increases the risk of miscalculation and gives rise to a threat environment more complex and dynamic than we have seen since the end of the Cold War.

Our adversaries have spent the last 30 years observing our global military operations and forming strategies to negate our conventional military advantages, especially the foundational benefits afforded by our strategic deterrent. A key element of our adversaries' strategy is to develop and demonstrate increasing capabilities to hold the homeland at risk below the nuclear threshold and in multiple domains, believing a credible threat to our homeland will undermine

our diplomats' ability to negotiate from a position of strength and degrade our ability to project military force from our homeland into other theaters.

Russia

Over the last decade, Russia has sought to influence the security environment by developing and deploying conventionally armed cruise missiles capable of reaching targets in the homeland. Russia has spent considerable money and effort to develop a new generation of highly precise cruise missiles that Russian leaders believe will be a credible means of threatening unacceptable damage on our homeland during a conflict. Having demonstrated the utility of these weapons during combat operations in Syria, the Russian military is now working to modernize their air- and sea-based launch platforms.

The Russian air force modernized five BEAR H heavy bombers in 2019, according to the country's Defense Minister, upgrading the aircraft's communications and navigation systems and enabling them to launch the new AS-23 cruise missile. The minister claimed that Russia's heavy bomber force conducted 48 air patrols in 2019 "to ensure a military presence in strategically important areas." Several of these flights approached the homeland and were intercepted by NORAD fighters. The Russian air force demonstrated new levels of cooperation with international partners, including the first-ever deployment of BLACKJACK heavy bombers to South Africa in October and an unprecedented combined air patrol with Chinese medium bombers over the Sea of Japan in July. The Russian air force has announced that its goals for 2020 include the modernization of an additional six BEAR-H bombers and a return to Cold War-era readiness levels for its heavy bomber fleet.

The Russian navy also expanded its operations of cruise-missile capable platforms in 2019, both on and below the ocean surface. In October, foreign press reported that multiple

Russian submarines conducted an exercise in the North Atlantic intended to practice penetrating the West's anti-submarine barrier between Greenland and the United Kingdom. Also in October, President Putin oversaw the Grom-2019 strategic command-staff exercise, which featured live launches of advanced cruise missiles by Russia's heavy bombers and its most capable naval platforms like the Severodvinsk multi-role submarine and the Admiral Gorshkov guided missile frigate. Earlier in the year, the Gorshkov deployed to the Caribbean Sea and made a port call in Havana, well within land-attack cruise missile range of the southeastern United States. President Putin announced in December that Russia plans to double its number of cruise missile-capable vessels by 2023.

Meanwhile, 2019 also saw continued expansion of Russia's military infrastructure in the Arctic. Throughout the year, Russia lengthened existing runways and built new ones at multiple airfields in the high north. In September, Russia deployed a Bastion coastal defense cruise missile unit to the Chukotka Peninsula, opposite the Bering Sea from Alaska, for a first-ever training launch from that region. The missile successfully struck a sea-based target more than 200 kilometers away, according to the Russian Defense Ministry. When deployed to the Russian northeast, this system has the capability not only to control access to the Arctic through the Bering Strait, but also to strike land targets in parts of Alaska with little to no warning.

Finally, Russia continues to modernize its strategic nuclear forces, which it views as the ultimate means to guarantee its sovereignty and survival. Russia made significant progress in 2019 on several of the "invincible" weapons that President Putin unveiled to the world during a landmark March 2018 speech depicting Russia's response to U.S. missile defense developments. In April, Russia launched the experimental Belgorod submarine, which is intended to serve as the launch platform for the Poseidon transoceanic nuclear torpedo. Despite a deadly accident in

August, Russia also continued development work on the extremely long-range Burevestnik nuclear-powered and nuclear-armed cruise missile. In December, a Russian general announced that the Kinzhal air-launched ballistic missile had been placed on "experimental combat duty" in the Russian Arctic. Also in December, Russia announced that its first regiment of Avangard-equipped intercontinental ballistic missiles (ICBMs) had assumed alert duty, marking the world's first operational ICBM armed with a hypersonic glide vehicle payload designed to challenge our missile warning systems.

China

China's rapid military modernization and efforts to extend its military's global reach demonstrate a growing willingness to challenge the United States. Of particular concern to USNORTHCOM and NORAD, China is developing many of the same technologies that the Russians have deployed and may seek to hold portions of the homeland at risk with long-range, conventionally armed precision-strike weapons. In a future crisis, China could use these weapons—along with its world-class offensive cyber capabilities—to attack our logistics nodes in an attempt to frustrate our force flows across the Pacific.

In the meantime, China is also investing heavily to improve the survivability and penetrability of its nuclear forces in an effort to guarantee its ability to retaliate following a strategic first strike. Among the novel weapon systems China is testing is an intercontinental-range hypersonic glide vehicle—similar to the Russian Avangard—which is designed to fly at high speeds and low altitudes, complicating our ability to provide precise warning.

Like the Russians, China also continues to invest heavily in the Arctic, determined to exploit the region's economic and strategic potential as a self-proclaimed "near Arctic" nation. In the last few years, Chinese survey vessels have conducted several deployments to the Bering and

Chukchi Seas, providing familiarity and experience that could eventually translate to Chinese naval operations in the region.

Finally, in the past year we have observed signs of a nascent but growing strategic cooperation between China and Russia—including the combined bomber patrol last July and Chinese participation in multiple Russian exercises.

North Korea

Kim Jong Un has demonstrated the capability to threaten the U.S. homeland with nuclear-armed ICBMs. In 2017, North Korea successfully tested an apparent thermonuclear weapon as well as two ICBM designs capable of ranging most or all of North America—feats only the five permanent members of the UN Security Council had previously achieved.

Following North Korea's last ICBM test in November 2017, Kim declared that the country had completed the research and development phase of its strategic weapons program and would now begin serial production and deployment of these new systems. In the last year, North Korea has tested several new short-range missile systems, demonstrating advancing technologies that could eventually be incorporated into its strategic systems.

During the December 2019 plenary meeting of North Korea's ruling Workers' Party Central Committee, Kim stated it was time for North Korea to take offensive measures to ensure the sovereignty and security of the country and claimed that he would soon unveil a new strategic weapon. While Kim did not specify what this new weapon would be, recent engine testing suggests North Korea may be prepared to flight test an even more capable ICBM design that could enhance Kim's ability to threaten our homeland during a crisis or conflict.

Iran

The Iranian regime has grown increasingly brazen in its strategic competition with the United States, as demonstrated by the ballistic missile attacks on Iraqi military bases hosting U.S. personnel in Iraq in January 2020. While Iran is not currently able to strike our homeland with strategic weapons, it has expended significant resources on ballistic missile and space-launch capabilities and could develop an ICBM capable of ranging the contiguous United States quickly if its leaders chose to do so. In the meantime, Iran retains the ability to conduct attacks in our homeland via its terrorist proxies and its growing cyber capabilities.

Capable Defense—Credible Deterrence

The international security environment and the threats arrayed against our homeland have evolved extraordinarily quickly over a short period of time, and there is every reason to believe this trend will continue for the foreseeable future. Our adversaries have invested heavily in advanced weapons and highly capable delivery platforms, and they have shown indications of their intent to target our homeland if necessary to achieve their strategic objectives. In order to defend against these 21st century threats, our homeland defense enterprise must reflect the fact that the threats to the homeland have expanded beyond the violent extremist threat that led to USNORTHCOM's establishment. Both USNORTHCOM and NORAD have refocused our efforts on deterring and defeating the complex nation-state threats and adversarial strategies that have eroded our military advantage, and our defense priorities should continue to evolve to stay ahead of current and emerging threats identified in the National Defense Strategy.

Our adversaries have the ability to threaten our homeland in multiple domains and from numerous avenues of approach. Whether an attack originates in cyberspace or from the physical approaches to the homeland, we cannot deter what we cannot defeat, and we cannot defeat that

which we cannot detect. In order to effectively defend the homeland, USNORTHCOM and NORAD have developed a Homeland Defense Design (HDD) consisting of three main elements: a layered sensing grid for domain awareness, an adaptive architecture for joint all-domain command and control (JADC2), and new defeat mechanisms for advanced threats, including cruise missiles, ballistic missiles, hypersonic weapons, and small unmanned aerial systems. These three elements are vital to deterring and defeating advanced threats to the homeland, and USNORTHCOM and NORAD are moving with a sense of profound urgency to bring these capabilities into the fight.

Our need to improve our domain awareness begins with developing and integrating advanced sensors capable of detecting and tracking threats no matter where they originate. In order to defend the homeland in all domains, we need a sensing grid with undersea, maritime, land, air, near-space, space, and cyber layers that reach from the seafloor to outer space. These sensors must be able to detect, track, and discriminate advanced cruise missiles, ballistic missiles, hypersonics, and small unmanned aerial systems at the full ranges from which they are employed. The sensors must also detect and track the platforms—aircraft, ships, and submarines—that carry those weapons. A robust and resilient space layer is increasingly critical to provide the earliest possible detection and fidelity of data required.

Stovepiped transmission of data from non-compatible sensors presents a significant impediment to our ability to defend against advanced threats. To overcome this issue, we need a robust architecture for JADC2 to effectively gather data from a myriad of sensors across all domains and share it seamlessly. The architecture must facilitate rapid data fusion, processing, and analytics to feed decision makers at all levels with accurate, decision-quality information at the speed of relevance. Data from any sensor should feed any defeat mechanism, and rapid data

fusion and analysis should provide faster, more precise solutions to all shooters. This architecture will facilitate high-tempo decision cycles for agile, resilient, redundant, and joint command and control. By leveraging a cloud architecture, big data analytics, edge computing, artificial intelligence, and machine learning, this network should sense a threat from one node and engage it precisely and expeditiously from another across vast distances and across all domains.

Finally, we require new defeat mechanisms for cruise missiles, ballistic missiles, hypersonics, and small unmanned aerial systems. As adversary threat systems, employment doctrine, and operational competencies become more numerous, multi-modal, and complex, our current defeat mechanisms will become increasingly challenged. Additionally, the cost ratio of adversary threat missiles to our missile defeat mechanisms is not in our favor. We must flip the cost ratio back in our favor with deep magazine, rapid fire, and low-cost defeat mechanisms.

Homeland Defense in the Digital Age: Leveraging American Ingenuity

Given the number and complexity of threat systems arrayed against the homeland today, we cannot afford the prohibitive costs or extensive time required to develop high-end, custom built, stove-piped systems provided through current acquisition practices. Instead, USNORTHCOM and NORAD have fundamentally changed how our commands engage with defense and commercial industry, and we are proactively seeking out and collaborating with private-sector partners who offer innovative and viable solutions to our most immediate challenges.

Specifically, our commands are collaborating with large and small companies from the commercial tech sector in order to leverage emerging technologies and digital-age approaches with potential homeland defense applications. Under this iterative approach, our commands and our commercial partners have developed a common understanding of our shared challenges and

opportunities over time. In turn, we are allowing our nation's innovators to apply their expertise and propose advanced, innovative solutions using new but proven technology that can be rapidly incorporated into the homeland defense ecosystem in order to improve our domain awareness, JADC2 architecture, and defeat mechanisms.

We are also adapting and evolving how we work with traditional U.S. defense industry. Rather than prescribing specific materiel solutions to the challenges facing our commands, USNORTHCOM and NORAD are engaged in ongoing two-way dialogue with defense industry innovators to share our perspective on the changing strategic environment, emerging threats to the homeland, and operational requirements. We are working with our industry partners to ensure they understand our specific challenges and needs. In turn, our partners are identifying ways to bring new and existing systems into the homeland defense architecture and provide tailored solutions to our unique challenges.

This approach has already shown game-changing potential. Over the last several months, USNORTHCOM and NORAD have collaborated with defense industry, commercial tech partners, and the military Services on successful field demonstrations of emerging sensor, information fusion, and satellite communications technologies. I am excited and encouraged by the results of these demonstrations, and we will continue to lead these experiments and to solicit innovative proposals from established defense industry and emerging tech partners.

As we defend the homeland against complex threats in all domains, our commands absolutely understand that the status quo is not acceptable and that we must act now to build a capable defense that provides a credible deterrent. In an age of rapidly advancing technology, rising strategic competition, and extraordinary innovation, we simply cannot afford to rely on antiquated technology and outdated approaches. To reverse our eroding military advantage, we

are bringing new thinking, new approaches, and new technologies to bear against our adversaries in order to defend our nation and our way of life.

Thanks to the ingenuity and innovation of American defense industry, our nation has fielded the most advanced and capable military in the world. The technical challenges we currently face are significant, but the extraordinary advancements in global commercial logistics and communications over the last decade are clear evidence those challenges are not insurmountable. USNORTHCOM and NORAD will remain engaged with our defense and commercial industry partners to address our most pressing challenges in ways that are proven, adaptable, and affordable.

Cruise Missile Defense

In concert in the National Defense Strategy, homeland defense is the number one priority and focus of USNORTHCOM and NORAD. Advanced cruise missiles now carried by Russian aircraft and submarines present a growing challenge to our current sensor networks and have the range and accuracy to strike military and civilian targets throughout the United States and Canada. As a result, our two commands are actively working to improve our ability to detect, track, and defeat potential cruise missile attacks against the homeland.

At my direction, USNORTHCOM and NORAD have shifted substantial manpower to this critical effort. With the cruise missile threat at the forefront of our minds, our commands are working closely with industry partners to develop a layered sensing grid, build an adaptive architecture for JADC2, and field advanced defeat mechanisms.

Investments in improving our CMD capabilities are necessary to defend our vital facilities and infrastructure, preserve our national ability to project power abroad, and help to safeguard our citizens and vital institutions. We do not need a force field over the entire nation,

but we also cannot present a soft target. We need a sufficiently capable steady-state defense to present a credible deterrent.

And, because the same cruise missiles that hold targets in the United States at risk also threaten our bases, personnel, and allies overseas, improving our defenses at home will have far-reaching impacts both in the homeland and for our forces, allies, and partners abroad. Aligning our defense investments with the stated priorities of the National Defense Strategy will profoundly improve our ability to defend our citizens and our way of life while strengthening each of the elements of our national power.

This is not the first time that a peer competitor has elected to hold our homeland at risk. Early in NORAD's history, when nuclear-armed Soviet bombers first presented an existential threat to the United States and Canada, our nations faced down that daunting challenge by establishing the Distant Early Warning line of radars and the Semi-Automatic Ground Environment (SAGE) command and control system in less than three years. That stunning achievement demonstrated the power of shared resolve and innovation by our great nations and had an immediate deterrent effect. We hear echoes of that era in today's strategic environment, and while the challenges before us are significant, history makes clear that innovation and resolve will allow us to bolster our strategic advantage.

While I am concerned by the limitations of some of our older sensors, recent advancements show great promise toward improving our ability to detect, track, and defeat advanced cruise missiles. In one key example, USNORTHCOM and NORAD partnered with the U.S. Air Force, U.S. Navy, U.S. Army, U.S. Marine Corps, and industry in December 2019 at Eglin AFB, Florida, on a demonstration that successfully showcased elements of JADC2 and the Advanced Battle Management System for cruise missile defense of the U.S. homeland.

Thanks to the outstanding support and collaboration by each of the Services, we were able to bring air, sea, and land domain forces together to demonstrate technology with significant potential for meeting our most urgent homeland defense requirements. USNORTHCOM and NORAD will continue to build on the momentum established with our Service partners so that we are capable of deterring, detecting, and defeating any potential threat to the homeland.

Specifically, the demonstration combined capabilities from across the Joint Force to detect, track, identify, and simulate the intercept of ground and air-launched subsonic cruise missiles. While still in the early stages of development, these efforts also demonstrated an "every sensor, fused data, best shooter capability" that incorporates machine learning and artificial intelligence to gather and act upon sensor data far more quickly and accurately than ever before.

By demonstrating the potential for these low-cost, multi-domain systems to defend critical targets, USNORTHCOM and NORAD are actively establishing and pushing hard on efforts with innovative industry partners in ways that break down slow-moving stovepipes between warfighters, acquisition agencies, and industry. Together with our partners, USNORTHCOM and NORAD will continue to ensure that we have the means to fulfill our essential homeland defense priorities and outpace the threats to our homeland by actively pursuing the National Defense Strategy objective to establish a national security innovation base that supports DOD operations and sustains security and solvency.

Our commands have taken an aggressive leadership role in identifying and evaluating potential solutions to the significant technical challenges associated with our cruise missile defense mission. Over the summer of 2019, USNORTHCOM and NORAD sponsored a test of over-the-horizon radar (OTHR) capabilities to evaluate their potential application to detect cruise missiles launched against the United States and Canada from the far north. This important test,

conducted in close collaboration with the U.S. Air Force Research Laboratory and Defence Research and Development Canada, allowed USNORTHCOM and NORAD to evaluate the ways in which OTHR can help to provide persistent surveillance of our northern approaches.

The OTHR test, using test arrays in Ottawa, Ontario and at Camp Grafton, North Dakota demonstrated outstanding collaboration between our U.S. Air Force, Canadian military, and industry partners in a shared effort to mitigate the cruise missile threat to the United States and Canada. That same spirit of common commitment was on display in October 2019 during a USNORTHCOM-sponsored homeland defense demonstration at Ft. Carson, Colorado. This event successfully demonstrated the potential for a mesh network and artificial intelligence to detect, identify, and track a cruise missile threat in realistic field conditions.

Ballistic Missile Defense

USNORTHCOM's ballistic missile defense (BMD) mission remains a no-fail mission. North Korea continues to openly threaten the United States with nuclear-capable ICBMs, and it is essential that our ballistic missile defense system continues to provide a reliable and lethal defense against a potential missile attack by North Korea or Iran, should Iran decide to develop ICBM technology.

Fielding modernized radars capable of discriminating between a lethal warhead and the debris, non-lethal components, and potential countermeasures associated with an inbound ICBM remains my top BMD priority. Improved discrimination capability will provide a higher probability of intercept and, therefore will deliver greater confidence in the successful defeat of an inbound nuclear armed re-entry vehicle. Improved persistent discrimination capability is even more necessary given the cancellation of the Redesigned Kill Vehicle (RKV).

While I understand the issues that led to the August 2019 decision by the Missile Defense Agency (MDA) to cancel the RKV, and I ultimately concurred with that course of action, I want to make it clear that I am deeply concerned with the resulting delay in adding to our ground-based interceptor capability and capacity. As we progress toward a next-generation interceptor (NGI) capability, USNORTHCOM remains responsible for defending the homeland from missile attacks. It is therefore necessary to swiftly develop and field a lower-tier missile defense capability as a complement to NGI to intercept current and emerging missile threats. Given the nature of the ballistic missile threat, I am a strong advocate for bringing a layered capability on board for the warfighter well before NGI is fielded.

From a warfighter perspective, a reliable and lethal follow-on system must be fielded as soon as practicable as our adversaries continue to pursue advanced missile technologies to threaten our homeland. I retain confidence in the current ground-based interceptor fleet and the ballistic missile defense system as a whole; however, to remain ahead of emerging threats, the timely fielding of improved discriminating sensor technology and an NGI is crucial. As our adversaries rapidly advance their capability and capacity to threaten the United States, USNORTHCOM is working side-by-side with MDA to ensure that USNORTHCOM's warfighter requirements are met, and I remain in close contact with VADM Hill to ensure our priorities remain aligned.

USNORTHCOM and NORAD's ability to accurately detect, discriminate, and track individual inbound ICBM warheads in the event of a ballistic missile attack from North Korea or potentially Iran is critical to the successful intercept of those weapons. With current and emerging threats in mind, improved terrestrial sensors are a necessary and cost-effective step in the evolution of our missile defense system. However, the urgency of taking steps now to

develop and field a future space-based sensing layer as soon as technology allows cannot be overstated.

As cruise, ballistic, and hypersonic missile threats evolve at an extraordinarily rapid pace, space-based sensors will become a necessity in the near future, and as we have seen with other adversary threat technologies, we cannot wait until a new weapon system is in the field before starting work on new technology to mitigate that threat.

Conclusion

As we enter a new decade, USNORTHCOM and NORAD remain laser focused on defending the homeland. Working side by side with our DOD, federal, industry, and international partners, our commands are committed to protecting our nations, our citizens, and our way of life from threats in all domains. The challenges facing us are daunting, but our adversaries and allies alike should never doubt our resolve.

While the weapons that threaten our homeland today are stealthier and more precise than those we faced during the Cold War, the hard-earned lessons of the past continue to echo today. The spirit of innovation and shared commitment to a common cause that brought our nation safely through previous conflicts will serve us well again during this period of strategic competition and uncertainty. Guided by our history of shared commitment and sacrifice, honored by the trust our citizens have placed in us, and profoundly committed to our sacred responsibility, the men and women of USNORTHCOM and NORAD are ready to deter and defeat any threat.

It is my profound honor to lead the airmen, soldiers, sailors, Marines, Coast Guardsmen, and civilians of USNORTHCOM and NORAD, and on their behalf, I want to thank the Committee for your steadfast support of our essential mission. We Have the Watch.

General Terrence J. O'Shaughnessy

General Terrence J. O'Shaughnessy is Commander, United States Northern Command and North American Aerospace Defense Command. USNORTHCOM partners to conduct homeland defense, civil support and security cooperation to defend and secure the United States and its interests. NORAD conducts aerospace warning, aerospace control and maritime warning in the defense of North America.

General O'Shaughnessy is a 1986 distinguished graduate of the U.S. Air Force Academy. He has commanded at the squadron, group, wing, NAF and MAJCOM levels, including the 57th Wing, Nellis Air Force Base, Nevada, the 35th Fighter Wing as Misawa Air Base, Japan, and the 613th Air and Space Operations Center, Hickam AFB, Hawaii. General O'Shaughnessy has served as the U.S. Pacific Command Director of Operations responsible for joint operations in a region encompassing more than half the globe and 36 nations. General O'Shaughnessy's joint experience also extends to his time as the Joint Staff J5 Deputy Director for Politico-Military Affairs for Asia where he shaped regional planning and policy in the Asia-Pacific and Central Asia regions, supporting the commanders of U.S. Pacific Command and U.S. Central Command. Prior to his current assignment, General O'Shaughnessy was Deputy Commander, United Nations Command Korea; Deputy Commander, U.S. Forces Korea; Commander, Air Component Command, Republic of Korea/U.S. Combined Forces Command; and Commander, 7th Air Force, Pacific Air Forces, Osan AB, South Korea and Commander, Pacific Air Forces and Air Component Commander for U.S. Pacific Command, Joint Base Pearl Harbor-Hickam, Hawaii.

General O'Shaughnessy is a command pilot with more than 3,000 hours in the F-16 Fighting Falcon, including 168 combat hours.

EDUCATION
1986 Distinguished graduate, Bachelor of Science, aeronautical engineering, U.S. Air Force Academy, Colorado Springs, Colo.
1992 Fighter Weapons Instructor Course, U.S. Air Force Fighter Weapons School, Nellis AFB, Nev.
1993 Squadron Officer School, Maxwell AFB, Ala.
1996 Master's degree in aeronautical science, Embry-Riddle Aeronautical University, Daytona Beach, Fla.
1998 Air Command and Staff College, Maxwell AFB, Ala.
2003 Industrial College of the Armed Forces, National Defense University, Fort Lesley J. McNair, Washington, D.C.
2003 Information Studies Concentration Program, National Defense University, Fort Lesley J. McNair, Washington, D.C.
2005 NATO Senior Officer Policy Course, NATO Defense College, Oberammergau, Germany
2007 Department of Defense Senior Managers Course in National Security, George Washington University, Washington, D.C.
2007 Air Force Enterprise Leadership Course, University of North Carolina at Chapel Hill
2009 Combined Air and Space Operations Senior Staff Course, Hurlburt Field, Fla.
2011 Joint Force Air Component Commander Course, Maxwell AFB, Ala.
2012 Joint Flag Officer Warfighter Course
2013 Joint Force Maritime Component Commander Course, Newport, R.I.
2015 National Defense University PINNACLE Course, Suffolk, Va.

ASSIGNMENTS
June 1986 - September 1987, student, undergraduate pilot training, Sheppard AFB, Texas
September 1987 - August 1988, student, T-38 lead-in fighter training and F-16 training, Holloman AFB, N.M., and Luke AFB, Ariz.
August 1988 - December 1991, F-16 aircraft commander and instructor pilot, Shaw AFB, S.C.
January 1992 - June 1992, student, F-16 Fighter Weapons School, Nellis AFB, Nev.
July 1992 - July 1993, weapons officer and flight commander, 35th Fighter Squadron, Kunsan AB, South

Korea
July 1993 - July 1997, assistant operations officer and air-to-ground flight commander, F-16 Division, U.S. Air Force Fighter Weapons School, Nellis AFB, Nev.
July 1997 - June 1998, student, Air Command and Staff College, Maxwell AFB, Ala.
June 1998 - June 1999, Chief, Air Superiority Weapons Branch, Global Power Programs, Office of the Assistant Secretary of the Air Force for Acquisition, the Pentagon, Arlington, Va.
June 1999 - June 2000, Chief, Fighter Programs, Office of Legislative Liaison, Office of the Secretary of the Air Force, the Pentagon, Arlington, Va.
June 2000 - April 2001, operations officer, 555th Fighter Squadron, Aviano AB, Italy
April 2001 - July 2002, Commander, 510th Fighter Squadron, Aviano AB, Italy
August 2002 - June 2003, student, Industrial College of the Armed Forces, National Defense University, Fort Leslie J. McNair, Washington, D.C.
June 2003 - August 2004, Chief, Joint Plans and Operations, Supreme Headquarters Allied Powers Europe, Mons, Belgium
August 2004 - July 2005, senior special assistant to the Supreme Allied Commander Europe and Commander, U.S. European Command, Supreme Headquarters Allied Powers Europe, Mons, Belgium
July 2005 - December 2006, Commander, 57th Adversary Tactics Group, Nellis AFB, Nev.
January 2007 - August 2008, Commander, 35th Fighter Wing, Misawa AB, Japan
September 2008 - August 2009, Commander, 613th Air and Space Operations Center, Hickam AFB, Hawaii
August 2009 - July 2010, Vice Commander, 13th Air Force, Hickam AFB, Hawaii
July 2010 - April 2012, Commander, 57th Wing, Nellis AFB, Nev.
April 2012 - August 2013, Deputy Director for Politico-Military Affairs for Asia, Joint Staff, the Pentagon, Arlington, Va.
August 2013 - October 2014 - Director for Operations, Headquarters, United States Pacific Command, Camp H.M. Smith, Hawaii
December 2014 – July 2016, Deputy Commander, United Nations Command Korea; Deputy Commander, U.S. Forces Korea; Commander, Air Component Command, Republic of Korea/U.S. Combined Forces Command; and Commander, 7th Air Force, Pacific Air Forces, Osan AB, South Korea
July 2016 – May 2018, Commander, Pacific Air Forces; Air Component Commander for U.S. Pacific Command; and Executive Director, Pacific Air Combat Operations Staff, Joint Base Pearl Harbor-Hickam, Hawaii
May 2018 – present, Commander North American Aerospace Defense Command and United States Northern Command

SUMMARY OF JOINT ASSIGNMENTS
June 2003 - August 2004, Chief, Joint Plans and Operations, Supreme Headquarters Allied Powers Europe, Mons, Belgium, as a colonel
August 2004 - July 2005, senior special assistant to the Supreme Allied Commander Europe and Commander, U.S. European Command, Supreme Headquarters Allied Powers Europe, Mons, Belgium, as a colonel
April 2012 - August 2013, Deputy Director for Politico-Military Affairs for Asia, Joint Staff, the Pentagon, Arlington, Va. as a brigadier and major general.
August 2013 - October 2014, Director for Operations, Headquarters, United States Pacific Command, Camp H.M. Smith, Hawaii, as a major general
December 2014 – July 2016, Deputy Commander, United Nations Command Korea; Deputy Commander, U.S. Forces Korea; Commander, Air Component Command, Republic of Korea/U.S. Combined Forces Command; and Commander, 7th Air Force, Pacific Air Forces, Osan AB, South Korea, as a lieutenant general.
May 2018 - present, Commander, North American Aerospace Defense Command (NORAD) and United States Northern Command (USNORTHCOM). Colorado Springs, Colo, as a general.

FLIGHT INFORMATION
Rating: command pilot
Flight hours: more than 3,000
Aircraft flown: F-16, AT/T-38 and T-37

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal
Defense Superior Service Medal with three oak leaf clusters
Legion of Merit with three oak leaf clusters
Meritorious Service Medal with three oak leaf clusters
Air Medal with oak leaf cluster
Aerial Achievement Medal with oak leaf cluster
Air Force Commendation Medal with oak leaf cluster
Air Force Achievement Medal with two oak leaf clusters
Combat Readiness Medal
Armed Forces Expeditionary Medal
Kosovo Campaign Medal
Global War on Terrorism Service Medal
Korea Defense Service Medal
Humanitarian Service Medal

EFFECTIVE DATES OF PROMOTION
Second Lieutenant May 28, 1986
First Lieutenant May 28, 1988
Captain May 28, 1990
Major Sept. 1, 1997
Lieutenant Colonel May 1, 2000
Colonel Aug. 1, 2004
Brigadier General Nov. 2, 2009
Major General Aug. 2, 2013
Lieutenant General Dec. 19, 2014
General July 12, 2016

(Current as of May 2018)

Vice Admiral Jon A. Hill, USN
Director, Missile Defense Agency
Before the
House Armed Services Committee
Subcommittee on Strategic Forces
March 12, 2020

Good morning, Chairman Cooper, Ranking Member Turner, distinguished Members of the subcommittee. I appreciate this opportunity to testify before you today. The Missile Defense Agency budget request of $9.187 billion for Fiscal Year (FY) 2021 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. Working together with the Services, international partners, and industry, the highly skilled and dedicated MDA government and contractor workforce stands ready to develop and deliver ready, reliable, and effective defenses the Nation needs to counter the proliferating and increasingly sophisticated missile threat.

Missile Threat – A Significant Inflection Point for Missile Defense

Potential adversaries continue to increase the number and capabilities of existing missile systems while adding new types of missile capabilities to their arsenals, creating an inflection point in the missile defense program that will complicate U.S. missile defense operations. Ballistic, hypersonic, and cruise missiles are becoming more capable of carrying conventional and mass destruction payloads farther, faster, and with greater accuracy. New ballistic missile systems feature multiple independently targetable reentry vehicles and maneuverable reentry vehicles, along with decoys and jamming countermeasures. Russia and

China are developing advanced cruise missiles and hypersonic missiles. Hypersonic missiles can be launched from ground ballistic missile launchers, released from aircraft, or launched from the sea. These missiles travel along unpredictable flight paths and at low altitudes, making them especially difficult to track and intercept. They are designed to overfly air defense sensors and fly below ballistic missile sensors.

Since the Soviet era, Moscow and Russia-based entities have provided offensive missile strike expertise and technology to China, North Korea, Iran, and Syria. Chinese entities have assisted Iran, North Korea, and others in developing their offensive missile programs. North Korea has demonstrated a diversified ballistic missile force, including road-mobile and submarine launch platforms, and is even accelerating its efforts to field missiles capable of threatening U.S. territories, deployed forces, allies, and partners in the region. It also has transferred ballistic missiles and associated technologies to other countries. Iran, like North Korea, also is developing and fielding more sophisticated theater missile systems capable of striking targets throughout the region ranging as far as southeastern Europe while proliferating offensive missile technology.

Approach to Addressing the Advanced Threat

MDA is developing a system that is agile and resilient to deter, deny and defeat missile threats. This requires the ability to globally view, track, and engage threat missiles using a multispectral, real-time, persistent, and survivable sensor architecture. The nation needs a resilient, all-domain, global sensor architecture, networked to fire control systems that can engage with the best weapons. In addition to upgrading every layer of the Missile Defense System, we have several initiatives in place to address the evolving threat. These initiatives

include continuous threat assessment, component-level technology maturation programs, continuous development efforts, and robust testing focused on defeating threats, such as hypersonic missiles, while we work with the Services and Combatant Commands to build out the missile defense force structure. The system will continue to leverage space-based, ground-based and maneuverable sea-based sensors. Yet there will never be enough terrestrial-based sensors to track maneuvering missiles in large numbers. If we are to outpace the threat, we need a persistent space-based global sensor capability for full track custody supporting fire control engagements. We must also pursue advances in joint all-domain and global command and control to support U.S. Northern Command (USNORTHCOM) in countering strategic cruise missiles and accelerate technology development to deliver a capable regional hypersonic missile defense architecture with glide and terminal defeat solutions, which I will address in more detail.

Unique authorities and processes enable MDA's ability to design, develop, test, and deploy capabilities in an agile manner against the rapidly advancing threat. Recent examples include fielding of the integrated Terminal High Altitude Area Defense (THAAD) and Patriot capability in less than four years and this year's delivery of the Long Range Discrimination Radar (LRDR), an entirely new capability, in less than seven years after receiving the warfighter requirement. The Agency continues to work with U.S. Strategic Command, the Joint Staff, and Services to streamline further prioritization of warfighter's needs.

We have undertaken an extensive review and realignment of our organization and people to reflect MDA's emerging roles in defending against advanced ballistic, hypersonic, and cruise missiles. The "MDA 2.0" organization established earlier this year will improve the focus

of missile defense programs and alignment of the MDA organization to be more responsive to the national defense strategy in addressing the highly dynamic threat environment. It will also streamline decision-making for building Joint and international missile-defense force structure. MDA 2.0 will increase the speed and efficiency of the Agency's response to complex all-domain threats while improving business practices, resource stewardship, and talent management.

Improving Warfighter Readiness

MDA is committed to missile-defense system readiness and developing newer, more lethal capabilities, while improving warfighter confidence. MDA works in concert with the Combatant Commands and Services to enhance readiness of the existing force. The Agency, for example, is committed to year-round sustainment support for critical missile defense systems, such as the global sensor architecture, hardened networked command and control, Ground-Based Weapon Systems, and Sea-Based Weapon Systems. Sustainment support includes incorporation of warfighter operational feedback, designing MDA systems for supportability, modernization, configuration management and frequent ground- and flight-testing. MDA also is committed to operating the Sea Based X-band radar at sea for extended periods. The SBX recently completed an unprecedented 582 consecutive days at sea then underwent a comprehensive maintenance period in Hawaii, and then returned on station for another extended operation in support of U.S. Indo-Pacific Command (USINDOPACOM) and U.S. Northern Command (USNORTHCOM) requirements. The Services operate and sustain capabilities while MDA provides critical support for unique missile defense capabilities.

The MDS incorporates defensive cyber operations to improve system resiliency and uses an integrated layered approach to enhance protection and optimize resources. MDA continues to work with supported Combatant Commands to identify essential information technology assets within the area of operations and across Command-sectors to ensure relevant cybersecurity safeguards are in place to ensure availability of critical services, resources, and operations and reliability of networked connectivity. MDA is constantly implementing new capabilities, such as upgraded network sensors, data analytics, a cyber-common operating picture, and Enterprise Security Incident and Event Manager, to monitor, detect, and defend MDA networks. MDA is working with USSTRATCOM and the Joint Functional Component Command for Integrated Missile Defense to improve the ability to direct and synchronize actions to detect, analyze, counter, and mitigate cyber threats and vulnerabilities in our R&D systems as well as the operational MDS.

Delivering Capability to Build Combatant Command and Service Capacity

MDA plans to increase U.S. missile-defense force structure to outpace emerging threats. As potential adversaries continue to field a wide array of offensive missile systems, MDA is committed to enhancing the qualitative and quantitative attributes of our missile defense forces. MDA continues to work with the Department and industry to increase the capability and lethality of missile defense weapon systems, including homeland defense interceptors, Aegis with Standard Missile (SM), THAAD, and Patriot through their integration and future evolution.

Ground-Based Weapon Systems

The Ground-based Midcourse Defense (GMD) program provides Combatant Commands a continuously available capability to defend the United States from long-range ballistic missile attacks. The GMD system includes Ground Based Interceptors, the GMD Fire Control system, Launch Support Systems, integrated with C2BMC and sensors. Each of the currently emplaced GBIs deliver a single kill vehicle to intercept and destroy threat warheads through the force of impact during the midcourse phase of their ballistic trajectory. GMD sustains the current fielded fleet through obsolescence mitigation, stockpile reliability testing, and planning and execution of flight and ground tests. In March 2019, the GMD system successfully executed Flight Test GMD Weapon System (FTG) -11, the first GMD salvo intercept-flight test against a threat-representative ICBM with countermeasures, destroying the re-entry vehicle with the Lead GBI and the next most lethal object with the Trail GBI. MDA also emplaced the first four of twenty interceptor silos and Silo Interface Vaults in Missile Field-4 at Fort Greely, Alaska.

MDA delivered the existing fleet of GBIs based on the known and projected threat at that time. Given changes in the threat environment, we are now evolving the GMD system with new sensors, like Long Range Discrimination Radar in Clear, Alaska, and the development of the Next Generation Interceptor (NGI). MDA has initiated development of a phased array technology replacement for the current parabolic antenna set of the In-flight Interceptor Communications System Data Terminal (IDT) that will greatly improve its communications throughput capability while overcoming IDT component obsolescence. MDA is leveraging investments made in the Redesigned Kill Vehicle (RKV) and the Multi-Object Kill Vehicle programs to begin development of NGI, which will improve homeland missile-defense

survivability and performance against evolving and complex threats. I want to emphasize that we are working very closely with the Intelligence Community and Combatant Commands to develop a set of requirements for NGI that will endure projected evolutions in the missile threat to the United States. We plan to award two competitive NGI development designs this year using competitive pressure to incentivize performance and schedule. Based on current estimates, I anticipate the first NGI round will be available to the warfighter as early as 2028.

MDA is investigating the possibility of providing a layered homeland defense capability by adding sensors, and modifying the Aegis Weapon System, SM-3 BLK IIA missile, THAAD weapon system, and C2BMC for future test demonstrations. As you know, Flight Test Aegis Weapon System (FTM)-44 will be the first Aegis and SM-3 BLK IIA intercept of a simple ICBM. For the THAAD weapon system, we will develop a concept interceptor as a risk reduction for the demonstration of potential increases in depth of defense for the homeland. I want to emphasize that Aegis SM-3 BLK IIA and the THAAD weapon system are not replacements for the long-range missile defense capability provided by GMD. The GBI has a much longer range and a larger battle space. However, these capabilities within a layered homeland defense architecture will increase the effectiveness of our defenses against potential rogue state ICBMs.

In the meantime, MDA will improve GBI fleet reliability while completing the expansion of silo capacity. We also will deliver updated GMD Ground System capabilities to support the LRDR, system track utilization, and improvements to discrimination. With a 2-/3-stage selectable booster, the Warfighter will have the option of not igniting the third stage to more effectively engage the full battlespace. We will demonstrate the 2-/3-stage selectable booster in the next GMD flight test (GM BVT-03), currently planned for FY 2021. MDA is continuing

capability upgrades and hardware technology modernization of key ground support and fire control systems, including improved cyber defenses and enhanced cybersecurity protection and testing.

The THAAD weapon system is a rapidly deployable system that can augment the MDS globally as demonstrated in deployments to Israel and to Romania. MDA currently provides sustainment support to the U.S. Army for seven fielded U.S. batteries, two of which are forward-deployed in USINDOPACOM and one in USCENTCOM areas of responsibility. MDA will continue to support sustainment for fielded U.S. THAAD batteries and all THAAD training equipment. MDA will continue THAAD procurement in FY 2021 with 41 THAAD Interceptors, 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. Development of multiple, independent THAAD software upgrades will address evolving threats and improve Warfighter defense planning and engagement capability.

MDA is providing a more robust integrated air and missile defense capability to support delivering more flexibility to the Combatant Commands. One focus area is the integration of the THAAD and Patriot weapon systems. Last year, MDA and the U.S. Army completed the live fire validation of remoting the THAAD launchers in Flight Test THAAD Weapon System (FTT)-23. This capability was the first of three major steps for improving operational flexibility for the THAAD weapon system. The FY 2020 plan includes validating launch on remote with the THAAD system data by the Patriot weapon system. In FY 2021, MDA and the U.S. Army will demonstrate the integration of the Patriot MSE missile into the THAAD battery. This final test

will lead to U.S. Army materiel release and option for deployment. MDA is also working with the Office of the Secretary of Defense (OSD) Operational Energy Office and other service stakeholders to improve system reliability, availability, fuel consumption, and life-cycle costs.

The Kingdom of Saudi Arabia (KSA) Foreign Military Sales (FMS) case, valued at $13.5 billion, includes seven THAAD batteries, 44 launchers, 360 interceptors, and associated equipment and support. MDA will continue to work with the KSA to commence delivery of the THAAD capability by the middle of the decade. In April 2019, MDA executed the award of USG Lot 11 and Kingdom of Saudi Arabia (KSA) Lot 1 Interceptors with priced options established for USG Lot 12 and additional KSA Interceptors for a total procurement of 400 interceptors. The negotiated Interceptor Average Unit Price for this procurement is the lowest in the history of the THAAD program. MDA is working to obtain Full Production Decision Authority for THAAD Interceptors to support Army inventory objectives. The cost savings achieved through combined FMS procurements will allow the Department to invest in significant capability and obsolescence improvements to U.S. THAAD systems.

In June 2019, the United Arab Emirates (UAE) committed additional funding to maintenance and sustainment of its two THAAD batteries. In addition, UAE has requested additional launchers to increase its capability and defended area. It is important to recognize that, with the KSA and UAE FMS cases, the Department is reducing the burden on its own missile defense in the region.

We have a valuable cooperative missile defense relationship with Israel. Not only can we help our partner develop systems to strengthen its missile defenses, but we can also learn a great deal from a nation that is battle-hardened and experienced in defeating missile threats.

MDA and the Israel Missile Defense Organization continue to cooperate on the development, co-production, and fielding of the Arrow System and David's Sling Weapon System. Additionally, we are funding procurement of the Iron Dome Defense System for the defense of Israel. This past year three joint tests successfully demonstrated the capability of the Israel's multi-layer defense system. In January 2019, Arrow Weapon System Test-17 demonstrated the exo-atmospheric capability of the Arrow 3 Weapon System to defend against ballistic missiles. In March 2019, the David's Sling Test-6 series examined the capabilities and performance of the entire David's Sling Weapon System against large caliber rockets and short-range ballistic missiles. In July 2019, Flight Test Arrow Weapon System-01 demonstrated the Israeli Arrow Weapon System's ability to conduct high altitude and high-velocity hit-to-kill engagements. Testing for these systems will continue in CY 2020 and CY 2021.

Sea-Based Weapon Systems

Sea-Based Weapon Systems (SBWS) continue to be a key part of the nation's regional defense for our deployed forces, allies, and partners, and they directly support and expand our homeland defenses with long-range surveillance and tracking capability. We will continue advancement of the SBWS, including improvements in system and missile reliability as well as increases in SBWS engagement capacity and lethality in alignment with Navy requirements. We will improve Aegis ship and ashore site performance against SRBMs, MRBMs, and IRBMs as well as demonstrate capability against ICBM threats.

We continue to increase our interoperability and integration with partners and allies to provide credible capability and deterrence against common threats. In May 2019, MDA replicated elements of the European Phased Adaptive Approach (EPAA) Phase 3 architecture in

Formidable Shield-19 (FS-19) using in-theater SBWS baselines and performed an Aegis SM-3 Block IA firing using Aegis Baseline 9.C2, firing at a simulated target. Ships from Canada, Denmark, France, Italy, the Netherlands, Norway, Spain, the United Kingdom, and the United States participated in FS-19. Today we are working with allies and partners to support planning for FS-21. MDA also will participate in an additional international flight test, Pacific Dragon 20 (PD-20). PD-20 will be a trilateral ballistic missile tracking and Tactical Data Link information-sharing event with the Japanese Maritime Self Defense Force, Republic of Korea Navy, and U.S. Navy participation, conducted at the Pacific Missile Range Facility.

In 2019, the Aegis SM-3 Block IIA program, developed under a cooperative development effort with Japan, received its Initial Production Decision, including permission to procure 37 SM-3 Block IIA missiles across FY18-FY20. Subsequently in December 2019, the MDA awarded a contract for 62 total missiles across these three years. These procurements will assist in expanding the capability and capacity of both the U.S. and Japanese fleets against the advancing threat. MDA will soon award a five-year Aegis SM-3 Block IB Multiyear Procurement (MYP) contract for FY19-FY23, including FMS. The President's Budget 2021 and the SM-3 Block IB MYP and SM-3 Block IIA contracts bring the inventory closer to the Navy's objective of 568 SM-3 missiles. Overall, we have achieved significant and affordable advances in our SBWS portfolio.

The United States is providing ballistic missile defense against current threats to U.S. forward deployed forces and Allies in Europe, better known as the European Phase Adapted Approach (EPAA). EPAA consists of four forward deployed BMD-capable ships in Sixth Fleet, an AN/TPY-2 sensor in Turkey, and an operational Aegis Ashore Missile Defense System Complex in

Romania. A second Aegis Ashore site is under construction in Poland. Completion of the Aegis Ashore Missile Defense System Complex in Poland will complete the EPAA.

The Aegis Ashore Poland site is about 90% complete; however, significant work remains to complete military construction activities necessary to begin installation of the Aegis Weapons System. Completion of this work and the follow-on acceptance milestones through to NATO acceptance will delay operationalizing the site until approximately 2022. The buildings, structures, and equipment are in place, however, the engineering and integration of the mission support system remains incomplete and are not ready for government acceptance.

The Chief Engineer of the U.S. Army Corps of Engineers and I have been reviewing all options to determine the best path forward. At the current pace of construction contract execution, Aegis Ashore Poland will achieve operational capability in 2022. Importantly, the contractor, at the President and CEO level, recently re-affirmed their intentions to finish the military construction portion of this project. We have also recently implemented additional contractual measures to guide the Prime construction contractor in prioritizing tasks to complete items required to support the Navy installation and the Aegis weapon system.

We also regularly re-evaluate the situation at the executive level and review all options. Of note, should the threat demand it, the MDA, with service and combatant commander coordination, has several ways to mitigate the delays at Aegis Ashore Poland and provide for the BMD defense of NATO consistent with EPAA Phase III objectives. To that end, we are working closely with EUCOM to minimize the operational impact of the Poland delay by accelerating the upgraded the Romania site weapon system, which is now complete, and preparing for the possible deployment of limited RDT&E SM-3 Block IIA missiles when delivered

later this year. The upgraded Aegis Weapon System along with the SM-3 Block IIA missiles and required upgrades for AN/TPY-2 and C2BMC will permit greater defensive coverage and engage-on-remote capability.

Terrestrial and Space Sensors

MDA is developing, deploying, and sustaining terrestrial radars to counter current and future missile threats, building Warfighter confidence, and increasing force structure. MDA continues to sustain the deployed fleet of AN/TPY-2 radars, the SBX radar, three deployed Upgraded Early Warning Radars (UEWRs), the Cobra Dane radar, and 40 mobile Aegis IAMD ships equipped with the SPY-1 family of radars. We are preparing for initial fielding of LRDR in FY21 to provide a persistent tracking and discrimination capability to the MDS to improve defense of the United States homeland against IRBMs and ICBMs. As MDA continues investments to prepare for capabilities needed in the far-term, we continue to improve system availability and reliability and to address sensors coverage gaps.

The continued integration of sensors into systems engineering and analysis leverages cost-effective opportunities to identify gaps and improve sensor performance. The enhancement of the AN/TPY-2 adjunct sensor rapid prototype is one important component of increasing missile-defense engagement capability and capacity. In FY 2020, MDA will add UEWRs in Clear, Alaska and Cape Cod, Massachusetts to the missile defense architecture in addition to completing next-generation processing equipment upgrades at UEWRs currently deployed at Beale Air Force Base in California, Fylingdales in the United Kingdom, and Thule Air Base in Greenland. MDA also is providing support to the United Kingdom as it considers

potential missile defense radar options to fulfill a commitment to field a missile defense radar to enhance coverage and effectiveness of the NATO BMD system.

Investments in sustainment will increase SBX operational deployment time at-sea to meet Warfighter operational requirements. During 2017-2019, the SBX completed a record 582 continuous days at sea, supporting operations, testing, and data collection. Missile defense engagements require constant improvement in sensor discrimination, electronic protection, and debris mitigation. Investments in upgraded AN/TPY-2 and SBX processors will improve performance characteristics for these radars. Object classification enhancements for the Cobra Dane radar and UEWR support improvements in sensor reliability and sensor cybersecurity.

We remain committed to the Aegis BMD development required to deliver the new construction DDG-51 Flight III Arleigh Burke-class destroyer with Aegis BL 10 (with BMD 6.0 integrated) and SPY-6 Air and Missile Defense Radar (AMDR). We will continue to align with the U.S. Navy to develop and deliver a comprehensive Integrated Air and Missile Defense capability against advanced threats in the Arleigh Burke-class Flight III Destroyers for a 2024 Initial Operational Capability. Aegis BMD 6.0 exploits AN/SPY-6 radar improvements to enhance Aegis combat effectiveness, to include advanced discrimination, significantly improved raid defense, and expanded engagement battlespace. AN/SPY-6 will enable U.S. Navy ships to have a greater standoff range from threat environments, providing greatly improved operational flexibility.

Space is a critical environment for addressing rapidly advancing threats across multiple regions of interest. In FY 2019, MDA finished on-orbit deployment of the Spacebased Kill Assessment (SKA) sensors and began experimentation of hit and kill assessment capabilities. SKA is a network of small sensors hosted on commercial satellites. In March 2019, SKA

demonstrated the Hit Assessment (HA) capability against an ICBM target in FTG-11, which led to SKA's transition and acceleration to an operational capability to provide the Warfighter an initial Post-Intercept Assessment solution. MDA began providing USNORTHCOM a situational awareness SKA HA capability in fall 2019 until the operational HA capability is fielded. In FY 2020 and 2021, MDA will take steps to add the SKA capability to the operational MDS baseline.

The Hypersonic and Ballistic Tracking Space Sensor (HBTSS) capability, the first installment in this all-domain sensor architecture, will contribute to the hypersonic defense fight by providing a persistent, layered capability to track dim boosting ballistic missiles and HGVs. The Space Development Agency (SDA) will execute HBTSS as part of the National Defense Space Architecture. In FY 2019, MDA completed the Preliminary Concept Design phase of the HBTSS acquisition effort. From the initial nine concepts in the Concept Design phase, MDA awarded four industry agreements for development of multiple hypersonic and ballistic tracking space sensor concepts that focus on key risk reduction through competitive prototyping of the payload design and signal chain-processing demonstration. A Preliminary Concept Review in first quarter FY 2021 will complete this phase.

In FY2021 and beyond, MDA will continue its coordination with SDA, Defense Advanced Research Projects Agency (DARPA), and the U.S. Space Force to leverage complementary risk reduction efforts, and ensure an ability to detect and track advancing and evolving threats. We also will explore opportunities to collaborate with the Space Force and Air Force on ground services, integration, launch, and operations.

In FY 2021 and beyond, MDA will continue its coordination with SDA, Defense Advanced Research Projects Agency (DARPA), and the United States Space Force to leverage

complementary risk reduction efforts, and ensure an ability to detect and track advancing and evolving threats. We also will explore opportunities to collaborate with the Space Force and Air Force on ground services, integration, launch, and operations.

Command and Control

Command and Control, Battle Management and Communications (C2BMC) hit its 15-year operational anniversary in 2019. Today it provides multiple Combatant Commanders with global persistent space-based infrared and land- and sea-radar sensor acquisition, tracking, cueing, discrimination, and fire-control quality data to GMD, SBWS, THAAD, Patriot, and coalition partners to support homeland and regional missile defense. As the integrating element of the MDS, C2BMC must swiftly adapt to address urgent warfighter needs and be responsive to MDS requirements and schedule changes.

In 2019, MDA completed the upgrade of all C2BMC mission nodes to the Spiral 8.2-3 configuration, which enables Aegis Weapon Systems to conduct engage-on-remote to defeat IRBM threats, providing a seven-fold increase in missile defense coverage when compared to an autonomous Aegis platform. MDA upgraded the operational BMDS Overhead Persistent Infrared (OPIR) Architecture (BOA) nodes to the next-generation variant that uses new algorithms to detect, track, and report dim missile threats. C2BMC and U.S. Space Command (USSPACECOM) demonstrated its all-domain capability by demonstrating USSPACECOM ability to task forward-based AN/TPY-2 radars in support of the space-domain awareness mission. C2BMC received operational acceptance of an INDOPACOM JEON capability that tracks and reports hypersonic missile threats over the early warning network in support of the missile warning and missile defense missions.

The very successful INDOPACOM JEON development was the program's prototype, and MDA incorporated those lessons learned into the C2BMC Spiral 8.2-5 and BOA 7.0 development programs. C2BMC Spiral 8.2-5 provides the MDS with command and control of the new LRDR for homeland defense. This capability will enable Air Force C2BMC Sensor Managers located at Beale Air Force Base in California and Cheyenne Mountain Air Force Station in Colorado to command and control the LRDR to enhance system-level discrimination and fire control data for GMD and further expand space domain awareness.

In FY2021, we will complete C2BMC Spiral 8.2-5 and BOA 7.0 system level integration testing and turn the capability over for warfighter operations in support of Missile Defense Increment 6B.1 homeland defense improvements. We will integrate the on-orbit Spacebased Kill Assessment (SKA) sensors with C2BMC and GMD to provide real time GMD hit assessment indications in 2022. A follow-on Post Intercept Assessment in 2025 will utilize multi-spectrum sensors to provide real-time GMD kill assessment capability.

The C2BMC Spiral 8.2-7 and BOA 7.1 software development programs will support Increment 7 fielding in 2023, providing system track messages for GMD and new space tasking algorithms, significantly reducing future sensor-integration risks for homeland defense. C2BMC will integrate new sensors to missile defense and combine their capability with existing missile defense sensors and network to establish a globally integrated real-time sensor architecture to provide enhanced dynamic space capabilities for USSPACECOM.

Developing Technology for the Future

With the emergence of new and more advanced threats, MDA's base investment requires a significant technology boost in order to develop newer innovative and disruptive technologies to defeat these 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. MDA will increase the speed of delivery of new capability to address evolving threats.

Hypersonic weapons pose perhaps the greatest challenge to missile defenses today. MDA 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. MDA leverages this data to drive its technology investments. We have made technology investments, upgraded ground-based radars and C2BMC, and delivered capabilities to counter these new threats, including the ability to track and report on offensive hypersonic weapon threats. We have awarded contracts for the development of 21 multiple hypersonic defense weapon-system concepts and down-selected to five concepts for further definition. We also awarded multiple hypersonic defense-component technology maturation contracts to develop component technologies necessary to extend the capability of future hypersonic defense systems. The Sea-Based Terminal (SBT) capability has demonstrated performance against these advanced maneuvering ballistic threats in flight-testing, such as FTM-27 Event 1/Event 2 and FTM-31, which is planned for third quarter FY 2020. MDA will conduct an additional SBT flight test against a next-generation hypersonic-threat representative target in FY 2023. Later this year, MDA will award multiple contracts focused on technology risk reduction for the

Regional Glide Phase Weapon System interceptor concept, with the eventual goal of providing greater depth of fire in our a layered defense architecture against cruise, hypersonic and maneuvering threats.

Investments have not been limited to kinetic kill technologies. We have invested in directed energy kill mechanisms, including multiple laser types and high power microwave as well as component technology to support development of sensors and interceptors. Directed energy has a greater magazine depth and potentially significantly lower cost than interceptor (kinetic kill) options, but it is not yet mature for the missile defense missions. Three of the laser systems MDA invested in have been or are in the process of transferring to the Services and to the Office of the Under Secretary of Defense, Research & Engineering (R&E) for further development. The Services are building prototype demonstrations using the lasers at the current power for their mission and R&E is investing in increasing the power. Once higher power is reached, MDA will have the opportunity to develop a prototype demonstration for the missile defense mission.

MDA will continue broad-based investments in efforts that reduce technology risk for future missile defense systems, including: Electro-Optical/Infrared Sensors, focal planes and arrays; high temperature materials; novel propulsion materials; improved antennas; and hypersonic defense and related efforts. The technologies MDA invested in previously are being leveraged by industry for the Next Generation Interceptor and will likely be leveraged for the Regional Glide Phase Weapon Systems prototype proposals. Other technologies will serve as the foundation for future missile defense system upgrades. Finally, MDA works collaboratively

with Universities, Department of Defense and Energy laboratories and foreign allies, leveraging other efforts to further missile defense technology advances.

Conclusion

Mr. Chairman and Members of the Subcommittee, in closing, our FY 2021 budget funds comprehensive missile defense development efforts, including several critical capabilities required by the Warfighter. 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 development.

The Department has undertaken an extensive review of how we transition and transfer missile defense programs from MDA to the Services. The Department's leadership, with considerable input from the Combatant Commands, Services, and MDA, believes MDA should continue to play to its strength by developing, procuring, and fielding missile defense systems, and then providing "MDA-unique sustainment support" for the life cycle of the system. The Services should continue to man, operate, and sustain those missile defense systems for their life cycles. Under this approach, which I endorse, transfer would involve the Services and MDA shifting specific cost-sharing responsibilities for operations and sustainment at agreed upon milestones after the fielding of new capabilities.

We must continue our work to outpace future offensive missile systems in order to defend the U.S. homeland, U.S. deployed forces, our allies and partners. MDA will continue to work closely with the Intelligence Community, the Services, and the Combatant Commands.

Finally, I would like to recognize the men and women who serve in our Armed Forces at home and abroad and who operate the MDS. Our Nation is fortunate to have such a highly skilled and dedicated fighting force.

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

Vice Admiral Jon A. Hill
Director, Missile Defense Agency

Vice Adm. Jon Hill is a native of Texas, born and raised on Fort Bliss. A Surface Warfare Officer, designated as an engineering duty officer, he is a graduate of Saint Mary's University. He earned his Master of Science in Applied Physics and Ordnance Engineering from Naval Postgraduate School.

Hill's first flag officer tour was program executive cfficer for Integrated Warfare Systems (PEO IWS). In this role, he was accountable for developing and certifying the deployment of all surface ship combat control systems, radars, missiles, launchers, electronic warfare, naval gunnery systems, and surface and subsurface anti-submarine warfare mission capabilities within the fleet and joint force.

Hill previously served as the deputy director, Missile Defense Agency. Other leadership and acquisition engineering positions include AEGIS Shipbuilding (PMS 400), Naval Surface Warfare Center (NSWC) Dahlgren Division and Port Hueneme Division, PEO Theater Surface Combatants, and on the Assistant Secretary of the Navy staff for Research, Development and Acquisition (ASN RD&A).

He also served on the Joint Staff (J-6), U.S. Army Staff for Missile Systems, and as a senior fellow on the Chief of Naval Operations Strategic Studies Group (CNO SSG XXVII). He served as technical director for AEGIS Ballistic Missile Defense then as AEGIS Combat Systems major program manager responsible for delivering Naval Integrated Fire Control and Counter Air (NIFC-CA) and Integrated Air and Missile Defense (IAMD) capabilities to forces afloat.

In June 2019, Hill became the 11th director of the Missile Defense Agency (MDA). In this capacity, he oversees the MDA's global mission to develop, deliver, and sustain layered capabilities to defend deployed forces, the United States, allies and friends against ballistic missile attacks in all phases of flight.

Personal awards include the Navy Distinguished Service Medal, Defense Superior Service Medal (two awards), the Legion of Merit (two awards), the Defense Meritorious Service Medal (two awards), Meritorious Service Medal (three awards), Joint Service Commendation Medal, U.S. Army Commendation Medal, Navy & Marine Corps Commendation Medal (two awards) and the Navy Achievement Medal (two awards).

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 HOUSE OF REPRESENTATIVES

SECOND SESSION, 116TH CONGRESS

FISCAL YEAR 2021 AUTHORIZATION REQUEST FOR MISSILE DEFENSE

MARCH 12, 2020

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Introduction

Chairman Cooper, Ranking Member Turner, 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 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 (USASMDC), I have Title 10 responsibilities to organize, train, and equip Army space and global missile defense forces. I serve as the Army's force modernization proponent for space, global 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).

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 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.

Both commands are uniquely organized to conduct joint, global operations for space and missile defense and comprise multi-compo Soldiers, Airmen, Sailors, Marines, and dedicated Civilians and Contractors geographically postured to support diverse missions. Our vision is one 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, USASMDC 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. To achieve this, the organizations I command align their activities to these priorities:

- 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.
- Accomplish our mission as one team of empowered, innovative, ready and resilient professionals.

My intent today is to highlight the dedicated people who serve in the diverse and geographically dispersed organizations under my command, to briefly outline the strategic environment, and to emphasize the responsibilities USASMDC bears as a provider of missile defense and space forces to geographic combatant commanders (GCCs). 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.

The Workforce—Our Greatest Asset

USASMDC and JFCC IMD cannot carry out our wide-ranging national security missions without the dedication of our greatest asset—our people. The continued support of Congress is critical to our ability to develop and retain a highly qualified and mission-ready team. Over the past months, I have seen countless examples of how our strength lies in our agile, adaptive space and missile defense workforce, a team of more than 3,000 highly trained and skilled Soldiers, Sailors, Airmen, Marines, and Civilians who stand vigilant 24/7/365, protecting the joint warfighter and defending the homeland. Our innovative and empowered personnel are the heart of both commands. It's our people who make us strong; it's our people who make winning possible.

> People are the Army's greatest strength and our most important weapon system.
> - CSA SASC Confirmation Statement May 2019

An Increasingly Complex Array of Threat Systems

Current global trends indicate adversary air and missile threats are becoming more capable, due in part to the proliferation of advanced technologies, resulting in systems with global reach, increasing speed, and greater accuracy. Many foreign missile systems are progressively incorporating advanced countermeasures including maneuverable reentry vehicles, multiple independent reentry vehicles, and electromagnetic jamming, all intended to defeat our missile defense capabilities. Moreover, numbers and variants of missile platforms are increasing. Many systems are mobile, which increases the difficulty in detecting, tracking, and targeting these weapons. Hypersonic glide vehicles delivered via ballistic missile boosters, as well as hypersonic cruise missiles under development, are emerging threats that will pose new challenges to missile defense systems.

Numerous countries are developing ground-, sea-, and air-launched land-attack cruise missiles using a variety of unconventional and inexpensive launch platforms. Today, nearly 30 countries possess ballistic missile capability. There are over 35 different variants of ballistic missiles in service across the globe today and new intermediate-range and intercontinental ballistic missiles (IRBM and ICBM) are under

development. North Korea maintains and continues to develop a viable short- to long-range ballistic missile inventory as a means to leverage political and economic gain and wield coercive influence over its neighbors. Iran's desire to have a strategic counter to the U.S. could drive it to field an ICBM. Its ongoing development of a space program could shorten a pathway to a longer-range system that could threaten U.S. and allied interests. China continues to have the most active and diverse ballistic missile development program in the world. It is developing, testing, and upgrading both ballistic and cruise missiles to counter a perceived threat to its national sovereignty. Intelligence assessments indicate China is developing offensive systems that can target areas of operation including Taiwan, the first and second island chains, as well as our homeland. In addition, China is developing a range of technologies to counter U.S. and other countries' ballistic missile defense systems. Russia, possessing a large strategic arsenal, continues to leverage emerging technologies to improve currently fielded and future systems. Other regional adversaries also possess ballistic and cruise missile capabilities that could pose a potential threat to U.S. interest and deployed U.S. forces, as well as those of our allies and partners. They have also shown an ever-increasing willingness to use them against opposition forces which can create ancillary global political and economic impacts.

> "U.S. homeland missile defense must both outpace rogue state offensive missile capabilities and hedge against possible future threat developments."
> - 2019 Missile Defense Review

Unmanned aircraft systems (UASs) 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 extensive range of UAS platforms in terms of size, velocity, range, altitude, flexibility, and capability makes the counter-UAS (C-UAS) mission complicated 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.

In the future, U.S. missile defense systems will face increasing challenges in the form of electronic and cyber attacks, as well as directed energy (DE). These types of threats will become more acute, especially as we make progress to develop U.S. space-based capabilities. We expect these 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 successfully engage incoming ballistic and cruise, as well as 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 cost-effective solutions to integrate current and future capabilities. We continue to prioritize integrated AMD 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 development, deployment, and employment of missile systems. 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. To enable effective active defenses and pre-launch attack operations, successful integration of multi-domain capabilities spanning from tactical to strategic and departmental to interagency is necessary.

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.

The 2018 National Defense Strategy prioritizes a strong commitment to security and stability in the Indo-Pacific region, Europe, and the Middle East. In conjunction with our allies and partners, the Department of Defense maintains deployed and forward-stationed Patriot; THAAD; Forward-Based Mode 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, and we are developing a more robust global AMD force posture that leverages partner nations' growing capabilities and capacity. These efforts are intended to reduce the strain on U.S. forces while enabling more timely modernization of our AMD assets.

Army Air and Missile Defense 2028 is the new concept that will guide 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 National Security Strategy, the 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.

Army Air and Missile Defense 2028 charts a new path for Army AMD, which is a top Army modernization priority. It addresses our ability to balance current operational requirements while shaping the future force and modernization efforts to counter future challenges. AMD is a top priority because it enables the Army's ability to penetrate and dis-integrate enemy A2/AD systems and exploit the resulting freedom of maneuver to achieve strategic objectives. Consequently, the Army has acted to increase the speed with which we are modernizing the AMD force. Army Air and Missile Defense 2028 nests within the Army Modernization Strategy, which enables us to deliver advanced

AMD capabilities to our warfighters on a substantially decreased timeline. The Air and Missile Defense Cross-Functional Team (AMD CFT) is the key agent that is rapidly developing capabilities in accordance with the strategy. It is ensuring future capabilities transition quickly from concept, to prototyping, to fielding. The programs that Army AMD is rapidly developing through the AMD CFT are: Army Integrated Air and Missile Defense (AIAMD); 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 and high power microwaves.

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 GCCs. This command is manned by multi-compo Soldiers, Civilians, and Contractors, who contribute to operations, planning, integration, control, and coordination of Army forces and capabilities in support of USSTRATCOM's missile defense mission. Other commands around the world, including all GCCs, also leverage the capabilities we provide. 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 Army Navy/Transportable Radar Surveillance and Control, Model 2, Forward-Based Mode (AN/TPY-2 FBM) radars. Highlights of the capabilities provided to current operations and readiness by our missile defense professionals include:

> "[The] missile defense mission remains a no-fail mission."
> - USNORTHCOM SASC Posture Statement February 2020

Support to Global Missile Defense: Soldiers from the 100th Missile Defense Brigade (MDB), headquartered in Colorado Springs, Colorado, and the 49th 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 components. At the Fort Greely Missile Defense Complex, the 49th 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. With the ongoing support of Congress, we have realized substantial quality of life improvements for these remotely stationed personnel and their Families.

> **"Interceptors (GBI) currently emplaced have the capability of defending the homeland from today's limited rogue threat."**
> - USSTRATCOM HAC-D Posture Statement, February 2020

Support to Global Missile Defense System Test and Development: Soldiers from the 100th MDB and the 49th 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

> **"Our missile defense forces here, are vital to our national defense and the world should know that they're ready."**
> - VPOTUS Elmendorf Air Force Base, Alaska, 2018

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. The most recent example was the FTG-11 test conducted in March 2019. The event enabled brigade and battalion Soldiers to demonstrate their tactics, techniques, and procedures in support of an operational flight test. GMD tests validate their readiness as they perform their operational tasks, while building warfighter confidence that the system will perform as designed.

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 at the conclusion of Fiscal Year 2021 and will provide additional capacity and flexibility. The development of the Next Generation Interceptor (NGI) will be a significant upgrade to the current interceptor fleet, providing the warfighter with improved system performance and greater reliability.

Space Support to Ballistic Missile Early Warning: Space-enabled capabilities are essential for missile defense operations. They provide and enable communications; positioning, navigation, and timing; intelligence, surveillance, and 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.

> "The exploitation of space provides a missile defense posture that is more effective, resilient and adaptable to known and unanticipated threats."
> - 2019 Missile Defense Review

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 deployed around the globe, providing continuous, dedicated, assured missile warning to USSPACECOM and GCCs in support of deployed and forward-stationed forces. In Europe, the relocation of the JTAGS detachment from Stuttgart, Germany, to Sigonella Naval Air Station, Italy, has been completed, increasing our operational missile warning capability. We continue to incrementally upgrade these systems to address the evolving nature of the threat.

USASMDC's second major task is to develop future missile defense forces and mature current capabilities. The Space and Missile Defense Center of Excellence (SMDCoE) represents Army equities across the joint community. Within the capabilities of Army and joint space, missile defense and high altitude, the SMDCoE 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 SMDCoE 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 (DOTMLPF–P) 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 the fall of 2019, USASMDC established the first commandant of the U.S. Army Space and Missile Defense (SMD) School within the SMDCoE. The commandant oversees all Army space and missile defense training, leader development, education, and personnel responsibilities, provides Army space proponency, and supports force modernization. The U.S. Army SMD School executes the Army Space Training Strategy in coordination with TRADOC and FORSCOM across the entire Army institutional and operational training enterprise at Army schools, home station training, and combat training centers. The SMD School is expected 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.

The SMDCoE is USASMDC's architect for future force design. While unified, its geographically dispersed team designs, builds, modernizes, trains, and educates Army space and missile defense forces. It contributes to developing superior space, missile defense and high altitude capabilities that enable multi-domain effects to protect the homeland and support tactical to strategic success whenever and wherever required. It drives change to the current force focused on combat ready forces and capabilities. This effort is balanced with a constant view to the future by preparing or adopting leap-ahead concepts or technologies through innovative solutions. In summary, it is uniquely organized and geographically well positioned to meet future Army needs.

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 disruptive and critical technologies that meet today's requirements and address future needs, enabling warfighter dominance in multi-domain operations. The Technical Center manages science and technology, research and development, and conducts test programs for space, integrated AMD, DE, hypersonics, and related technologies. 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.

Following are brief summaries of a few of our research and development efforts, as well as an overview of the capabilities of an essential Army testing range.

> "We are no more than a few years of having...directed energy weapons of military utility."
> - Dr. Michael Griffin, Center for Strategic and International Studies Interview, December 2018

Directed Energy: The Technical Center is the Army lead for high energy laser 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 have the

potential to be 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 unmanned aerial systems and defeating improvised explosive devices and other improvised threats.

Tactical Space Technologies: As the Army lead for space research, development and engineering, our Technical Center identifies, develops, demonstrates, and integrates space technologies in the areas of responsive space and space superiority. To meet Army operational needs, focus areas include persistent beyond line-of-sight communications via small satellites for forces deployed in remote areas; functionally effective resolution imagery via small satellites; solutions for assured positioning, navigation, and timing; ground C2 systems to reduce operator burden; and direct downlink of tactical data feeds.

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. 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. 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 strategically located and remotely challenged 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 2019, RTS supported four Minuteman III test launches (Glory Trips) to successfully validate and verify the

effectiveness, readiness, and accuracy of the weapon system. Hypersonic system testing has become a significant element of test planning at RTS. Because of the geographic remoteness and available complex sensor suite, RTS has seen a significant upswing in hypersonic systems test planning. There are currently multiple active hypersonic test programs in various stages of planning at RTS.

In concert with its testing mission, 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 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 will be an important capability in this mission. When Space Fence becomes fully operational, it will enable 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 National Defense Strategy and the Army Vision and enables Multi-Domain Operations (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

> AMD is a Critical Enabler of the Army's Ability to Conduct Multi-Domain and Joint All-Domain Operations

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. A summary of the Army's AMD strategic direction and major programs follows:

Air and Missile Defense Readiness: Readiness remains the Army's top priority. 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. With an increased AMD presence in USCENTCOM, USINDOPACOM, and USEUCOM, a significant portion of the AMD force is committed abroad. The Army must continue to take action to mitigate stress on the force and restore strategic flexibility. Without a sustained decrease in demand, the AMD force will face difficult choices over the coming years as overseas requirements will consume several battalions that require modernization. Within the last five years, the Army has implemented a Sustainable Readiness Model, established an AMD test detachment, and fielded the Dismounted Patriot Information Coordination Central (DPICC). During the past couple of years, the Army fielded five DPICCs to USINDOPACOM, USEUCOM, and USCENTCOM providing these CCMDs greater flexibility and a smaller deployable footprint to meet mission requirements.

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 10th Army Air and Missile Defense Command in USEUCOM to a general officer.

Army Integrated Air and Missile Defense: The AIAMD program is a top Army AMD modernization priority. AIAMD integrates current and future AMD sensors and weapons into a common integrated fire control capability that allows the warfighter to fully integrate AMD capabilities across all echelons. The Integrated Air and Missile

Defense Battle Command System (IBCS) is the materiel solution for AIAMD and 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 task organized into a formation with an inherent, integrated mission command system. The IBCS open architecture enables rapid integration of legacy and developmental sensors and shooters, providing capabilities to defeat emerging threats in MDOs. The program is on schedule, moving forward in accordance with the 2018 Congressional report. It will go into its limited user test this spring, leading to a scheduled Milestone C decision in Fiscal Year 2022.

The program will field common mission command nodes for Army AMD forces to defend against manned aircraft and UAS, air-to-ground missiles, tactical ballistic missiles, cruise missile (CM), and RAM attacks. The IBCS will operate with air surveillance and fire control capabilities across the Army, Air Force, and with joint and multinational AMD capabilities across all echelons. It will enhance the lethality of the AMD force. By dismantling the current system-centric mission command paradigm, it will dramatically increase capability and also facilitate open industry competition in support of the AMD community. AIAMD is one of the Army's contributions to Joint All Domain Command and Control (JADC2) and there is continued experimentation to link with C2 systems for Army and joint fires. Additional efforts are currently underway to explore the feasibility and potential benefits of integrating the Army's IBCS and MDA's Missile Defense System (MDS) Command and Control, Battle Management, and Communications (C2BMC), including THAAD fire control center, to fully support AIAMD interoperability with the MDS.

Terminal High Altitude Area Defense System: THAAD is a key component of the MDS 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 endoatmospheric and exoatmospheric intercept capability using proven hit-to-kill technology. There are currently seven operational THAAD batteries. THAAD batteries are deployed to Guam and the Republic of Korea in

response to the North Korean nuclear and missile threat. The U.S. Forces Korea (USFK) Joint Emergent Operational Needs Statement (JEONS) requirement improves Patriot and THAAD interoperability and brings a Patriot launch-on-remote capability in Fiscal Year 2020 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: 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 GCCs' 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. Ten of fifteen Patriot battalions are modernized with the latest software and hardware capabilities to counter new emerging and evolving threats. Another two battalions are currently under modernization and the final three Patriot battalions will be modernized during Fiscal Year 2020. 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, this capability will be pure-fleeted across all

Patriot battalions beginning in Fiscal Year 2022. To overmatch the near-term evolving threat, the Army is continuously improving Patriot capability while moving toward the AIAMD IBCS architecture including a new sensor and fire protection capability.

Lower Tier Air and Missile Defense Sensor: Replacing the present Patriot radar, LTAMDS will provide sensing capabilities in the lower-tier portion of the missile defense battlespace and enable the full capabilities of the PAC-3 MSE missile. Additionally, LTAMDS will serve as a sensor node on the IBCS network, address capability gaps against advanced threats, modernize technology, reduce operations and sustainment costs, mitigate obsolescence, and enhance reliability and maintainability.

To ensure a fair-and-open competition, an LTAMDS Sense-Off demonstration was conducted in 2019. The competition provided industry the opportunity to demonstrate potential LTAMDS solutions. The Army leveraged sense-off results, with modeling and simulation efforts to evaluate industry capabilities and determine future growth potential. Following the sense-off and proposal evaluations, the Army awarded an Other Transactional Authority (OTA) to Raytheon on October 16, 2019, for the delivery of six prototypes. The objective of the rapid prototyping effort is fielding four sensors to one battalion in 2022.

Indirect Fire Protection Capability: The Army is developing new capabilities to defeat air, UAS, CM, and RAM threats. The primary IFPC mission is to provide a robust protection capability against these threats to supported forces within fixed and semi-fixed locations. To address a near-term gap in defenses against potential CM threats, the Army is procuring the Israeli Iron Dome system as an interim capability.

Counter-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 C-UAS executive agent duties and established a C-UAS joint capability office (JCO). Key focus areas for the JCO include developing joint requirements and materiel solutions, as well as integrated plans, training, and doctrine. C-UAS 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 has deployed over 500 C-UAS systems (man-portable, expeditionary, and mobile) and continues to adapt to changes in theater UAS threats. The modification of counterfire target acquisition radars, equipped with multi-mission air surveillance target acquisition capabilities, improves the warfighter's ability to detect and defeat these low, slow, and small UAS threats. Efforts continue to close the risk gap to protect our maneuver forces with short-range defense capabilities.

Maneuver-Short Range Air Defense: M-SHORAD will provide a dedicated maneuverable and survivable AMD capability for maneuvering forces against fixed-wing, rotary-wing, and UAS threats. In Fiscal Year 2018, the Army began developing and fabricating initial M-SHORAD systems that integrate existing Army capabilities into a Stryker combat vehicle. Rapid prototype development and integration activities continue, and four M-SHORAD battalions are scheduled to be fielded in Fiscal Years 2021 through 2023. In addition, the Army continues to mature high energy lasers and electronic warfare (EW) 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 interceptor 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 Unified Command Plan (UCP) assigned missile defense mission, enabling the headquarters to focus on integration and advocacy. Headquartered at Schriever Air Force Base in Colorado Springs, Colorado, JFCC IMD is manned by a cohesive team of Army, Navy, Air Force, Marine Corps, Civilian, and Contractor personnel.

As the Secretary of Defense and various combatant commanders have previously testified, warfighters remain confident in our ability to protect the Nation against missile attacks. However, as the global missile threat continues to evolve and in accordance with the Missile Defense Review, 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 which penetrates our defenses. JFCC IMD's principal mission is to coordinate with, and operationally support, the joint warfighters at the GCCs, and advocate for their requirements with the materiel developers at MDA and the Services. On behalf of the GCCs and USSTRATCOM, JFCC IMD champions warfighter priorities and capability needs, including continued development of a robust sensor network, integrated discrimination capabilities, redundant and resilient C2 networks with enhanced cybersecurity defenses, and improved interceptors for both homeland and regional missile defenses.

Through JFCC IMD, we work across DoD and alongside key allies and partners to improve integration of existing capabilities, maximizing efficiency and effectiveness in global missile defense missions. The essential force multiplier is integration—a critically important mission enabler that JFCC IMD directly supports. As a functional component command of USSTRATCOM, JFCC IMD 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 supporting ground and flight tests.

To accomplish these efforts, we maintain close collaborative relationships with the GCCs, MDA, the Services, OSD, the Joint Staff, and our allies and partners. We continually seek to enhance our deployed forces' capabilities while gaining operational experience and confidence in our collective ability to defend the Nation, deployed forces, partners, and allies. Some of our key efforts to enhance missile defense planning and capabilities for both the homeland and regional architectures follow:

Expansion and Integration of the Missile Defense Architecture: In response to the evolving strategic environment, we continue to bolster homeland and regional missile defense capabilities. In development of the global missile defense mission, we are supporting the advancement of the new capabilities such as 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; and various other new capabilities such as high energy laser, and other DE technologies. Given the many challenges associated with implementation of these architectures, JFCC IMD, in support of USSTRATCOM's coordinating authority role for global missile defense, collaborates with the GCCs to assess and address cross-regional gaps in the areas of planning, policy, capabilities, and operations.

Multiregional Missile Defense Asset Management: JFCC IMD, in coordination with USSTRATCOM and the GCCs, 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 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 and Assessment: JFCC IMD works with the missile defense community to refine processes that synchronize transregional global missile defense planning and operations. Codified in periodic revisions to the Global Missile Defense Concept of Operations, these processes ensure unity of effort and mitigate potential seams and gaps across geographic areas of responsibility. Consistent with the Department's transition to planning based on adversary problem sets, JFCC IMD has continued to refine our process for adversary-centric missile defense plans assessments, and completed further objective analysis of missile defense risks across multiple GCC plans. This assessment methodology identifies systemic risk, informs recommendations for shortfall mitigation, and increases effectiveness in future missile defense planning efforts. This analysis informs our biennial Global Integrated Air and Missile Defense Assessment which shapes 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 combatant commanders' campaign and contingency plans. We continue to refine our approach, ensuring integrated capabilities are appropriately postured to counter transregional threats in accordance with the National Defense Strategy, the 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. In support of those efforts, our Global Missile Defense Concept of Operations includes an International Engagement Framework which provides a common approach to identify potential

partners, a model to identify a level of maturation, and an assessment mechanism. This approach has formed the analytical basis for previous Department Reports to Congress on Allied Integration. Another 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 Department of State, OSD, Joint Staff, CCMDs, and MDA convene quarterly 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. The 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 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. Events like Nimble Titan foster greater confidence in combined missile defenses and provide a means to advance U.S. efforts in

> "By working together with allies and partners we amass the greatest possible strength for the long-term advancement of our interest."
> - 2018 National Defense Strategy

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 FLO, a German Air Force officer, has been an integral player in Nimble Titan, NATO ballistic missile defense training, and allied and partner modeling and simulation efforts. We expect to receive a Danish FLO this year to increase our understanding of multinational missile defense policy, capabilities, and planning initiatives in the European region.

Joint Missile Defense Training and Education: 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. Last year, OSD designated JFCC IMD's Joint Ballistic Missile Defense Training and Education Center as the first Joint Center of Excellence. It now offers 16 mission-oriented resident and mobile training team courses, and online courses to include orientation, asset management, C2BMC situational awareness, and general officer/flag officer seminar training. Over the past year, JFCC IMD instructors executed 230 courses, training over 3,700 students worldwide. Additionally, JFCC IMD provided training courses to our allies and partners through military-to-military and Foreign Military Sales training venues. In 2019, this included training to the Japan Self Defense Force Joint Staff, the Republic of Korea Armed Forces, and the United Arab Emirates.

Warfighter Capability Acceptance and Integrated Master Test Plan: As missile defense architectures mature, warfighters require a credible, comprehensive assessment of new capabilities to inform operational acceptance into the global MDS. The warfighter relies on a robust and operationally relevant test campaign to confidently field and integrate new capabilities into their existing IAMD architectures.

Our recent Warfighter Capability Acceptance Progress Report highlights improvements made to Robust IRBM Defense for USEUCOM and USCENTCOM. The next Warfighter Capability Acceptance report is scheduled to be completed in 2020 and will include THAAD remote launcher capability in support of the USFK JEON.

In the past year, JFCC IMD supported the MDS test campaign with some significant firsts: the first salvo (two GBIs) engagement of an ICBM-class target; operational flight test of the GMD system; the first use of the space segment of the Spacebased Kill Assessment in a GMD flight test; the first Aegis SM-3 Block IIA simulated engagement of an ICBM-class target; and the first use of THAAD remote launch capability.

We also supported a Patriot MSE launch-on-remote engagement using THAAD data. This test featured the first Patriot launch-on-remote engagement against an SRBM class target and supports USFK's JEON and the 2016 National Defense Authorization Act (NDAA) interoperability requirement for Patriot and THAAD. In a few months, a flight test is scheduled to demonstrate Aegis BMD's capability to engage an ICBM-class target.

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 integrate offense and defense in a comprehensive posture. Creating a comprehensive approach will require balancing a variety of offensive approaches within our deterrence calculus. 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

> "The United States will pursue greater integration of attack operations with active and passive missile defenses."
> - 2019 Missile Defense Review

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, EW, 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 Cooper and Ranking Member Turner, 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 GCCs, 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 MDS capabilities to counter global missile threats and to protect our Nation, deployed forces, allies, and partners.

While operational, doctrinal, and materiel developments are essential, our most important assets are the thousands of Soldiers, Sailors, Airmen, Marines, Civilians, and Contractors who deploy and operate our IAMD systems. As recognized by Department leadership, the strength behind our outstanding workforce is their Families. Their contributions and sacrifices are foundational to the dedication and performance of our workforce—the role and support of our Families empowers mission accomplishment.

I appreciate having the opportunity to address missile defense matters and look forward to addressing your questions.

LTG Daniel Karbler
Commanding General, USASMDC

Lieutenant General Daniel L. Karbler assumed command of the U.S. Army Space and Missile Defense Command and Joint Functional Component Command for Integrated Missile Defense on Dec. 6, 2019.

LTG Karbler most recently served as the chief of staff, U.S. Strategic Command, Offutt Air Force Base, Nebraska. He was the principal adviser to the USSTRATCOM commander and deputy commander, and directed the activities of the command staff by developing and implementing policies and procedures in support of the command's missions. He chaired numerous boards, oversaw the command's corporate process and served as the director of the commander's staff.

LTG Karbler also served as the commanding general of the U.S. Army Test and Evaluation Command. Prior to that, he served as the director, Joint and Integration, Army G-8 at the Pentagon.

LTG Karbler has held multiple leadership positions, from platoon leader to installation chief of staff and school commandant. He has commanded both B Battery and D Battery in the 5th Battalion, 7th Air Defense Artillery Regiment, 32nd Army Air and Missile Defense Command while assigned to U.S. Army Europe. He also commanded 3rd Battalion, 43rd Air Defense Artillery Regiment, 32nd AAMDC at Fort Bliss, Texas; the 31st Air Defense Artillery Brigade, 32nd AAMDC at Fort Sill, Oklahoma; and the 94th AAMDC at Fort Shafter, Hawaii.

LTG Karbler earned his Bachelor of Science in 1987 from the United States Military Academy at West Point where he was commissioned as a second lieutenant in the Air Defense Artillery branch. He also holds a Master of Business Arts from Benedictine College in Atchison, Kansas, and a Master of Arts in strategic studies from the National War College. His military education includes the Air Defense Artillery Officer Basic and Advanced Courses, the Command and General Staff College and the National War College.

His awards include the Distinguished Service Medal, Defense Superior Service Medal, Legion of Merit, Bronze Star, Defense Meritorious Service Medal, and the Israeli Air Force Combat Operations Badge.

OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR POLICY

PRESENTATION TO THE

SUBCOMMITTEE ON STRATEGIC FORCES

HOUSE ARMED SERVICES COMMITTEE

U.S. HOUSE OF REPRESENTATIVES

HEARING ON FISCAL YEAR 2021 PRIORITIES FOR MISSILE DEFENSE

STATEMENT OF DR. ROBERT SOOFER
DEPUTY ASSISTANT SECRETARY OF DEFENSE FOR
NUCLEAR AND MISSILE DEFENSE POLICY

MARCH 12, 2020

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U.S. HOUSE OF REPRESENTATIVES

Statement of Dr. Robert Soofer
Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy
Before the
House Armed Services Committee
Subcommittee on Strategic Forces
March 12, 2020

Introduction

Chairman Cooper, Ranking Member Turner, and Members of the Committee, thank you for the opportunity to testify before you today on the international threat environment and the Department's missile defense policy, posture, and budget. In the year since the last budget hearing on these topics, North Korea, Iran, China, and Russia have all made significant advances in their missile forces – a development DoD anticipated and accounted for in this budget request. This Committee's support has been absolutely vital to the progress we have made so far, and will be even more crucial to supporting the Department's commitment to defending against the missile threats we face this year and beyond.

The FY2021 budget demonstrates this commitment by presenting the requests of the Missile Defense Agency (MDA), the Services, the Space Development Agency (SDA), and others for efforts supporting missile defense or missile defeat missions. These resources maintain and extend the service lives of our current forces, promote readiness, increase lethality, reinforce deterrence and assurance missions, and invest in the advanced technologies needed to counter future missile threats across the spectrum of threats.

Evolving Threat Environment

As adversary missile technology matures and proliferates, the threat to the U.S. homeland, allies, partners, and our forces in the field becomes increasingly dynamic and difficult to predict. While traditional fixed and mobile ballistic missile threats continue to grow, adversaries are also investing in ground-, air-, and sea-launched cruise missiles with diverse ranges. China and Russia are also developing and testing hypersonic missile technology, with Russia recently deploying the world's first operational intercontinental-range hypersonic glide vehicle (HGV). These missile technologies are being incorporated into adversary strategies meant to coerce and intimidate the United States and its allies by threatening critical targets in our homelands.

China, for example, fields over a thousand ballistic missiles including approximately 150-450 medium range ballistic missiles (MRBMs) which they claim have maneuverable warheads, and a growing number of intermediate range ballistic missiles (IRBMs) including the nuclear-capable DF-26. The PLA Navy and Air Force also continue to develop land-attack cruise missiles. China is also developing its own hypersonic glide vehicle program which is meant to challenge the U.S. military presence across the Pacific.

Russia maintains one of the largest missile inventories in the world and is building new ballistic, cruise, and hypersonic missiles to support its aggressive regional and global policies. Depending on the delivery platform, these new Russian missiles can range our NATO and Asian allies, U.S. forces, and the U.S. homeland. As an example, one regional threat our forces and allies face is the SS-26 Stone short-range ballistic missile, which can carry a variety of payloads including anti-personnel/anti-material, fragmentation sub-munitions, high explosive, thermobaric, high explosive earth-penetrators, electromagnetic pulse, and nuclear warheads. Russia's commitment to its missile force modernization is evident in the sheer number of missile types it is producing as well as its prioritization in their military budget.

North Korea has worked aggressively to develop nuclear ballistic missiles capable of threatening the U.S. homeland, allies, and partners. Despite our diplomatic efforts, North Korea continues its ICBM programs that will allow it to strike the United States. It has conducted multiple ICBM tests and showcased several ICBM variants, including the Hwasong-14 and Hwasong-15. Furthermore, North Korea has tested new regional ground- and sea based-ballistic missiles.

Iran, which possesses well over a thousand missiles, continues efforts to modernize and proliferate its regional missile systems. Iran views its missile arsenal as a valuable tool of coercion in the broader region of the Middle East and beyond – a fact clearly demonstrated by its launch of over a dozen ballistic missiles into Iraq recently. We believe Iran could gain valuable information from its space-launch program, despite its recent failure, which could contribute to an effort to develop an ICBM should it choose to do so. Iran has shown a willingness to use missiles to attack Saudi Arabia and transfer such weapons to its Houthi proxies in Yemen that have made extensive use of ballistic and cruise missiles and UAVs.

Adversaries seek to defeat U.S. missile defenses not just through advances in their offensive missile technology, but also through targeted and coercive diplomatic campaigns. We have seen concerted Chinese and Russian efforts to intimidate allied leadership against cooperating with the United States on regional missile defense as well as attempts to sow misinformation and disinformation on U.S. homeland defenses, while increasing their own already considerable missile defense capabilities. The ultimate goal of these Chinese and Russian efforts is clear: the vulnerability of U.S., allied, and partner homelands and forces to missile coercion and attack.

U.S. missile defense policy recognizes the reality of this dynamic threat environment and addresses the protection of the United States, its forces abroad, allies, and partners, both now and in the future.

Missile Defense Policy and Roles

To address the evolving challenges to our security and the security of our allies and partners, the United States is focused on a layered defense, with adaptable systems to meet the evolving threat environment. U.S. policy for defense of the homeland is to stay ahead of rogue state missile threats while relying on nuclear deterrence to address the large and more sophisticated Chinese and Russian ICBM arsenals. U.S. regional policy is to work with allies and partners to defend against common regional threats and preserve U.S. ability to support, reinforce, and achieve U.S. military objectives during a crisis or attack. As for emerging threats, U.S. policy is to hedge against unexpected adversary developments by investing in advanced technology so the United States, its allies, and its partners can defend against strategies of coercion or attack in the future.

Within this framework – homeland, regional, and emerging threats – our key missile defense policy objectives are centered on the following areas, as articulated in the 2019 Missile Defense Review (MDR):

- Defending the U.S. homeland, our military forces abroad, allies, and partners;
- Diminishing the benefits of adversary coercive threats and attacks;
- Assuring allies and partners that we will stand by our security commitments;
- Preserving our freedom of action to conduct military operations; and,
- Hedging against future, unanticipated offensive missile threats.

The MDR continues to be the Department's guiding policy document and we are working with this Committee's staff to keep you updated on DoD's implementation efforts.

Beyond the familiar roles missile defenses play in U.S. strategy described above, I would like to articulate some of the practical benefits missile defenses provide U.S. policy. First, credible U.S. missile defenses create another level of uncertainty in adversary attack planning, thereby discouraging attack. Second, U.S. missile defenses provide the United States insurance against the failure of deterrence and diplomacy, a distinct possibility when dealing with rogue states such as North Korea and Iran. Third, U.S. missile defense strengthens the leverage of U.S. diplomats at the negotiating table, such as when discussing North Korea's denuclearization by demonstrating U.S. ability to resist coercion and threats of limited nuclear attack. Fourth, U.S. missile defenses provide the President and other senior officials a "time buying" option during a crisis – relieving some pressure decision-makers may face about responding quickly to a developing attack. Fifth, U.S. missile defenses can intercept unauthorized or accidental adversary missile launches which can help decrease the risk of inadvertent escalation. Finally, U.S. missile defenses protect radars and other military systems that provide situational awareness, reducing the risk of miscalculation or misperception during a crisis, as well as reducing the likelihood of successful missile attacks against such systems.

In this age of growing missile threats to the U.S. homeland, where lines are now being blurred between traditional ballistic missiles and cruise missiles and hypersonic weapons, U.S. policy is at a pivotal stage. We remain confident that we can protect the homeland from rogue state missile attack today and we rely on our nuclear weapons to deter strategic attack from China and Russia. The current ground-based midcourse (GMD) defense system is well suited for the threat it was designed to defeat. We are also seeing the emergence of new threats to the homeland such as long-range cruise missiles. The United States is exploring options to improve its ability to provide strategic warning to U.S. leaders against emerging Chinese threats and long-range Russian bombers, as well as the ability to defend against cruise missile attacks on the homeland.

Regional missile threats to our allies, partners, and U.S. forces abroad range from a limited missile strike to a potentially much larger attack utilizing ballistic, cruise, and hypersonic missiles. U.S. regional missile defense policy is to work with allies and partners to further our

mutual interests against common threats through mutually-advantageous investments in missile defenses. We seek to deny an adversary any confidence that a missile attack can achieve a decisive victory or prevent the United States from operating within an adversary's anti-access/ area-denial zone.

Emerging offensive missile threats will not remain fixed targets and adversaries will not allow their capabilities to remain static; so U.S. policy is to continuously re-evaluate its missile defense capabilities to make sure they meet current requirements as well as make the necessary investments in research and development to counter future advances in adversary capabilities. The Under Secretary of Defense for Research & Engineering, the Missile Defense Agency (MDA), the Services, and the Defense Advanced Research Projects Agency (DARPA) programs demonstrate the Department is investing in efforts to counter hypersonic missiles, improve laser-scaling, and develop advanced materials.

U.S. Missile Defense Capabilities and Posture

The FY21 budget request recognizes the reality of the threats, advances U.S. policy objectives, and lays out the capabilities and posture essential for the credibility of our deterrence, assurance, and damage limitation missions.

U.S. Homeland Defense

The United States continues to strengthen its homeland missile defenses and is pursuing more advanced capabilities to stay ahead of rogue state threats. Today, the U.S. is defended by the GMD system which consists of 44 GBIs supported by a globally integrated network of sensors and a Command and Control system. To improve the current GMD system, the FY 2021 budget request includes funds for: software advances to enhance existing sensors' performance; deploying a new missile tracking and discrimination sensor in Alaska; refurbishing the COBRA DANE radar; continuing the integration of the Space-based Kill Assessment capability into the missile defense system; and increasing the current GBI fleet's reliability through hardware and software improvements.

DoD is also pursuing more advanced capabilities for the nation as missile threats evolve. First, we are investing in the expansion and modernization of the GMD system. This effort includes a request for the development of a new all-up-round interceptor with the advanced

technology needed to meet the future threat, the Next Generation Interceptor (NGI). We anticipate, based on our success-driven schedule, initial fielding of NGI interceptors as early as 2028, and will continue delivering new interceptors until we meet the appropriate fleet mix of 64 interceptors.

Second, we are enhancing the reliability of the existing GMD system by conducting Stockpile Reliability Program (SRP) and Service Life Extension (SLE) testing of the deployed GBI fleet to inform potential upgrades to extend service life until replaced by NGI. Of special note, MDA will develop the technology needed to expand the GBI battlespace through selectable 2nd and 3rd stage employment, discrimination improvements, and upgraded cybersecurity.

Third, to maintain and improve an effective, robust layered missile defense system, DoD is exploring options for layered homeland missile defense capabilities to complement the existing GMD system and enhance protection of the homeland. This year MDA will conduct a flight test of the SM-3 Block IIA against an ICBM-class target to determine its feasibility as part of an architecture for layered defense of the homeland. MDA is also evaluating the technical feasibility of a new THAAD interceptor to support homeland defense. This layered defense construct, should it prove feasible, would offer additional opportunities to engage missile threats in the late mid-course phase and could be available mid-decade. Successful flight testing will be essential to any potential layered defense of the homeland.

Some have expressed concern that should the SM-3 Block IIA intercept test against an ICBM-type target succeed, and we subsequently decide to incorporate the system into a homeland defense architecture, our plans to build a number of these interceptors could upset strategic stability with China and Russia by threatening to negate some level of their nuclear deterrent. China and Russia will certainly make this argument, but their own sizable investments in homeland missile defense, to include Russia's 68 nuclear-capable interceptors surrounding Moscow, against the full range of missile threats demonstrate their hypocrisy on the topic. Nevertheless, we size our homeland missile defenses to counter the rogue state threat and rely on nuclear deterrence against the much larger Chinese and Russian strategic missile arsenals. Not only do Chinese and Russian strategic missiles vastly outnumber the currently planned number of interceptors, but they also incorporate missile defense countermeasures which they claim will overcome any defense.

Lastly, we are developing a new generation of advanced ground and space based sensors to better detect, track, and discriminate enemy missile warheads. These include completion of a ground-based long range discriminating radar in Alaska and the development of new space-based sensors to track more sophisticated missile threats. Space sensors offer significant advantages for continuous tracking and discriminating threats over the geography limitations of terrestrial sensors. This provides a potential interceptor the data needed for an engagement success.

Regional Defense

As we look beyond the homeland, potential adversaries are developing new, more lethal regional ballistic, cruise, and hypersonic offensive missiles to strike regional U.S. forces, allies, and partners. These missile capabilities support A2/AD strategies designed to contest U.S. and allies' ability to respond to regional aggression, inhibit our freedom of maneuver, and erode our ability to reinforce allies in crisis or conflict. In response, the U.S. is modernizing and increasing its regional missile defense posture by: increasing our capacity by procuring additional Patriot, THAAD, and sea-based SM-3 and SM-6 interceptors; fielding additional mobile platforms, including more BMD-capable Aegis ships, to better respond to crises or conflicts; integrating U.S. regional systems to expand the area that can be defended and employ interceptors more efficiently; and integrating regional ballistic missile and cruise missile defenses. For example, the U.S. Army is acquiring two Israeli-built Iron Dome batteries for cruise missile defense that will over time become part of its larger Integrated Air and Missile Defense (IAMD) posture.

The United States recognizes the increasingly complex nature of the threat and the multiple systems needed to properly characterize, track, and neutralize adversary regional missile threats. Our IAMD posture must be adaptable to new adversary capabilities and tactics. Thus, U.S. geographically-focused combatant commands are developing forward-looking IAMD roadmaps that will guide future missile defense architectures and cooperation strategies with allies and partners. The objective of these roadmaps is to develop and deploy, with our allies and partners, interoperable and integrated missile defense sensors, interceptors and command and control. These "master plans" provide a combatant command-level framework that addresses IAMD with respect to theater design, capabilities and capability gaps, as well as responsibilities and contributions. They outline the strategy for achieving the capability and capacity requirements to deter, and if necessary defeat, the wide range of threats facing our forces worldwide. In addition

to U.S. efforts, NATO is developing an IAMD capability to defend the Alliance from regional air and missile threats from any direction.

Preparing for Emerging Missile Threats and Uncertainties

Looking to the future, our investment strategy and priorities will focus on how best to address more advanced adversary missile threats. In addition to improving today's operational systems, we are examining advanced concepts and technologies. For example, we requested funding in FY21 to develop space-based sensors to improve detection, tracking, and discrimination; and, conduct R&D for defenses against hypersonic missiles, including near-term sensor and command and control upgrades; and concept definition for a regional glide phase weapon system.

Working with Allies and Partners

We must also continue working together with allies and partners to enhance our regional missile defense efforts in the Indo-Pacific, Europe, and the Middle East. We face these threats collectively. Our cooperation strengthens deterrence and provides assurance essential to the unity of our alliances which are threatened by missile coercion and attacks.

The Indo-Pacific is one of the most important regions of the world, and is a cornerstone for cooperative missile defense efforts with strong alliance partners such as Japan, the Republic of Korea, and Australia. A few highlights include the U.S. and Japan are successfully co-producing the SM-3 IIA interceptor, which will defend against more advanced threats. Japan is also in the process of procuring two Aegis Ashore BMD systems which will add to Japan's layered defense posture. The U.S. is also cooperating with South Korea to upgrade its PAC-2 batteries to the more advanced PAC-3 system. South Korea also hosts a U.S. THAAD battery which complements U.S. and ROK Patriots units on the peninsula providing for a layered defense against missile attack. Australia currently deploys Aegis-equipped ships and by the end of the decade has plans to field a new class of Aegis-equipped frigates.

Missile defense plays a critical role in the collective defense capabilities of NATO, and we are working toward improving both the effectiveness and interoperability of current systems to provide more robust protection. NATO has an operational ballistic missile defense capability,

based upon the Aegis Ashore site in Romania, Aegis BMD ships that can be assigned to NATO in a crisis, radars like the AN/TPY-2 in Turkey and early-warning radars in the UK and Greenland, and NATO command and control. The final phase of this effort will be achieved with the completion of the Aegis Ashore site in Poland. Distinct from the NATO BMD standing mission, which is directed against threats from outside the Euro-Atlantic area, the Alliance has integrated air and missile defense capabilities that would be deployed in a crisis to defend against ballistic and cruise missiles from any source.

In the Gulf, missile defenses have proved invaluable – both as a deterrent and an effective response when deterrence fails. Saudi Arabia and the UAE have conducted a number of successful intercepts of hostile missile attacks with their Patriot systems. In response to Iranian aggression, we have provided missile defense systems – Patriot and THAAD batteries – to defend mutual interests in Saudi Arabia. We continue to provide critical ballistic missile early warning data throughout the region. In addition, the U.S. is executing an FMS case with Saudi Arabia for 7 THAAD batteries. There is still much more to be done and the U.S. is making progress with its partners in the Gulf to help establish missile defense capabilities that, when integrated over time, would provide the basis for a networked, layered defense across the region.

Our budget for $500M continues the longstanding support for U.S.-Israeli cooperation on missile defense – highlighted today by our cooperation on the David's Sling Weapon System to counter SRBMs and cruise missiles, and the Arrow-3 hit-to-kill interceptor to address regional ballistic missile threats. Our request also supports co-production of Israel's Iron Dome system to counter rockets, mortars, artillery, and UAVs.

Conclusion

In summary, we must be prepared to meet the growing dangers from offensive missile threats together with allies and partners. In the process, we will strengthen our ability to protect our homelands and our forces; enhance deterrence; and prepare to meet future threats which continue to evolve. Missile defenses, both homeland and regional, provide an invaluable counter to increasingly capable offensive missile forces and the coercive strategies behind them. The

United States will continue to lead the way in missile defense, and together with our critical allies and partners throughout the world, we will deter and defeat our common threats.

Dr. Robert Soofer
Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy

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Rob was previously a Professional Staff Member and Republican staff lead for the Subcommittee on Strategic Forces of the Senate Armed Services Committee, with oversight responsibility for missile defense, nuclear forces, arms control, nonproliferation policy, U.S. Strategic Command, and Department of Energy nuclear weapons and non-proliferation activities.

Between January 2009 and December 2012 he served as strategic forces policy advisor to Senator Jon Kyl, the Republican Whip. In this capacity, he was a senior advisor to the Republican caucus during Senate consideration of the 2010 New START Treaty. Rob also served as a Military Legislative Assistant to Senator Slade Gorton (R-WA) and as Professional Staff Member on the Senate Republican Policy Committee.

Executive branch experience includes: Deputy Director, Office of Missile Defense Policy (Office of the Under Secretary of Defense for Policy); Professor of National Security Policy at the National War College; and various policy positions with the Strategic Defense Initiative Organization/Missile Defense Agency. In 2003, he was called to active duty as a Lieutenant Commander in the Naval Reserve and assigned to the newly created Terrorist Threat Integration Center.

Rob received his Doctorate in International Relations from the University of Southern California (1987) and is a graduate of the National War College (1994). He received the Department of Defense Exceptional Civilian Service Medal and is the author of Missile Defenses and Western European Security (Greenwood Press, 1988).

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MISSILE DEFENSE

Lessons Learned From Acquisition Efforts

Statement of Cristina T. Chaplain, Director,
Contracting and National Security Acquisitions

GAO-20-490T

GAO Highlights

Highlights of GAO-20-490T, a testimony before the Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

For over half a century, the Department of Defense has funded efforts to defend the United States from ballistic missile attacks. From 2002 to 2020, MDA has received about $174 billion to develop the BMDS and has requested about $9.2 billion for fiscal year 2021. The BMDS consists of diverse and highly complex land-, sea-, and space-based systems and assets located across the globe.

This statement summarizes lessons that GAO has identified from its prior reviews of MDA starting in 2004 that can be applied to strengthen the transparency and acquisition practices for developing and fielding missile defense elements. Specifically, this testimony provides information on (1) steps MDA has taken to increase transparency and reduce acquisition risks; and (2) ongoing challenges associated with improving transparency and reducing high risk acquisition practices. In our prior work, GAO reviewed key MDA management documents including annual program reviews, tests plans and budget documents. We also interviewed officials from MDA and from other key DOD offices.

What GAO Recommends

GAO is not making any new recommendations in this statement. GAO has previously recommended that MDA take steps to increase transparency and align its acquisition approach to reduce high-risk practices. MDA concurred with certain recommendations and is taking steps to implement them.

View GAO-20-490T. For more information, contact Cristina T. Chaplain at (202) 512-4841 or ChaplainC@gao.gov.

March 12 2020.

MISSILE DEFENSE

Lessons Learned From Acquisition Efforts

What GAO Found

The Missile Defense Agency (MDA) has taken important steps in recent years to improve management practices, reduce acquisition risks, and deliver capabilities to defend the United States and its allies from ballistic missile attacks. Specifically, MDA has made advances across a broad range of management activities, such as improving stakeholder outreach, reducing concurrency, (broadly defined as the overlap between product development, testing, and production), improving testing of the Ballistic Missile Defense System (BMDS) and increasing transparency of its progress. MDA has also made progress toward improving homeland and regional defense.

However, MDA can go further to align itself with best practices as it faces ongoing challenges associated with improving transparency and reducing high risk acquisition practices. These challenges include:

- *Stakeholder involvement:* MDA has improved its outreach to stakeholders, including the intelligence community and other DOD stakeholders, however, opportunities remain, such as obtaining more input from the defense intelligence community. While MDA is not required to do so, the community is uniquely positioned to help keep pace with emerging threats and validate threat models
- *Concurrency:* MDA has taken steps to reduce concurrency, but falls back on this practice when experiencing developmental delays or schedule pressures. The recently canceled Redesigned Kill Vehicle (RKV) initially aligned production decisions with flight testing. However, in response to advancements from North Korea, development and production were performed concurrently and flight testing was reduced, thereby removing the safeguards that had been put into place.
- *Flight test schedule changes:* Despite initiating a new approach to developing its flight test schedule in 2009, MDA continues to struggle with execution. Namely, MDA is frequently revising its annual schedule by adding new tests, and deleting or delaying others—sometimes multiple times.
- *Transparency of test cost estimates:* MDA regularly makes changes to its test schedule without reporting the impact to its costs and funding needs. We continue to believe that breaking out funding requests by test will improve transparency into planned versus actual test costs and aid departmental and congressional decision makers as they make difficult choices of where to invest limited resources.

MDA is at a pivotal crossroads, needing to balance its ability to pursue new and advanced efforts while also maintaining its existing portfolio. Congress and the Secretary of Defense are undertaking multiple reviews to determine how to address these concerns and chart a path forward for MDA.

Chairman Cooper, Ranking Member Turner, and Members of the Subcommittee:

I am pleased to be here today to discuss the Missile Defense Agency's (MDA) progress in developing and fielding missile defense elements, as well as ongoing challenges that the agency faces. MDA's mission is to develop an integrated and layered Ballistic Missile Defense System (BMDS) to defend the United States, its deployed forces, allies and friends from ballistic and hypersonic missile attacks. In order to meet this mission, MDA is developing a highly complex system that includes land-, sea-, and space-based systems and assets located across the globe. MDA has received approximately $174 billion from fiscal years 2002 through 2020 and is requesting an additional $9.2 billion for fiscal year 2021 to continue its efforts.

Since the fiscal year 2002 National Defense Authorization Act was enacted, we have been mandated to prepare annual assessments of MDA's progress towards its acquisition goals and objectives. Since our first report in 2003, we have reported on MDA's progress and challenges in acquiring and fielding BMDS capabilities.[1] In general, we have reported that MDA has developed, demonstrated, and fielded a limited homeland and regional ballistic missile defense capability, but MDA has fallen short of its goals, in part, because of high-risk acquisition practices. These include initiating new programs without robustly assessing alternative solutions, incorporating high levels of concurrency, and fielding capabilities prior to completing flight testing. These practices enabled MDA to quickly ramp up efforts in order to meet tight, presidentially directed deadlines, but they also resulted in problems that caused some programs to be canceled or significantly disrupted. In recent reports, we have also identified contracting challenges; challenges in working with warfighters and stakeholders, such as the intelligence community; and

[1]Related GAO reports are found at the end of this statement.

challenges associated with testing, such as optimistic planning.[2] We have also reported on MDA's need for more reliable models and simulations, which play an integral role in validating performance.[3]

MDA has made efforts to put newer programs on a more sound footing and it has taken some actions to address acquisition issues, including adopting acquisition best practices in some cases. However, MDA is not always able to sustain its use of these best practices.

Today, I will highlight (1) steps MDA has taken to increase transparency, reduce acquisition risks, and deliver capability; and (2) ongoing challenges associated with improving transparency and reducing high-risk acquisition practices. My testimony is based on reports we issued from April 2003 to December 2019 and on preliminary observations for our ongoing work covering fiscal year 2019. For our previous work, we reviewed MDA management documents including their reported baselines and test schedules. We compared these plans against MDA's actual delivery and testing achievements recorded in agency documents and through interviews with agency officials and relevant officials in the Department of Defense. More detailed information on our objectives, scope, and methodology can be found in those reports. For our ongoing work covering fiscal year 2019, we reviewed MDA's planned delivery and testing goals for fiscal year 2019. We also discussed the agency's plans and performance in interviews with agency officials and the BMDS Operational Test Agency. In addition, we met with officials from the office of the Undersecretaries of Defense for Research and Engineering and Acquisitions and Sustainment.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained

[2]GAO, *Missile Defense: Some Progress Delivering Capabilities, but Challenges with Testing Transparency and Requirements Development Need to Be Addressed,* GAO-17-381 (Washington, D.C.: May 30, 2017); GAO, *Missile Defense: The Warfighter and Decision Makers Would Benefit from Better Communication about the System's Capabilities and Limitations,* GAO-18-324 (Washington, D.C.: May 30, 2018); GAO, *Missile Defense: Delivery Delays Provide Opportunity for Increased Testing to Better Understand Capability,* GAO-19-387 (Washington, D.C.: June 6, 2019) and *Missile Defense: Further Collaboration with the Intelligence Community Would Help MDA Keep Pace with Emerging Threats.* GAO-20-177. (Washington, D.C.: Dec. 2019).

[3]See GAO-18-324 and GAO-19-387.

provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

MDA is responsible for developing a number of systems, known as elements, with the purpose of defending against ballistic and hypersonic missile attacks. MDA's mission is to combine these elements into an integrated system-of-systems known as the Ballistic Missile Defense System (BMDS). The goal of the BMDS is to combine the abilities of two or more elements to achieve objectives that would not have been possible for any individual element. These emergent abilities are known as integrated capabilities or BMDS level capabilities. Table 1 provides a brief description of selected BMDS elements.

Table 1: Description of Selected Ballistic Missile Defense System (BMDS) Elements

BMDS element[a]	Description
Aegis Ballistic Missile Defense (BMD) Weapon System	Aegis BMD includes ship- and land-based ballistic missile defense capabilities using a radar, command and control, and Standard Missile-3 (SM-3) interceptors.
Aegis BMD Standard Missile-3 (SM-3) Block IB	Aegis BMD SM-3 Block IB features capabilities to identify and track objects during flight to defend against short-, medium-, and intermediate-range ballistic missiles threats.
Aegis BMD SM-3 Block IIA	Aegis BMD SM-3 Block IIA has increased range, more sensitive seeker technology, and an advanced kill vehicle to defend against medium- and intermediate-range ballistic missiles.
Aegis Ashore	Aegis Ashore, a land-based version of Aegis BMD, uses SM-3 interceptors and Aegis BMD capabilities as they become available and will have three locations: one test site in Hawaii and two operational sites, one in Romania and one under construction in Poland.
Command, Control, Battle Management, and Communications (C2BMC)	C2BMC is a globally deployed system of hardware—workstations, servers, and network equipment—and software that links and integrates individual elements, allowing users to plan ballistic missile defense operations, see the battle develop, and manage networked sensors. C2BMC integrates Ballistic Missile Defense System Overhead Persistent Infrared Architecture (BOA), which is made up of space-based sensors that support the BMDS missions by providing cues and tasking to downstream sensors and weapon systems.
Ground-based Midcourse Defense (GMD)	GMD is a ground-based system with launch, communications, and fire control components that use interceptors with a booster and a kill vehicle to defend against intermediate- and intercontinental-range ballistic missiles. The fielded inventory of GMD interceptors currently consists of: 20 interceptors equipped with the Configuration (C)1 boost vehicle and Capability Enhancement (CE)-I kill vehicle; 16 interceptors equipped with the C1 boost vehicle and CE-II kill vehicle; and 8 interceptors equipped with the C2 boost vehicle and CE-II Block I kill vehicle.
Sensors	
Army Navy/ Transportable Radar Surveillance and Control Model 2 (AN/TPY-2)	AN/TPY-2 is a transportable X-band high-resolution radar capable of tracking ballistic missiles of all ranges that can be used in two modes: (1) forward-based mode—to support Aegis BMD and Ground-based Midcourse Defense, or (2) terminal mode—to support Terminal High Altitude Area Defense.

BMDS element[a]	Description
Long Range Discrimination Radar (LRDR)	LRDR will be an S-band radar and will provide capabilities to track incoming missiles and discriminate the warhead-carrying vehicle from decoys and other non-lethal objects for GMD. Construction and integration activities are ongoing, with initial fielding planned for fiscal year 2021 and transfer to the Air Force planned for 2022.
Sea Based X-Band (SBX)	SBX is a radar capable of tracking, discriminating, and assessing the flight of ballistic missiles. It is mounted on a mobile, ocean-going, semi-submersible platform capable of being positioned to cover any region of the globe. SBX primarily supports the GMD system for defense of the U.S. and is considered a critical sensor for GMD, in part because it is able to provide tracking information to the GMD interceptor as it targets an incoming threat missile.
Upgraded Early Warning Radars (UEWR)	UEWR is a solid-state, phased-array, long-range radar that detects sea-launched or intercontinental ballistic missiles. Three UEWRs were upgraded and integrated into the BMDS to improve sensor coverage by critical early warning, tracking, object classification, and cueing data. They were transferred to the U.S. Air Force in October 2013 and are located in Beale, California; Fylingdales, United Kingdom; and Thule, Greenland. Modernization efforts for UEWRs located in Clear, Alaska and Cape Cod, Massachusetts are ongoing.
Targets and Countermeasures b	Targets and Countermeasures provides a variety of highly complex short-, medium-, intermediate-, and intercontinental-range targets to represent realistic threats during BMDS flight testing.
Terminal High Altitude Area Defense (THAAD)	THAAD is a mobile, ground-based system to defend against short- and medium-range threats using a battery that consists of interceptors, launchers, a radar, and fire control and communication systems.

Source: GAO analysis of Missile Defense Agency data | GAO-20-490T

[a]MDA is developing and has already fielded additional elements for the BMDS that are not included in this statement because they fall outside the scope of the BMDS Accountability Report. In addition, programs that have been transferred to a military service for production, operation, or sustainment such as the Cobra Dane Radar and Patriot Advanced Capability-3 program are not covered in this statement.

[b]Targets and Countermeasures provide assets to test the performance and capabilities of the BMDS elements, but these testing assets are not operationally fielded.

MDA was established in 2002 with exceptional flexibilities to manage the acquisition of the BMDS—developed as a single program—that allow MDA to expedite the fielding of assets and integrated ballistic missile defense capabilities. These flexibilities allow MDA to diverge from DOD's traditional acquisition life cycle and defer the application of certain acquisition policies and laws designed to facilitate oversight and accountability until a mature capability is ready to be handed over to a military service for production and operation.

In addition, MDA has been operating in an environment of tight timeframes for delivering capabilities—beginning with a presidential directive in 2002 to field a limited capability by 2004. This was followed by a presidential announcement in 2009 to begin deploying U.S. missile defense in Europe in 2011 finishing in 2020. This schedule required

concurrency among technology, testing and other development activities.[4] More recently, MDA has been directed to develop and deploy defenses against hypersonic and cruise missile threats as soon as technologically able. These schedule pressures compound challenges associated with complex technology, design, and integration associated with the missile defense mission that normally require careful planning, disciplined engineering practices, extensive coordination, and effective management and oversight to be successful.

MDA Has Taken Steps to Improve Management Practices, Reduce Acquisition Risks, and Deliver Capability

MDA has taken important actions to increase transparency, reduce high-risk approaches in its management of BMDS elements, and test and deliver BMDS capability. Specifically, MDA has improved reporting in its annual progress reports to the Congress and made advances across a broad range of management activities, including the involvement of stakeholders, reducing concurrency, and continued efforts to improve key aspects of testing necessary to demonstrate delivered capability.

- *Increased Transparency:* MDA, consistent with several of our recommendations has increased the ability to track progress over time in the BMDS Accountability Report (BAR). This is MDA's annual report that presents the current estimate of the BMDS programs' baselines. To increase insight into MDA's management of the BMDS, MDA implemented significant changes to its key acquisition processes and for the first time developed and reported detailed baselines for each element in the BAR in 2010. As we found in March 2011, MDA's prior approach limited the ability for DOD and congressional decision makers to measure MDA's progress on cost, schedule, and testing.[5] While MDA's changes were positive, over the years, we made

[4]This effort to deploy missile defense was initially comprised of four phases between 2011 and 2020. MDA delivered the first phase, for short- and medium-range defense of Europe, in December 2011, and delivered the second phase for medium-range missiles in December 2015, but the delivery of the third phase has been delayed from December 2018 to fiscal year 2022. Its effort for the first three phases were characterized by schedule delays, technical challenges that led to reductions in the scope of capability delivered, as well as testing reductions, which reduced confidence in capabilities that had been delivered. In March 2013, the Secretary of Defense canceled the fourth phase, which was intended to provide an additional layer for defense of the United States against intercontinental ballistic missiles. The cancelation was driven in part by affordability concerns, schedule delays and technical risks associated with these programs.

[5]GAO, *Missile Defense: Actions Needed to Improve Transparency and Accountability,* GAO-11-372 (Washington, D.C.: Mar. 24, 2011).

additional recommendations to further improve MDA's reporting.[6] In response to our recommendations, MDA made improvements to the BAR that include providing details on variances to its test plan from year to year and including information on its use of contract actions known as an Undefinitized Contract Actions (UCA) and Unpriced Change Orders (UCO).[7]

- *Improved Stakeholder Outreach:* MDA has increased its outreach to DOD stakeholders over the past few years. Our prior work on defense acquisitions has shown that establishing buy-in from decision makers is a key factor in achieving better acquisition outcomes because DOD components provide varying perspectives due to their unique areas of expertise and experience.[8] For example, as we reported in December 2019, MDA has recently increased its interaction with the defense intelligence community.[9] Specifically, MDA engaged the defense intelligence community on an analysis of alternatives the agency completed in February 2017 that assessed future sensor options for the BMDS. In addition, MDA reached out to the defense intelligence community on another analysis of alternatives pertaining to defense against hypersonic missiles. In fact, officials from several DOD organizations we met with over the past two years observed that MDA's engagement with their organizations was improving.
- *Reducing Concurrency*: MDA continues to take steps to reduce concurrency, an issue we have reported on for many years.[10] Concurrency is broadly defined as the overlap of development, testing, and production; coupled with an aggressive testing schedule. MDA's concurrent development has often left the agency committing

[6]See GAO-11-372; GAO-17-381; and GAO-18-324.

[7]UCAs authorize contractors to begin work before an agreement on terms, specifications, or price have been agreed upon. See Defense Federal Acquisition Regulation Supplement (DFARS) subpart 217.74. A UCO is generally a unilateral, within-scope order on which the parties have not yet reached agreement on an equitable adjustment. See DFARS subpart 243.2. For additional information on MDA's use of UCAs, see GAO-18-324.

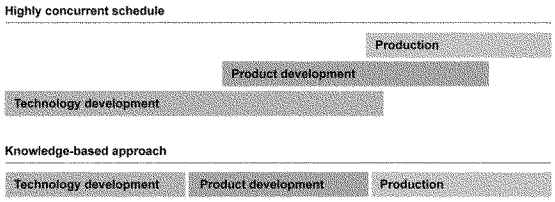
[8]GAO-17-381

[9]As we reported in GAO-20-177, MDA uses information from the defense intelligence community to determine how to design and test its weapon system.

[10]GAO, *Defense Acquisitions: Production and Fielding of Missile Defense Components Continue with Less Testing and Validation Than Planned*, GAO-09-338 (Washington, D.C.: March 2009); GAO, *Missile Defense: Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486 (Washington, D.C.: April 2012); GAO, *Missile Defense: Opportunities Exist to Reduce Acquisition Risk and Improve Reporting on System Capabilities*, GAO-15-345 (Washington, D.C.: May 2015); and GAO-19-387.

to production and fielding before development is complete. This approach has resulted in performance shortfalls, cost increases, and schedule delays. MDA has taken steps to mitigate this risk consistent with our recommendations. For example, as we found in May 2017, MDA took steps to reduce concurrency in the Aegis BMD SM-3 Block IB by adding in tests and delaying the full-rate production decision until the tests were completed. Figure 1 represents a highly concurrent acquisition schedule as compared to an approach based on gaining knowledge before proceeding to the next acquisition phase.

Figure 1: Concurrent Schedules vs. Knowledge-Based Approach



Source: GAO analysis of Missile Defense Agency data. | GAO-20-490T

- *Improving BMDS Testing:* MDA has improved the accuracy of tools it uses to assess integrated BMDS capabilities. The BMDS is a system of systems that cannot be completely assessed using intercept flight tests because of the system's scope and complexity, and because of safety constraints. Consequently, MDA, independent DOD testing organizations, and the warfighter must rely heavily on representations of the integrated BMDS called models and simulations in ground testing. This approach is used, rather than live tests, to test the operational performance of the whole BMDS against attacks with more threats represented. Our preliminary observations for fiscal year 2019 are that the number of accredited models and simulations that are needed to assess the integrated performance of the BMDS has steadily risen over the last 3 years.

Over the past several years, we have reported on MDA's progress in delivering assets and capabilities to counter attacks as well as cyber threats.[11] MDA delivered important BMDS capabilities for architectures in

[11]See GAO-15-345; GAO-18-324; and GAO-19-387.

the United States as well as those defending U.S. troops and allies in Europe, the Middle East, and the Eastern Pacific. For example:

- *Homeland Defense:* In fiscal year 2017 and 2018, MDA delivered a significant integrated capability for defending the United States, including improvements in the ability to discriminate lethal objects in targets, and increased capacity. This was a key achievement in fulfilling a directive from the Secretary of Defense to increase inventory of ground-based interceptors by the end of 2017.
- *Regional BMD:* In fiscal year 2016, MDA delivered capabilities for the second phase of its effort in Europe, called European Phased Adaptive Approach (EPAA). This effort required coordinated development of a number of elements and their integration to provide integrated BMDS-level integrated capabilities against short and medium range ballistic missiles. More recently, in fiscal years 2018 and 2019, MDA rapidly delivered capabilities for its effort to meet an urgent regional need.

In addition, preliminary observations from our review covering fiscal year 2019 indicate that cybersecurity assessments in fiscal year 2019 informed the network defense posture in U.S. Northern Command and provided data on how to reduce mission risk for these elements operating in a cyber-contested environment. Moreover, the agency is incorporating lessons learned from prior cyber activities, and continues to address issues discovered in prior testing, improving its overall cybersecurity survivability. However, our preliminary observations indicate much remains to be done to ensure cyber resiliency of the BMDS including the completion of cybersecurity testing for capabilities delivered in 2017 and 2018, along with conducting element-level operational cooperative and adversarial assessments.[12]

[12]Operational cybersecurity testing consist of two types of assessments: a Cooperative Penetration and Vulnerability Assessment (CVPA) and an Adversarial Assessment (AA). A CVPA provides initial information about the resilience of a system in an operational context, which is used to develop the subsequent AA. The AA characterizes the operational effects caused by threat representative cyber-attack and the effectiveness of defensive capabilities.

MDA Faces Ongoing Challenges to Improve Transparency and Reduce High-Risk Acquisition Practices

MDA has made efforts to put some programs on a more sound footing and it has taken actions to address the issues I just mentioned. However, MDA can go further to align itself with best practices for acquisitions. Today, I will highlight certain acquisition challenges MDA still faces.

- *Stakeholder involvement:* While MDA has increased its outreach to the stakeholders over the past few years, opportunities remain for further engagement on key decisions. For instance, as we found in December 2019, although MDA has been increasing its engagement with the intelligence community, MDA provides the defense intelligence community with limited insight into how the agency uses threat assessments to inform its acquisition decisions. MDA is not required to obtain the defense intelligence community's input; however, the community is uniquely positioned to assist MDA keep pace with rapidly emerging threats. Moreover, this limited insight has, in part, prevented validation of threat models designed to assess BMDS capabilities. Without validation, any flaws or bias in the threat models may go undetected, which can have significant implications for the performance of MDA's weapon systems. MDA and the defense intelligence community recently began discussing a more suitable level of involvement in the agency's acquisition processes and decisions. As we recommended in May 2017 and December 2019, MDA also needs to strengthen its collaboration with other stakeholders, including the warfighting community and independent cost and technical experts.[13] In the early stages of the RKV program, concerns raised about the design—which ultimately was a key reason for the cancellation of the RKV—went unheeded. For example, preliminary observations for our assessment covering fiscal year 2019 showed that MDA and contractors did not adequately address technical risks despite numerous warnings from stakeholders about the performance issues. However, MDA officials indicate they are working with stakeholders more closely as they plan for the Next Generation Interceptor, a new more advanced interceptor.
- *Concurrency:* Although MDA has taken steps to reduce concurrency as we have previously recommended, the agency still turns to this practice when experiencing developmental delays or schedule pressures.[14] For example, we reported in June 2019 that delays to construction resulted in MDA's introduction of increasing levels of

[13]See GAO-17-381 and GAO-20-177.

[14]See GAO-12-486; GAO-15-345; and GAO-17-381.

concurrency into the delivery schedule for the Aegis Ashore site in Poland. We found that key phases of the delivery process had been shortened from 16.5 months to 6.5 months.[15] While overlapping acquisition activity, in theory, could speed up the construction process, this risky practice ultimately failed to mitigate the effects of problematic construction practices. However, program plans indicate that the site has experienced further delays and will not be ready for operational use until at least 2022—a 4 year delay from the original 2018 delivery date. In addition, the recently canceled Redesigned Kill Vehicle (RKV) program originally sought to avoid concurrency by aligning production decisions with flight testing. However, later—in response to the advancement of the North Korean missile threat—the program accelerated RKV development by concurrently performing development and production and reducing the number of necessary flight tests. This acceleration altered the schedule for the previously aligned flight tests and production decisions.

- *Contracting:* Although MDA has flexibilities in managing its acquisition process, it must follow the same contracting regulations that apply to DOD, including the Federal Acquisition Regulation and the Department of Defense Federal Acquisition Regulation Supplement. These regulations allow MDA to use a particular type of contract action called an undefinitized contract action when the negotiation of a definitive contract is not possible in sufficient time to meet the government's requirements and government interests demand that the contractor be given a binding commitment so that contract performance can begin immediately. These actions authorize contractors to begin work before an agreement on terms, specifications, or price have been agreed upon. In May 2018, we found that the average length of the undefinitized period and the not-to-exceed price of MDA's undefinitized contract actions had increased over the past 5 years.[16] While MDA policy permits use of undefinitized contracts on a limited basis, we and others have found that they can place unnecessary cost risks on the government. As we reported in June 2019, while MDA improved its performance in timely definitization of these contract actions, the total not-to-exceed value of the undefinitized contract actions MDA initiated in 2018 far exceeded previous years we reviewed.[17]

[15]GAO-19-387

[16]GAO-18-324

[17]GAO-19-387

- *Transparency in test cost estimates:* As we reported in May 2017, MDA requests more than $1 billion in funding each fiscal year for the tests outlined in its integrated test schedule based on MDA's internally developed test cost estimates. However, our analysis found these estimates were inconsistent and lacked documented traceability. A cost estimate is the summation of individual costs using established methods and valid data. Developing and maintaining reliable cost estimates ensures the appropriate amount of funds are needed when requested and for the expressed purpose. We found, however, in May 2017, MDA's testing budget lacked transparency and could be improved.[18] Specifically, we found that MDA's annual budget submission did not provide insight into the funding for each specific test. MDA regularly makes changes to its test schedule without reporting the impacts to its costs and funding needs. Without a breakout of MDA's costs by test in its annual budget submission and BAR, how many times or how much funding has been requested, received, or used for a specific test will continue to be unclear. Therefore, we recommended that MDA break out funding request by test. DOD did not concur with our recommendation and stated that MDA's current approach for assigning resources prior to the test execution, is adequate. We continue to believe that breaking out funding requests by test will improve transparency into planned versus actual test costs and aid departmental and congressional decision makers as they make difficult choices of where to invest limited resources.

Changes to MDA's Test Schedule Persist, Reducing Knowledge to Support Asset and Capability Deliveries

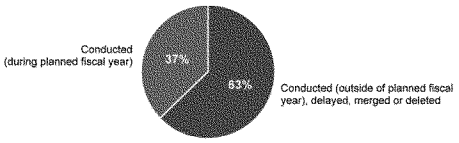
MDA also continues to struggle with fully achieving its annual flight testing goals. After MDA revised its approach to developing the annual Integrated Master Test Plan in 2009, in February 2010, we recognized the new test schedule's potential to address prior issues with shifting testing requirements or test dates, and adding or deleting tests. MDA also focused its testing to collect data necessary to support the development of models and simulations.

However, MDA's test plan has not stabilized. Since it formalized its approach in 2010, MDA has continued to revise its test schedule frequently by adding new tests, and deleting or delaying tests, in some cases, multiple times and further into future fiscal years. As a result, less testing is being conducted prior to delivery than originally planned, which means less data are available to understand BMDS capabilities and limitations. Specifically, preliminary observations from our fiscal year 2019

[18]GAO-17-381

review show that from fiscal year 2010 through fiscal year 2019, MDA has conducted only 37% of its planned testing as originally scheduled, while the remainder has been either been delayed, deleted or conducted in a later fiscal year, as shown in figure 2.[19]

Figure 2: Timeliness of Missile Defense Testing Events for Fiscal Years 2010-2019



Source: GAO analysis of Missile Defense Agency data. | GAO-20-490T

In addition, we reported in June 2019 that European Phased Adaptive Approach (EPAA) Phase 3 testing against intermediate range ballistic missiles (IRBM) had been reduced by 80 percent and MDA no longer planned to conduct a flight test against a raid—a likely tactic in a real-world attack—prior to delivery. The lack of raid flight testing prevented the accreditation of Aegis BMD models for assessment under those circumstances in all fiscal year 2019 ground tests that included Aegis BMD.

Balancing New Efforts with Existing Portfolio Needs will be Challenging

MDA is currently at a pivotal crossroads, needing to balance its ability to pursue new and advanced efforts while also maintaining its existing portfolio of BMDS elements that have not transferred to the military services as originally planned. The new and advanced efforts, such as hypersonic defense and a Next Generation Interceptor (NGI) for GMD, are research and development-intensive tasks, which carry significant technical risks and financial commitments. If MDA's elements are not transferred as originally intended, as they move further into production and operations and sustainment these elements will continue to consume a growing portion of the agency's budget.

MDA and military services have taken some actions to prepare for transferring the BMDS elements; however, the actions have not enabled

[19] As in our prior reports on MDA's annual progress, tests where MDA participated but did not possess the primary system under test (e.g. Army's Patriot program or Israel's Iron Dome) have been omitted from the totals.

transfer primarily due to a lack of early and frequent coordination, according to officials from the Undersecretary of Defense for Research and Development and Acquisitions and Sustainment. Consequently, there are overarching concerns related to transfer such as who funds the sustainment of the elements which have not been resolved. Congress and the Secretary of Defense have directed multiple reviews to determine how to address these concerns and chart a path forward for MDA.

Chairman Cooper, Ranking Member Turner, and members of the Subcommittee, this concludes my prepared statement. I would be happy to respond to any questions you may have at this time.

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Related GAO Products:

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Missile Defense: The Warfighter and Decision Makers Would Benefit from Better Communication about the System's Capabilities and Limitations. GAO-18-324. Washington, D.C.: May 2018.

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Ms. Chaplain currently serves as a Director, Acquisition and Sourcing Management, at the U.S. Government Accountability Office. She has responsibility for GAO assessments of military space acquisitions, NASA, and the Missile Defense Agency. Among other topics, she has led reviews on the International Space Station, the Space Launch System and the Orion crew capsule, acquisition progress for major NASA projects, the James Webb telescope, commercial cargo and crew, NASA contract management, contract terminations, weather satellites, and the Global Positioning System. In addition to her work on space and missile system development, Ms. Chaplain has led a variety of DOD-wide contracting- related and best practice evaluations for the GAO. Before her current position, Ms. Chaplain worked with GAO's financial management and information technology teams. Ms. Chaplain has been with the GAO for 26 years. She received a bachelor's degree, magna cum laude, in International Relations from Boston University and a Masters Degree in Journalism from Columbia University.

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