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HEARING

ON

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2019

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES
ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

SUBCOMMITTEE ON STRATEGIC FORCES HEARING

ON

FISCAL YEAR 2019 BUDGET REQUEST FOR MISSILE DEFENSE AND MISSILE DEFEAT PROGRAMS

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FISCAL YEAR 2019 BUDGET REQUEST FOR MISSILE DEFENSE AND MISSILE DEFEAT PROGRAMS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON STRATEGIC FORCES,
Washington, DC, Tuesday, April 17, 2018.

The subcommittee met, pursuant to call, at 3:31 p.m., in room 2118, Rayburn House Office Building, Hon. Mike Rogers (chairman of the subcommittee) presiding.

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

Mr. ROGERS. Good afternoon. This subcommittee will come to order.

We want to welcome to our hearing on the fiscal year 2019 budget request for missile defense and defeat activities. And I want to thank our witnesses for their service to our country, but also for being here and the preparation that you have to put into these hearings. I know it takes a lot of time and energy, but it is very helpful to us.

Our witnesses today are the Honorable John Rood, Under Secretary of Defense for Policy; General Lori Robinson, Commander, Northern Command [NORTHCOM], North American Aerospace Defense [NORAD] Command. And I want to take a moment to especially recognize General Robinson. You have been a friend of this committee, and not only the commander of NORTHCOM and NORAD, but also across your 37 years of service to this great Nation.

I know I speak on behalf of this committee and the HASC [House Armed Services Committee] as a whole, when I thank you for your dedicated and unwavering service, and we wish you well in your retirement.

Mr. LAMBORN. I would like to give her a round of applause.

[Applause.]

Mr. ROGERS. General Lieutenant Sam Greaves, and no, he is not retiring. He is just getting warmed up. He is the Director of Missile Defense Agency [MDA]. And, General, congratulations on your assignment as director of MDA. You are no stranger to this committee, and we look forward to continuing to work together with you on missile defense for a long time.

And Lieutenant General Dickinson—it has got Lieutenant down here. Lieutenant General James Dickinson, Commander, Army, Space and Missile Defense Command, Army Forces Strategic Com-

mand, and Joint Functional Component Command for Integrated Missile Defense for the U.S. Strategic Command.

Let me start by just highlighting some of what we have seen since our previous missile defense hearing in June of last year. North Korea has tested a missile with ICBM [intercontinental ballistic missile] range. Iran continues to develop their own ICBMs under the guise of space launch program. Putin boasted in his recent national speech about, and I quote, "invincible missile," close quote, targeted at the United States. And China is surging ahead with their own missile programs, most notably the hypersonic, in the hypersonic realm.

Fortunately, I think this administration gets it. The budget amendment we received last year, for an additional $4 billion for missile defense in the fiscal year 2019 request, which includes about $12 billion across the board for missile defense, seemed appropriate giving the rising threat levels around the globe.

As is highlighted in the National Defense Strategy, and I quote, "We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment. To address the scope and pace of our competitors' and adversaries' ambitions and capabilities, we must invest in modernization of the key capabilities through sustained predictable budgets," close quote.

Now, we are waiting on this administration to release the Missile Defense Review. Hopefully, in the coming weeks, we will see it.

We have developed the best missile defenses in the world, but for the most part, they are technologies that were started 15 years ago. The increasing threat makes it essential that we expand and enhance our missile defenses, not only with capacity, but also through steps of leaps in technology right now, and not 5 years from now.

Increasing our GBI [ground-based interceptor] inventory, land-based sensors and regional interceptor capacity is critical, but cannot come at the cost of seriously going after technologies like directed energy, space sensing and boost phase capability.

I want to thank our witnesses again. I look forward to the discussion, but right now, I would like to turn to the ranking member, my friend and colleague from Tennessee, Mr. Cooper, for any opening statement he may have.

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

STATEMENT OF HON. JIM COOPER, A REPRESENTATIVE FROM TENNESSEE, RANKING MEMBER, SUBCOMMITTEE ON STRATEGIC FORCES

Mr. COOPER. Thank you, Mr. Chairman.

I would also like to welcome the witnesses, and in particular, wish General Robinson the best of luck. You have served your Nation well. You should be very proud.

I will hold most of my questions for the classified portion of the hearing, so I will abbreviate my remarks now and look forward to hearing the testimony of the witnesses.

Mr. ROGERS. Great. Now, we will ask each of the witnesses to summarize their opening statements. You will be allowed 5 minutes. I want to let you know that each of your opening statements

in their full will be taken into the record. Without objection, so ordered.

Mr. Rood, I recognize you first for your opening statement.

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

Secretary ROOD. Mr. Chairman, thank you.

Chairman Rogers, Ranking Member Cooper, and distinguished members of the committee, thank you for the opportunity to appear before you today to testify on behalf of the President's fiscal year 2019 budget request in support of our efforts to improve our missile defense capabilities so that we remain ahead of the evolving threat while providing effective, integrated, and interoperable regional missile defenses in support of our global defense strategy.

As the National Defense Strategy points out, the United States, allies, and partners confront a security environment that is more complex and volatile than any we have experienced in recent memory.

Today, over 20 states possess offensive missiles and potential adversaries are expanding their missile capabilities in three directions simultaneously. They are increasing the capabilities of their existing missile systems, adding new and unprecedented types of missile capabilities, and integrating offensive missiles more thoroughly in their coercive threats, military exercises, and war planning.

As you mentioned, Mr. Chairman, in your opening statement, over the past several years, North Korea has made substantial improvements in their ICBM program. Iran is extending the range of its ballistic missile systems with the goal of achieving an operational ICBM capability, and through its space launch vehicle program could shorten the pathway to an ICBM because space launch vehicles use similar technologies.

Potential adversaries are also fielding an increasingly diverse and expansive modern range of regional offensive missile systems that can threaten the American forces abroad, allies, and partners.

Their regional offensive missile systems include multiple types of short-, medium-, and intermediate-range missiles intended to provide coercive political and military advantages in regional crises or conflicts.

These missile systems appear to be a central element of Russia's frequent and explicit coercive nuclear threats to the United States, our allies, and partners.

As you mentioned, Mr. Chairman, Russia is developing a new generation of advanced, regional ballistic and cruise missiles that support its anti-access/area denial strategy intended to defeat U.S. and allied will and capability in regional crises or conflicts.

China is also engaging in substantial modernization efforts that are summarized in my statements, that I will not repeat.

So this as the backdrop and the strategic context, let me turn to a discussion of the 2019 budget request for missile defense and the policies, programs, and capabilities that it supports.

The Department's budget request supports the President's direction set out in the National Security Strategy to develop a layered missile defense system to protect the American homeland from

North Korean and Iranian missile threats. The request also supports regional missile defenses to protect our deployed forces, allies, and partners.

Our missile defense system not only protects the United States, it strengthens deterrence of war, and assures our allies and partners.

Today, the ground-based missile defense system provides protection for the Nation. It consists of 44 ground-based interceptors deployed in Alaska and California, in land-, sea-, and space-based centers, as well as the command and control system operated 24 hours a day by trained service members.

We are strengthening this system, investing in technologies to ensure that we can continue to counter rogue state missile threats to our homeland.

In 2017, DOD [Department of Defense] requested the reprogramming of fiscal year 2017 funding of more than $400 million to counter the North Korean missile threat. Congress approved this request, for which we are grateful. These funds support important homeland defense activities, including initiating work on the procurement of 20 additional ground-based interceptors in Alaska as early as 2023, which would bring the total to 64 fielded interceptors. The reprogramming also funded a service life extension to the Cobra Dane radar in Alaska and software upgrades to the Sea-Based X-Band radar, both of which are essential elements to our homeland defense.

In November of 2017, the President submitted an amendment to the 2018 budget request for $4 billion for missile defense, which includes construction of a new missile field at Fort Greely, Alaska, and additional funding for 20 more GBIs.

The fiscal year 2019 budget request includes $9.9 billion for the Missile Defense Agency, and $3 billion additional dollars for air and missile defense activities in the military departments.

This budget funds a more capable GBI, with the redesigned kill vehicle; the deployment of a missile tracking and discrimination sensors, a network in Alaska, Hawaii, and the Pacific region; and a new Space-Based Kill Assessment capability.

These near-term investments will help us obtain substantially more performance and efficiency out of the GMD [Ground-Based Midcourse Defense] system necessary to meet the evolving threat. We are also taking steps to bolster homeland defenses against air and cruise missile threats.

In 2018, we will complete the first part of a two-part effort to provide effective surveillance against these threats to the National Capital Region. Doing so will enhance our ability to detect, track, and investigate suspicious aircraft, as well as cruise missiles, and when necessary, cue our missile defense systems against this full spectrum of air threats.

We are on track to begin the second phase of this effort in fiscal year 2019, which will expand our capability to detect, identify, and take decisive action before threats can strike potential targets within the National Capital Region. We are also looking into technologies and concepts that can be used to provide scalable and deployable options for expanding this capability.

The Department's budget request also includes deployment of regional missile defenses tailored to meet threats to U.S. forces abroad and allies and partners in Europe, the Middle East, and Indo-Pacific region.

The budget enhances our regional missile defense capabilities through additional Patriot missiles, as well as THAAD [Terminal High Altitude Defense], SM–3 [Standard Missile-3] Block IB, and SM–3 Block IIA interceptors.

Our focus is on developing and fielding missile defense capabilities that are mobile and relocatable, which allows us flexibility to respond to a crisis wherever it might emerge.

Because systems such as Patriot, THAAD, and Aegis BMD [ballistic missile defense]-capable ships can be surged when and where required, they make it possible to deploy layered missile defense capabilities that are responsive to regional threats as they arise.

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

Looking forward, it is clear our potential adversaries are modernizing and expanding their capabilities. We must ensure that our missile defense investment strategy and priorities enable us to meet the most dangerous threats today while also enabling us to counter future missile threats as they expand.

Mr. Chairman, let me conclude by stating that in this increasingly complex and threatening environment, DOD must sustain the capabilities needed to deter and defend against attacks on our homeland, our forces abroad and our allies and partners.

We must make the investments needed to address the ongoing erosion of our operational advantages and maintain the preeminent military power in the world.

Thank you, again, for the opportunity to testify before you today.

[The prepared statement of Secretary Rood can be found in the Appendix on page 33.]

Mr. ROGERS. Thank you, Mr. Rood.

General Robinson, you are recognized.

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

General ROBINSON. Thank you. Chairman Rogers, Ranking Member Cooper, and distinguished members of the committee, I am honored to join you today to testify alongside Under Secretary of Defense Rood, General Greaves, and General Dickinson.

As has been mentioned, the strategic environment and threats facing our Nation continues to evolve. Our adversaries are taking deliberate steps to extend their operational reach and are developing new capabilities to range targets in North America and Canada.

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

I am confident the ground-based midcourse defense system can defeat this threat today. And I strongly support the continued improvements to the ballistic missile defense enterprise in order to maintain our advantage.

We continue to work closely with the Missile Defense Agency, the intelligence community, and other combatant commands as part of a collaborative effort to outpace the threat.

I am grateful, as has been mentioned, for the committee's approval of the fiscal year 2017 above-threshold reprogramming, and support the budget amendment that will increase the system's capability and capacity.

Under my NORAD responsibilities, advanced cruise missiles with a low radar cross section represent a challenge to our air defense systems. Russia continues to modernize its delivery systems, long-range bombers and strategic submarines, capable of launching from distances not previously seen, reducing the indications and warnings we are likely to receive prior to a combat launch.

To defend against advanced cruise missiles, as have been mentioned, we are making prudent investments in advanced sensors and defensive weapon system to protect our Nation's vital assets.

The men and women, the warriors of USNORTHCOM and NORAD stand united in a common purpose, ready to face the threats of the United States and Canada today, and we are evolving to face the threats of tomorrow.

Sirs, as you have mentioned, I am getting the privilege to retire. I will tell you that after 37 years of serving my Nation, and after having these last 2 years, having the sacred responsibility of defending our Nation, I want you all to know my gratitude, my heartfelt appreciation for your support to NORAD and U.S. Northern Command, and to our Nation's Armed Forces, soldiers, sailors, airmen, Marine, Coast Guardsmen, and civilians, and in my NORAD hat, Canadians.

Thank you, again, for giving me the privilege and opportunity to speak, and I welcome your questions.

[The prepared statement of General Robinson can be found in the Appendix on page 37.]

Mr. ROGERS. Thank you, General Robinson. General Greaves, you are recognized for 5 minutes.

STATEMENT OF LT GEN SAMUEL A. GREAVES, USAF, DIRECTOR, MISSILE DEFENSE AGENCY

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

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

I am also very pleased to report that we are executing these funds with the utmost urgency. I would also like to thank the thousands of men and women across the government and industry who

worked tirelessly everyday across the globe in support of our Nation's Ballistic Missile Defense System. I truly believe they remain our asymmetric advantage.

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

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

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

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

The agency will also continue redesigned kill vehicle redevelopment efforts, enhance the stockpile reliability program, and expand the GBI battlespace.

Integrated space and terrestrial sensors for cueing, tracking, discriminating, and targeting ballistic missile threats are critical to improving missile defense architecture and its robustness.

This budget will continue to fund the Space-Based Kill Assessment Demonstration Program, to deliver a capability to confirm intercepts for improved defense of the homeland.

We are also continuing concept definition studies for space-based missile defense tracking sensors.

If pursued, space sensors will be able to detect and track both traditional as well as emerging threats as part of the BMDS architecture.

Additionally, as the space layer matures, we will need an improved space test infrastructure to support verification in such areas as concept of operations, and the technical performance of space assets under development.

This budget will also increase the number of Terminal High Altitude Area Defense, or THAAD, interceptors to improve regional missile defenses for the protection of our foreign-deployed forces, allies, and partners.

We will continue to install the Aegis ballistic missile defense weapon system on Aegis ships, and deliver Standard Missile-3 Block IB interceptors.

We are also supporting the European Phased Adaptive Approach [EPAA] providing coverage and protection of NATO [North American Treaty Organization] European territory, populations, and forces against the increase in ballistic missile threat from the Middle East.

Our request will support continued integration of the SM–3 Block IIA missile, which is a co-development effort with Japan into the Aegis BMD weapon system.

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

This budget request will continue the development of breakthrough technologies for integration into the BMDS, including discrimination improvements, multi-object kill vehicle technology, hypersonic defense technology, and exploring high-powered lasers and interceptors that have potential against threat missiles in the boost phase of flight.

Additionally, as we evaluate the elements of the missile defense system, we will actively pursue developing elements that have multimission and department-wide utility and leverage systems such as the F–35, which likely has the sensor, communications, and shooter capability in support of the Ballistic Missile Defense System.

Finally, we take the financial audit and our fiscal stewardship role very seriously, and MDA has robust and accountable financial management processes in place.

As a note, we closed out fiscal year 2017 with $151 of expiring funds out of an $8.6 billion budget that is on our books. We are now in the midst of the fiscal year 2018 full financial statement audit and have received no findings to date.

The bottom line is, we are committed across the entire agency to achieving fully auditable books and maintaining the confidence of the Congress and the American public.

Mr. Chairman, Ranking Member Cooper, and members of the subcommittee, I look forward to answering your questions.

Thank you.

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

Mr. ROGERS. Thank you, General Greaves.

General Dickinson, you are recognized for 5 minutes.

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

General DICKINSON. Chairman Rogers, Ranking Member Cooper, and the other distinguished members of the subcommittee, thank you for your support of our soldiers, civilians, and their families. I am honored to testify before you today to emphasize the importance of air and missile defense to our Nation, deployed forces, al-

lies, and partners. Air and missile threats continue to increase, both in quantity and in offensive capability.

With this in mind, thank you for the passage of the fiscal year 2018 Appropriations Act, and your continuing support for the Nation's air and missile defense forces. Your support enables us to continue fulfilling our role in securing the Nation today and developing future forces and capabilities to deter and counter tomorrow's threats.

I would like to briefly summarize the missions of the organizations I represent today. First, the United States Army Space and Missile Defense Command, Army Forces Strategic Command, SMDC/ARSTRAT, serves as a force provider in support of our combatant commands. SMDC/ARSTRAT, a multifaceted, multi-compo [component] command, consists of two warfighting brigades, a technical center, and future warfighting center that provides trained and ready space and missile defense forces and capabilities to the warfighter in the Nation.

Stretching across 11 different time zones and 23 dispersed locations, we provide low-density, high-demand capabilities for today's fight, as well as build future space and missile defense capabilities for tomorrow by researching, testing, and integrating space missile defense, cyber, and directed energy technologies.

The changing operational environment and evolving threat requires to provide the Army and the joint force with enhanced air and missile defense capacity and capability and maintain readiness while managing the high operational demand of our low-density forces.

Within SMDC/ARSTRAT, we are collaborating closely with the Army's Air and Missile Defense cross-functional team on capabilities to increase the lethality of the Army and the joint force, including maneuver short range air defense and directed energy. The cross-functional team is a key part of the Army's new modernization effort that enable us to rapidly develop requirements and ensure future capabilities, transition quickly from concept to prototyping to fielding.

I also have the privilege of commanding the Joint Functional Component Command for Integrated Missile Defense, or JFCCIMD, which supports United States Strategic Command by integrating and synchronizing global missile defense operations. JFCCIMD conducts global missile defense operation support, advocates for and recommends acceptance of missile defense capabilities, and executes joint and combined global missile defense training and education for the Nation.

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

Despite their unique missions, a unifying principle for both SMDC/ARSTRAT and the JFCCIMD is our number one priority; to protect our homeland. Both commands will remain bold and innovative, offering solutions to ensure our Nation's forces are prepared to fight across multiple domains.

Finally, the challenges we face cannot be met without the dedication of our greatest asset, our people. The remarkable service mem-

bers, civilians, and contractors, along with their families stationed at home and globally deployed provide support to the Army and the joint warfighter each and every day.

I have the utmost confidence and respect for the warriors who volunteer to operate these highly complex systems around the world.

Thank you for your continued support for the committed professionals who develop, deploy, and operate our Nation's air and missile defense systems.

I have addressed in detail the full range of these missions and how we are executing them. And I ask that my statement be submitted for the record, and I look forward to addressing your questions. Thank you.

[The prepared statement of General Dickinson can be found in the Appendix on page 95.]

Mr. ROGERS. Without objection, the statement is accepted into the record. And I will recognize myself for questions. I will kind of let you know what we are planning.

We are going to be called for votes around 5:00, so it is my hope we can get through one round of questions in open session and then trot down to the SCIF [sensitive compartmented information facility] for the closed portion before votes because, well, I won't be over there.

But first, General Greaves, you made reference to the Romanian and the Polish Aegis Ashore sites. I am curious as to the Romanian site, how the new AAW [anti-air warfare] system that we put into the MDA is coming along. Can you give us a progress report on that air defense system?

General GREAVES. Mr. Chairman, the AAW system is not operational today. Within the Missile Defense Agency, my predecessor initiated, and we completed, two demonstrations of potential capability as in flowing data from a simulated source and then from actual tracks into the Aegis weapon system to demonstrate that capability would work. As of right now, we are awaiting funds to complete the demonstration of an actual system, which would include an Army low-cost radar as a potential candidate, as well as the C–RAM [counter rocket, artillery, and mortar] system.

So as of today, it is not operational.

Mr. ROGERS. Great. In looking at the President's budget for 2019, it appears that the Missile Defense Agency has a gap in developing critical advance technology, such as high-powered directed energy for boost phase missile defense and space sensing.

As you quoted, Secretary Mattis, quote, "If we fail to adapt the speed of relevance, our focus will lose," close quote. Yet, in these critical technology areas we continue to trade studies and analyses by starting programs with goals for operational capabilities.

How does a 1-year delay in Missile Defense Agency specific funding impact your ability to deliver high-powered direct energy and space-sensing capabilities?

General GREAVES. Mr. Chairman, I am concerned about that delay. However, I am very encouraged with the fact that my new boss, Dr. Griffin, working with Ms. Lord in her capacity, have the focus and are reengineering and redirecting the Department to pri-

oritize, as Dr. Griffin has testified, number one priority being hypersonic, both offense and defense, as well as directed energy.

And we have had conversations. I have seen actions being taken to prioritize those two areas, as well as other technology areas, to deliver that capability to keep pace with the threat.

Mr. ROGERS. Great. And this would be to any of the witnesses. Across the board, there has been a consensus on the need to get to space for missile defense tracking and discrimination. Again, without the benefit of having the Missile Defense Review, can you lay out the Department's position on how space is being looked at in regards to warfighting domain for missile defense? Are you still looking at what a space-based intercept constellation could provide? Is the ultimate goal for directed energy to be used in space? And this would be for any one of you who want to take it.

Secretary ROOD. Maybe I will start, and if General Greaves has something, or the others, they would like to add, please do.

Sir, you are correct that we are concerned that space—not concerned. Space has become a warfighting domain. It is a contested area. What we are observing in terms of the activities of other nations is of concern. And so you have that as a backdrop with this contested and congested space domain, and then in the missile defense area, certain capabilities as highlighted in our various statements that countries like North Korea, Iran, Russia, and China are pursuing that cause us substantial concern.

So we are looking at capabilities that could be employed in space, both sensor capabilities and others. It is one of the subjects that we are continuing to evaluate potential alternatives in that regard. No final decision is made yet on those capabilities that would be pursued, but it is definitely an area of active study in the Department.

General GREAVES. Mr. Chairman, I would add that moving our sensing layer to space to work in coordination with the ground layer is absolutely essential to keep pace with the threat that we know is coming. I would point out one such example is the hypersonic threat. As my deputy is fond of saying, "if you can't see it, you can't shoot it."

So the first thing we need to do is ensure that we can maintain birth-to-death tracking of threats that are flying lower, that can maneuver, that not as predictable as the ballistic missile threat. So it is essential that we deploy and operate a space-sensing layer to begin with.

The other part of it is the focus on boost phase intercept. I do not believe we have an option to not have some sort of capability for boost phase intercept, whether it be directed energy or kinetic weapons. I think there are a number of things that have to happen, of course. Policy, force structure, concept of operations. Those things have to be developed by the COCOMs [combatant commands] and other parts of the Department, but the ability to have a boost phase intercept capability is, I believe, essential as we move into the future.

As far as space-based interceptors, there are challenges that need to be worked through from the policy area, whether or not to base it. The technology has got to be developed, but I believe that we should be doing some work in that area to essentially lay the

groundwork if a nation decides to deploy space-based interceptors, we haven't lost that time.

Time is the key. The threat is time. Because, as a Nation, we can do anything given enough time to develop and deploy capabilities. So that is my input, sir.

Mr. ROGERS. Thank you. The Chair now recognizes the ranking member for any questions he may have.

Mr. COOPER. Thank you, Mr. Chairman. All of the witnesses are interested in protecting all of America, but the one exception to that is Secretary Rood's testimony where he gave special protection coming to the National Capital Region. How do we tell our friends in New York or Boston or Norfolk, Newport News, or South Florida, they get less protection than we do here?

Secretary ROOD. Sir, the policy is to protect the entire United States, and that is the, in fact, the capability that the Ballistic Missile Defense System that has been deployed for the Nation possesses.

What I was referring to in my statement is there are some improvements that are being made for the ability to detect aircraft and cruise missiles as part of a two-phase program that provide that enhancement. That does not mean the rest of the country will not enjoy protection as well.

As you know, through our air defense system that General Robinson and others execute, we do surveil for threats to all 50 States, where we look at those threats, evaluate them, and certainly work through those defense systems.

Mr. COOPER. I think it is pretty clear in your paragraph at the bottom of page 2, the top of page 3, that the National Capital Region comes first, at least as far as aircraft or cruise missile threats are concerned. And your exact quote is, "We are also looking into technologies and concepts that could be used to provide scalable and deployable options for expanding this defensive capability," presumably to the rest of the country.

Secretary ROOD. There are options like that for improving the capabilities that would be applied, not only to the rest of the country, but elsewhere outside of this country that we are looking at. But in terms of the ability to defend the country against cruise missile threats, those things for aircraft, the rest of the country also will have means to do that. But there are some particular programs that have been underway for some time to provide some phased improvements in our capability for the air threats. I am happy to provide you a fuller briefing or more information on that if you would like, sir.

Mr. COOPER. We will talk about it in classified session. Thank you, Mr. Chairman.

Mr. ROGERS. The Chair now recognizes the gentleman from Colorado, Mr. Lamborn.

Mr. LAMBORN. Thank you, Mr. Chairman. Thank you all for being here. General Robinson, I wish you the best in the future, and thank you for your service. But thank you all for the great work that you are doing.

And the first question, actually, this is not missile defense, but it has to do with space. Yesterday, I was at the Space Symposium, and Vice President Pence, who is also chairman of the Space Coun-

cil, talked about a new directive from the council on space management, watching and tracking debris, similar things, taking that responsibility and giving it to the Department of Commerce.

Mr. Rood, will that help the military focus better on its core mission, to give that responsibility away?

Secretary ROOD. Yes, sir, it will. As described at the Space Symposium and elsewhere, the number of objects in space continues to increase, and that number of objects not only being satellites, but some of the debris and other matters. The Defense Department has had the responsibility to catalogue those objects, and to engage in a discussion with commercial operators in space with the aim of providing safe use of that space for their communication satellites or other items.

As that has grown, the Commerce Department, we think, is the more appropriate player to do that. And our colleagues at the Commerce Department have stepped forward to take on that mission. The Defense Department will still maintain its responsibilities in the defense space. We will partner with the Commerce Department, but it is an area the Commerce Department will more appropriately take the lead.

Mr. LAMBORN. Fantastic. That is great to hear.

Okay. Back to missile defense. General Greaves, I would like to ask you a question. You touched on some very important cutting-edge technologies, developing multiple object kill vehicle, directed energy, tracking, hypersonic. Are we devoting enough resources in this budget that we are discussing to advance those technologies, or should we be doing more R&D [research and development] in any of those areas?

General GREAVES. Congressman, we are beginning the work on hypersonic, beginning the work on directed energy, and continuing the work at a lower level on the multiple object kill vehicle.

I have significant hope, from what I have seen already within the Department, that with Dr. Griffin's focus and the priorities he has laid out for the Department, that the discussion will become a lot more robust. And my hope is that we will see increased resources dedicated to those areas in the next budget.

Mr. LAMBORN. Well, this is a really important issue. And I think as we discuss the NDAA [National Defense Authorization Act], we are going to want to make sure that the R&D resources are really there. Are you saying that it is kind of lacking right now and we need more resources?

General GREAVES. Congressman, I am saying the threat has demonstrated a capability within the last 18 months that was somewhat theoretical before that time. We have seen their rapid progress, and time is the enemy, and which is driving the Department under Dr. Griffin's leadership to focus on those areas and provide the resources, I believe, that we will need to provide capabilities to stay in advance of the threat. So my hope is to see additional resources in that area in the next PB [President's budget].

Mr. LAMBORN. All right. Thank you so much. And lastly, and the chairman already talked with you about this, and that is space-based sensors, whether it is infrared or electrical optical—radar, detectable, optical, so on and so forth. Are we doing enough in those areas for space-based sensors?

General GREAVES. Let's see. Again, I will start with a threat. And the threat I see is the hypersonic threat as the greatest threat.

We are executing the planning, and I expect to see a significant increase in the amount of time and resources that we will spend in that area. It is the top priority, I believe, for me within the agency, to enhance our sensor architecture, and to include moving that sensor architecture to space in concert with what we have on the ground.

Mr. LAMBORN. All right. Thank you so much. Mr. Chairman, I yield back.

Mr. ROGERS. I thank the gentleman. The Chair now recognizes the gentlelady from Hawaii, Ms. Hanabusa, for 5 minutes.

Ms. HANABUSA. Thank you, Mr. Chairman.

General Robinson, thank you very much for your service.

I have some questions for you about NORTHCOM and NORAD. So what is the interface between the two? They both seem to be your commands, but separate.

General ROBINSON. Yes, ma'am, that is a true statement. Under my North American Aerospace Defense Command hat, I am responsible for defending Canada and the United States in the air domain. And so that can be, whether it is Russian long-range aviation or submarine shooting missiles. So I am responsible for that.

In my NORTHCOM hat, as the commander of Northern Command, I am responsible for defending the United States from a ballistic missile defense threat. I also work defense support to civil authorities as well as theater security cooperation with Canada, Mexico, and the Bahamas.

Ms. HANABUSA. So, General, as you know, Hawaii had the infamous false missile alert, so I am trying to figure out, who is it that would have, or should have, detected, if a missile was fired from North Korea, and whether it was headed for Guam, United States continent, or Hawaii, who would have been the agency, or the entity, that should be the one, frontline, detecting it?

General ROBINSON. So we looked at that, that STRATCOM [U.S. Strategic Command] does the initial sensing, and then we work our way through on as the missile—and I can be much more clear in the closed session.

Ms. HANABUSA. Okay.

General ROBINSON. But as we work our way through the missile launch, and as it goes through flight, then there is different roles and responsibilities that we have. And at the end of the day, when it comes time to defend the United States against a ballistic missile, it is me as the commander of NORTHCOM.

Ms. HANABUSA. So just so that I am clear, when we are talking about Hawaii or Guam, is it different, or is that considered to be as it reaches a certain, it seems like trajectory, it would become your responsibility?

General ROBINSON. Ma'am, I would really rather talk about that in a closed session, so I can give you the detail you are looking for.

Ms. HANABUSA. Okay. And as you can imagine, that is a question that is plaguing us in Hawaii right now. We are trying to figure out who is the one who should know. The one thing that the congressional delegation is uniform on in Hawaii, our four members, is that we believe that we should split apart the, quote, "the emer-

gency alert system" between that which is potentially military ballistic missile, in particular, and that which would be, like we just had major flooding, and hurricanes and tsunamis, that should be something that the State should handle.

But we are not sure the State should be delving in this area of missiles and missile alerts.

In the testimony, let me get to, I believe, General Dickinson. When we talk about the whole spectrum of missile defense and how we break it up in terms of—from the, I guess, when it shot up and it goes up in the trajectory and then it goes straight and then it starts to come down. Do you have any specific role in that scenario, or is that General Greaves?

General DICKINSON. So I will start off with the operational perspective, and I will turn it over to General Greaves for the technical piece to that. But what you are describing is our ability to look at the total trajectory of the ballistic missile flight and able to influence, or have capabilities in each stage of that flight, whether it is prelaunch, whether it is during the mid-course, terminal, or even the boost phase, our ability to do operational planning and then have capabilities that are able to influence each one of those steps in the flight of that missile is very important.

So when you look at operational design around the world in each of the different COCOMs for our regional missile defenses, as well as our national defenses, we looked at that very carefully to see how we do that. And then the capabilities that come along with that are critical to our ability to influence each one of those sections of flight.

Ms. HANABUSA. General, I don't mean to be insulting in any way, but if it takes us long to detect it as you just gave the explanation, there are a lot of people who are going to be very antsy. General, do you have anything to add?

General GREAVES. Just one clarification, ma'am, is that my role as the acquirer, our folks, they essentially work with industry to deliver the capability. The operational use of those systems rest with the combatant commanders.

Ms. HANABUSA. Thank you very much. And with that, I yield back.

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

Mr. HUNTER. Thank you, Mr. Chairman. Thank you, lady and gentlemen, for being here and for your service.

I guess, General Dickinson, let's talk about, if we could, the way that the pendulum swings from high-tech to low-tech based on what we are doing at whatever point in time that we exist right now, which is looking at North Korea, looking at Russia and China, talking a lot about space, very complex, giant systems. When 10 years ago, the focus was the C–RAM, our counter battery radars, acquiring rockets and other, just mortars and hate and disconnect and content that guys were shooting at our forward operating bases in Iraq and Afghanistan.

So that is switched now. So now we are focusing more on space stuff, I guess my general question is, to begin, do you think the pendulum is staying where it needs to be to where we get back in that fight again where we are getting shot at all the time, and real-

ize we kind of lost that sharpness that we had in that fight and gave it up to the more high-tech, big fight? And realizing that there is only a few countries where it takes satellites and interceptors and other things to stop their ICBMs. There is lots of countries that can do a lot of bad things to forward-operating bases in Africa or the Middle East and the Philippines, to other places. I guess, that is the pendulum question. Where are we?

General DICKINSON. So I think with regards to your question, so we have identified that, your mention of the C–RAM system. The Army, as a whole, has identified that as an area that we are continuing development in in terms of building back a short range air defense capability that we will bring back into the Army formations here in the next several years.

We are currently looking at what we call maneuver SHORAD [short range air defense] capabilities, whether that is a gun-missile mix or potentially in the future to a directed energy. My particular command, we are looking into directed energy and have had good success in demonstrating a 5KW [kilowatt] laser mounted on a Stryker combat vehicle. And we have had very good success over the last year and a half or so with four different tests where we actually had soldiers on the Stryker combat vehicle engaging small UAS [unmanned aerial system], squad-copter type targets very successfully.

So as we mature that technology beyond 5KW onto 50KW with the ultimate objective for the Army at 100KW, we are looking at that. That will be integrated into what we call an IFPC [indirect fire protection capability] which is the follow-on to C–RAM that will have an ability to use directed energy as well as potentially gun-missile mix. We are also looking to see whether or not we can employ electronic warfare in some of those capabilities as well.

So overall, the Army has identified the fact that we need to bring back that capability into the maneuver forces for the Army. And so to your question, I would say the pendulum is probably about right. We are looking at what we need to do to address what you described, the counter-UAS, counter-cruise missile capability, and we are looking to the near-peer adversaries that have the more sophisticated missile technology.

Mr. HUNTER. Look at what the Ukrainians went through with the Russians bombarding them with artillery fire.

And I would like the members of this committee to know, we are the ones, this committee before I was in Congress, put the C–RAM in Iraq in the first place. It was the Navy. It shoots spent uranium, missiles coming in. The military didn't want to do it. This committee loaded one up in California, sent it out there, and they could then shoot rockets and mortars coming in with the spent uranium, and it saved a lot of lives.

But it was one of the things that this committee did that was outside of the box that the military didn't want to do.

All right. I guess, lastly, are you looking at what the Ukrainians have done with our counter-battery radars that we gave them with restrictions? We couldn't give them any offensive weaponry for the last 8 years, but we gave them counter-battery radars. And they have really rigged those up to do some amazing things. Have you guys looked at that?

General DICKINSON. We continue to look at that and other operational scenarios we have had in the theater with our own weapon system as we build to the future with that capability.

Mr. HUNTER. And, I guess, tying in with that, you have the new Integrated Air and Missile Defensive Battle Command System, the IBCS. Can you just talk about that briefly?

General DICKINSON. So that is the future system we are ——

Mr. HUNTER. In terms of the budgeting and its milestones on being on track in time.

General DICKINSON. So the program, overall, is on track to deliver in 2022. We will do a limited user test in 2020. That system will, that capability brings online the fact that we will be able to bring in multiple sensors, multiple shooters onto an integrated fire control network.

So that will greatly enhance our capability to essentially have the best shooter and the best sensor coupled together to prosecute the targets.

Mr. HUNTER. And that will plug into whatever the distributed common ground system is in the future, I would guess?

General DICKINSON. We are looking at that. Yes.

Mr. HUNTER. Okay. All right. Thank you very much. Thank you, Mr. Chairman.

Mr. ROGERS. I thank the gentleman. The Chair now recognizes the gentleman from New Jersey, Mr. Norcross, for 5 minutes—or not.

The Chair now recognizes the gentleman from the great State of Alabama, Mr. Byrne, for 5 minutes.

Mr. BYRNE. Thank you, Mr. Chairman. I think General Greaves, this is directed to you, but if I am wrong, tell me. I want to talk about hypersonic. Are you the right person for that?

General GREAVES. One of several.

Mr. BYRNE. Well, if somebody else needs to answer this, jump in. I know that you all have spent a little over a year now on your analysis of alternatives, and I have been reading that recently China has made some pretty shocking advances in the realm of hypersonic weapons. Aside from the flight testing they have done, there are reports that they are heavily investing in their ground testing infrastructure and have planned to have a wind tunnel operational by 2020 that can simulate hypersonic speeds, which would allow them to better test their weapons, and no indications that they are slowing down the development of their capabilities.

And earlier this year, Admiral Harris of PACOM [U.S. Pacific Command] testified before this committee that Chinese hypersonic weapons are one of the biggest threats in his region.

So can you tell us as you are coming to the close of the analysis of alternatives, what you have learned so far and how far the agency is in moving forward?

General GREAVES. Yes, sir. You are correct, we are coming to closure on the AOA, the analysis of alternatives. I should be able to get a quick look within the next 30 days, and before end of the year, that should be completed.

What we are determining is that the architecture that we need to defend against that hypersonic threat will be air-, ground-, and space-based. The most important one initially is to deploy that

sensing layer I referenced before. But also, we need to look at the system's engineering portion of that to roll out and develop the architecture that is required, as well as a potential new interceptor that we may need to mitigate that threat.

So it is a complete architectural look at what will be needed. And the threat, the enemy is time, again. So we look to Dr. Griffin and Ms. Lord's leadership within the Department to strongly advocate for what will roll out of the AOA, and to ensure that activity is resourced and funded in next year's budget, and we can continue on to deploy those capabilities to meet the threat.

And I will turn it either to Secretary Rood or General Robinson to see if they have anything to add.

Secretary ROOD. Sure. I think General Greaves largely covered it, except to say, I concur with you fully about the growth of the threat. I think we are very concerned about the rate of progression that we have seen, not only in China, but elsewhere, like Russia.

And so it is an area that we are looking very seriously at in the Department, and the analysis of alternatives being led by General Greaves and Dr. Griffin.

Mr. BYRNE. Let me pose a hypothetical to you, a very disturbing hypothetical. There is a breakdown in Congress, and we decide to go back to the funding levels that are established in the Budget Control Act for the out-years. What does that do to what you are responsible for, Mr. Rood?

Secretary ROOD. Well, certainly the Congress, in its recent actions, has shown great confidence in the Defense Department leadership to come forward with the kind of programs and capabilities to defend the Nation.

Mr. BYRNE. It was a 2-year deal, and it could break down. What happens to what you are responsible for, if there is a breakdown, and we go back to those spending levels under the Budget Control Act?

Secretary ROOD. It would obviously pose a substantial concern, because the levels envisioned in the Budget Control Act [BCA] are significantly below that which we are operating now.

As the National Defense Strategy makes clear, we have entered a period of competition amongst the great powers, with China and Russia being our principal concerns. But certainly, states like North Korea, Iran, and the fight that we are in with violent extremism posing a substantial threat. So certainly, a substantially smaller defense budget as envisioned under those BCA caps would be a significant concern for us.

Mr. BYRNE. Would it endanger your ability to defend America against a missile attack?

Secretary ROOD. Well, we would obviously continue to mount an effective defense with the capabilities we have, but certainly, a smaller topline budget and how that got translated down to missile defense would impose some significant constraints.

Mr. BYRNE. Thank you. I yield back, Mr. Chairman.

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

Mrs. DAVIS. Thank you. Thank you, Mr. Chairman. Thank you all very much for being here.

This morning, and you might have seen or heard, we had a session on promoting DOD's culture of innovation. And the question really is whether or not we are able to keep pace with the scope of innovation in the defense technology sector given a host of issues, including culture, but some of the, really, the restrictions that we have in terms of our own laws, in terms of our own need to create multiple layers of authority, and a little different from DARPA [Defense Advanced Research Projects Agency], as you well know.

How do you see that? Could you comment on that? Because I think a lot of us know and understand some of the difficulties we have, that it takes a long time to bring many of those technologies to bear. And by the time we are ready for them, it is late. What do you see? What holds you up in being able to get what you need to the warfighter in a timely fashion?

General GREAVES. Ma'am, I will start with what Dr. Griffin said this morning, the three impediments that he discussed this morning. The first being excessive processes, bureaucracy; the second being risk aversion, risk aversion nature; and the third being a fear to fail. Those are things which are the biggest impediments.

I totally concur with him that leads to, if not indecision, the length of time it takes to make a decision.

I think speed of decision making within the Department is what we need. And with those three impediments that Dr. Griffin laid out and his intent to reduce or attempt to eliminate those, I think will go a long way in ensuring that we can make decisions in a time-relevant manner, as the Secretary of Defense talked about, to deliver the capability we need. Thank you.

Secretary ROOD. The only thing I would add, Congresswoman, is that for Secretary Mattis, improving the Department's capabilities to both be good stewards of taxpayers' dollars, as well as to improve the speed at which we can field capabilities to the warfighters, is his third, one of his three top lines of effort. He works that through his leadership team.

Deputy Secretary of Defense, in particular, are very focused in this area. And I think the legislation that Congress passed creating the separation with an Under Secretary for Research, Engineering, and an Under Secretary for Acquisition [and] Sustainment is certainly something we fully embrace and are starting to move forward with.

So the problem and the challenge certainly is very well understood by the senior leadership in the Department. We have now got to make the changes necessary to support the kind of innovation you just discussed.

Mrs. DAVIS. And I think that Congress is ready and willing to try and work through a number of those requirements so they don't basically take us down a complicated path that perhaps we are going to be able to avoid in the future. Recognizing, of course, we still have many requirements that are going to be out there.

Thank you. I appreciate that.

I think the other issue that we have all worked with and talked about is whether or not it is possible through the use of multiple satellites to, in fact, have less expensive technology, more of it that

may, in fact, help us to mitigate some of the high cost and even the issues around missile defense.

Is that something that you feel that we can be exploring further and we should be exploring further?

General GREAVES. Ma'am, I totally agree. We are exploring it today. We've taken action in certain areas today and within the recent past, and it is something we must do in the future. Whether or not it is disaggregating missions or payloads from what I call our Battlestar Galacticas, or hosting payloads or using commercial capabilities, those are all things that I know the Department has been looking at, is looking at, and will be looking at into the future.

Mrs. DAVIS. Thank you. And just quickly, the agency's top line of $11.5 billion for this fiscal year is going to be cut down in the administration's budget to $9.9 billion. Is that of concern to you, that you will be able to, you know, mitigate, again, the impacts of what is being proposed as a spending reduction?

General GREAVES. Ma'am, the answer is yes, it concerns me. But I do believe that we have got the management structure in place, the attention in place. The threat has voted. I mean, the fact that North Korea has done what it has done is visible to the entire Nation, the entire world. So it is reality we are dealing with. And those discussions will be very robust within the Department to ensure that we deploy a missile defense system that is capable of defending the Nation.

Mrs. DAVIS. Thank you. Thank you, Mr. Chairman.

Mr. ROGERS. I thank the gentlelady.

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

Mr. HICE. Thank you, Mr. Chairman. General Greaves, let me begin with you with this. For directed energy boost phase missile defense application, can you explain the similarities and differences between what MDA requires versus the services?

General GREAVES. Yes, sir. Short answer is power level. As you heard, General Dickinson discussed his requirements to go from 5 kilowatts to 50 to 100.

The missile defense requirements begin at 500 kilowatts to a megawatt. And we can discuss more of that in the closed session. But power level as well as delivery capability for the boost phase intercept mission, if you may recall the airborne laser program, chemical laser, which essentially operated within the atmosphere, where we are looking at a deployment capability that is much higher, 60,000 feet-plus, and all of the beam steering, beam quality requirements that go along with that. So bottom line is power level.

Mr. HICE. General Dickinson, anything you would like to add to that?

General DICKINSON. I would agree with what General Greaves said. What we are developing right now is intended for more of a close fight, if you will, and in support of the maneuver forces, whether Army, Marine. And the power levels we are talking about are appropriate for countering UAS and potentially cruise missiles, you know, in the short term.

Mr. HICE. Okay. General Greaves, are there areas that are not being addressed by the Department's High Energy Laser Advanced Development Program that are specific to what MDA had intended

to use for those funds in fiscal year 2019 that would somehow delay the missile defense capability?

General GREAVES. No, sir. What I would say is that the discussion is a Department concern—a Department-level discussion right now. So we are looking at the requirements that on the lower end, as General Dickinson mentioned, as well as mine, we are working with Dr. Griffin's staff and Dr. Griffin, in particular, to ensure that the funds that were allocated for directed energy and the funds that we requested, make it down to our level.

Mr. HICE. Okay. The last question that I have for you, in your written statement, I wanted to shift gears a little bit here, but in your written statement, you discussed the need to develop technology and capabilities that will take out ICBMs in their boost phase of flight.

Can you explain how in the fiscal year 2019 budget that is being requested how that would help those technologies?

General GREAVES. Yes, sir. Basically, it is the amount we have got allocated to do what we call laser scaling. We have been able to demonstrate 30 kilowatts in the lab. We need to continue the work to upgrade that power level demonstration capability to 100 kilowatts in a step-wise fashion to get to the 500–1 megawatt level.

So the technology work is absolutely essential so that we can demonstrate the capability on the ground and in the air—that is part of the plan—before we leap off into a full system that has promises with which we haven't delivered the high-technology readiness level capabilities that we need to develop and deploy the system.

Mr. HICE. Okay. So you feel comfortable that the night, a PB 2019 budget request would be sufficient?

General GREAVES. I will be advocating for additional funding, to be quite honest with you.

Mr. HICE. That is what I wanted to know.

General GREAVES. There were hard decisions that had to be made within the Department, and the PB represents the product of those decisions.

Mr. HICE. Okay. Alright. Thank you very much. Mr. Chairman, I yield back.

Mr. ROGERS. The gentleman yields back. The Chair now recognizes the gentleman from Alabama, Mr. Brooks, for 5 minutes.

Mr. BROOKS. Thank you, Mr. Chairman.

General Greaves, it has been brought to my attention that requirements for a THAAD follow-on development program have been eliminated, even though other missile defense systems have had ongoing follow-on development after their initial fielding.

Given the pace of threat evolution globally, and given that THAAD is a successful and in-demand system, can you share your plans, if any, for an ongoing THAAD follow-on that would build upon current capabilities?

General GREAVES. Congressman, to be quite honest, we, across all of our systems, look at what the next generation can produce and can field. THAAD currently meets the requirements that have been delivered to us. And I will not say that it is not being done. I would say that the system that we have delivered meets require-

ments, and we are looking to see what capability will enhance its capability for the future.

Mr. BROOKS. As a follow-up, currently, THAAD has—excuse me, was operationalized in Hawaii in 2009 to provide additional homeland missile defense against longer-range threats from North Korea.

Perhaps, perhaps, THAAD could provide another layer of coverage against ICBMs for homeland defense. What, if any, part of your plans to test that against ICBM targets?

General GREAVES. Congressman, I request that we cover that in the closed session.

I have a quick answer for you, but I would not want to say too much in the open session.

Mr. BROOKS. All right. If you would, I am not sure if I will be here during the closed session, but if you will answer that question for the record, I would appreciate it.

We are about to have votes called in 5 or 10 minutes, is what I have been notified, and I do have other meetings that are conflicting.

General GREAVES. The short answer, sir, we have studied it and we have got the answer.

Mr. BROOKS. All right. Thank you.

General Greaves and General Dickinson, are you concerned that current THAAD battery and interceptor availability will be challenged given current and future operational requirements?

General GREAVES. Why don't you take it?

General DICKINSON. Yeah, as of today, we have got six going to seven operational THAAD batteries. And Congressman, I know you are well aware, we have one that is in Guam and one recently deployed to Korea.

So, you know, as you look at the capacity that we have, we have got five ready or soon to be five, four right now, five here this fall that will be fully operational.

I think the THAAD weapon system and the way it is developed and designed right now, gives us some flexibility in capacity, operational flexibility in the sense that we can move, you know, additional launchers from one battery to the other to increase capacity, if needed. But at this particular time, I think the seven batteries, which I believe are the program of record by MDA, is satisfactory.

Mr. BROOKS. Do you have a plan to provide additional THAAD batteries to the Army or to add launchers to the existing batteries to increase defensive capabilities?

General GREAVES. Congressman, General Dickinson mentioned the program of record. So as of today, the answer is no. The program of record is seven.

However, there is discussion within the Department on what the THAAD battery requirement is. And if that changes, we will request resources to develop and deploy that capability.

Mr. BROOKS. And then finally, General Greaves, can you talk a little about the status of the joint emergent operational need [JEON] for U.S. Forces Korea, what work has begun, and what work needs to be done. I am aware of your unfunded requirement of $284 million for the JEON, and I am concerned that key integration work for THAAD and the PAC–3 MSE [Missile Segment En-

hancement] missile and for launch through own remote capability has not been funded.

General GREAVES. Yes, Congressman. That is one of the top priorities for General Brooks in Korea, who discussed that requirement with me directly. We have laid out a plan, which if resourced properly provides—require that capability to improve the interoperability between those two systems, and we will continue to advocate for the funding required to complete that project, and pending Department decision, we will see where we go next.

Mr. BROOKS. All right. Mr. Chairman, that concludes my questions.

Gentlemen and lady, thank you for your service. And I yield the remainder of my time back.

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

Mr. COFFMAN. Thank you, Mr. Chairman. To all the witnesses, how is the rapid advance of North Korean missile technology, obviously, they still have to weaponize that launch system, but how has that affected your decisions, the U.S. missile defense posture?

Secretary ROOD. Well, I will start and invite my colleagues to add to that, sir. Certainly, the rapid pace that the North Koreans are improving their capabilities in the demonstrable way they have gone about that with some two dozen ballistic missile tests in recent years, accompanied with nuclear test, has really punctuated the concern that we have had for quite some time about North Korea. It punctuated it with an exclamation point.

So that has gotten our attention. We have, as mentioned in our statements, last year requested supplemental funding, which the Congress was supportive of—and thank you for that—to increase the pace at which we are doing that. But the size, scale, and sophistication of the threat is growing, and the size, scale, and sophistication of our defense is proposed to grow in the President's budget request.

And we are presently examining the capabilities to take that to a substantially higher level, not just for the United States. As discussed, we have deployed THAAD to South Korea, we are in conversations with our Japanese allies and other partners about how we can improve our collective capabilities to be able to respond to that threat, sir.

General ROBINSON. Sir, the only thing I would add to that is, as the commander of NORTHCOM, is, you know we watched very quickly the rapidity with which he did testing and the speed with which he made capability. So with the ATR [automatic target recognition] that was given to us last year, to be able to add capacity while we are still working on the redesigned kill vehicle will also add to the capability and still working on discrimination radars.

So all of this is good news to help us, but we watch him very closely.

General GREAVES. Congressman, I support entirely what Secretary Rood and General Robinson just articulated. It has caused us and helped us to focus our efforts on, and make the articulation of the threat a whole lot easier because it's been demonstrated, and the timeline has been compressed due to the demonstrated capability that we have seen.

General DICKINSON. And in my role as a force provider for General Robinson for the soldiers that actually operate the GM [Ground-Based Midcourse Defense] system, I will tell you that I am absolutely confident in that capabilities to operate that system 24 hours a day on behalf of the Nation, and completely confident, given the capabilities that we have seen demonstrated in the weapon system that we have, and in complete agreement with where we are going on the path to improve the reliability and performance of the system.

Mr. COFFMAN. I wonder if—all witnesses, again—I mean, across the board, there has been a consensus on the need to get to space for missile defense tracking and discrimination. Again, without the benefit of having the MDR [Missile Defense Review]. And can you lay out the Department's position on how space is being looked at in regards to a warfighting domain for missile defense?

Are you still looking at what a space-based intercept constellation could provide? Is the ultimate goal for directed energy to be used in space?

Secretary ROOD. I will just start briefly, and again, reiterate that we are concerned about the progression of space capabilities and the contested nature of space as a domain, just as a general matter.

In the area of missile defense, of course, the offensive missiles that could be fired against the United States will transit space and reenter.

We have had, in our architecture for some time, space-based capabilities to track and detect the launch of those missiles, and there have been efforts over the years to have a space-based test bed and other activities to evaluate competing capabilities.

Certainly, the Missile Defense Agency and General Greaves can articulate that further, have put forward concepts for space-based tracking capabilities which the Department has funded for demonstration this year, and we are looking at additional capabilities in that regard, both in the space-based tracking area and evaluating the capabilities that could be potentially fielded in space for the kill mechanism, whether that be through directed energy or other means.

Those are things we are simply evaluating at this stage, but General Greaves may want to articulate more.

General GREAVES. Congressman, it begins with the threat. Today's ballistic missile threat is fairly predictable. You throw a baseball from where I am, in that direction, it will go in that direction.

The concern, again, is what we have seen Russia, China, and other nations do in the area of hypersonic, where it is lower-flying, maneuverable, and the need, as they deploy more complex countermeasures, things aimed at defeating our missile defense capabilities, the need, the absolute essential need to track and maintain custody of that threat from beginning to end, and that draws you up into space. We don't have enough radars to populate the globe to maintain that same level of custody.

So from a space-sensing layer, absolutely essential, first thing we need to do, increase that capability. And then as a Nation, decide what the next step is with deploying an interceptor, if it is space-based, whether or not to do it, how to use directed energy, spending

resources on the technology and initial development work to essentially determine if that capability is real or not.

So it is really critical that we pursue the space-based capability.

Mr. COFFMAN. Thank you, Mr. Chairman. I yield back.

Mr. ROGERS. It looks like if we walk briskly down to the SCIF, we will be able to get the classified section done before votes. So we will stand in recess for 5 minutes while we move to the SCIF.

[Whereupon, at 4:44 p.m., the subcommittee proceeded in closed session.]

A P P E N D I X

APRIL 17, 2018

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

APRIL 17, 2018

Opening Remarks – <u>As Prepared for Delivery</u>
The Honorable Mike Rogers
Chairman, Subcommittee on Strategic Forces
House Armed Services Committee

Hearing on the "Fiscal Year 2019 Budget Request for Missile Defense and Defeat Activities"

April 17, 2018

Good morning. The subcommittee will come to order.

Welcome to our hearing on the "Fiscal Year 2019 Budget Request for Missile Defense and Defeat Activities."

Thank you to witnesses for being here today and for your service to the Nation. And for your time preparing for this hearing—we greatly appreciate it. Our witnesses are:

- **The Honorable John Rood**
  Under Secretary of Defense for Policy
- **General Lori Robinson**
  - Commander
  - Northern Command
  - North American Aerospace Defense Command

And I would like to take a moment to especially recognize General Robinson. You have been a friend of the Committee not only as the Commander of NORTHCOM and NORAD, but across your 37 years of service to this great nation. I know I speak on behalf of this subcommittee, and the HASC as a whole, when I thank you for your dedicated and unwavering service, and we wish you the best as you retire from the Air Force.

- **Lieutenant General Samuel Greaves**
  - Director
  - Missile Defense Agency

General, congratulations on your assignment as the Director of MDA. You are no stranger to this committee, and we look forward to our continued work together on missile defense.

- **Lieutenant James Dickinson**
  - Commander
  - Army Space and Missile Defense Command
  - Army Forces Strategic Command and Joint Functional Component Command for Integrated Missile Defense at U.S. Strategic Command

Let me start by just highlighting some of what we've seen since our previous missile defense hearing in June of last year.

North Korea has tested a missile with ICBM-range. Iran continues to develop their own ICBMs under the guise of a space launch program. Putin boasted in his recent national speech about an "invincible" missile targeted at the United States, and China is surging ahead with their own missile programs – most notably in the hypersonic realm.

Fortunately, I think this Administration gets it. The budget amendment we received last year for an additional $4 billion for missile defense and the FY19 request, which includes about $12 billion across the board for missile defense, seem appropriate given the rising threat levels around the globe.

As is highlighted in the National Defense Strategy, "We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment. To address the scope and pace of our competitors' and adversaries' ambitions and capabilities, we must invest in modernization of key capabilities through sustained, predictable budgets."

Now, we are still waiting on the Administration to release the Missile Defense Review, hopefully in the coming weeks.

I expect it will follow suit with where the NDS and NPR have forged a path, and continue to address what the last Administration has failed to do for the previous 8 years.

We have developed the best missile defenses in the world, but for the most part, they are technologies that were started almost 15 years ago.

The increasing threat makes it essential that we expand and enhance our missile defenses—not only with capacity, but also through leaps in technology—right now and not 5 years from now.

Increasing our GBI inventory, land-based sensors, and regional interceptor capacity is critical, but cannot come at the cost of seriously going after technologies like directed energy, space sensing, and boost phase capability.

Thank you again to our witnesses—I look forward to the discussion.

With that, let me turn to our ranking member for any statement he would like to make.

HASC-SF Hearing

Mr. John Rood

Under Secretary of Defense for Policy

April 17, 2018

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

Security Environment and Strategic Priorities

As the *National Defense Strategy* points out, the United States, allies, and partners confront a security environment that is more complex and volatile than any we have experienced in recent memory. Today, over twenty states possess offensive missiles, and potential adversaries are expanding their missile capabilities in three different directions simultaneously. They are increasing the capabilities of their existing missile systems; adding new and unprecedented types of missile capabilities to their arsenals; and, integrating offensive missiles more thoroughly in their coercive threats, military exercises, and war planning.

Over the past several years, North Korea has rapidly accelerated its ICBM development program. Iran is extending the range of its ballistic missile systems with the goal of achieving an operational ICBM capability, and through its Space Launch Vehicle (SLV) program could shorten a pathway to an ICBM because space launch vehicles use similar technologies.

Potential adversaries are also fielding an increasingly diverse, expansive, and modern range of regional offensive missile systems that can threaten U.S. forces abroad, allies, and partners. Their regional offensive missile systems include multiple types of short-, medium-, and intermediate-range missiles intended to provide coercive political and military advantages in regional crises or conflict. These missile systems appear to be a central element of Russia's frequent and explicit coercive nuclear threats to U.S. allies and partners. For example, Russia is developing a new generation of advanced, regional ballistic and cruise missiles that support its anti-access/area denial (A2/AD) strategy intended to defeat U.S. and allied will and capability in regional crises or conflicts.

A key component of China's military modernization is its short-range ballistic missile (SRBM) arsenal designed to prevent U.S. military access to support regional allies and partners. China is augmenting this short-range missile force with a growing number of medium- and intermediate-range ballistic missiles, including sophisticated anti-ship ballistic missiles that pose a direct threat to U.S. aircraft carriers.

Russia and China are also developing advanced sea- and air-launched cruise missiles and hypersonic missile capabilities that can travel at exceptional speeds with unpredictable flight paths. These are the realities of the emerging missile threat environment that U.S. missile defense policy, strategy and capabilities must address.

Missile Defense Policy and Posture

With this as the strategic context, let me turn to a discussion of the FY2019 Budget Request for missile defense and the policies, programs and capabilities it supports. The Department's budget request supports the President's direction set out in the *National Security Strategy* to deploy a layered missile defense system to protect the American homeland from North Korean and Iranian missile threats. The request also supports regional missile defenses to protect our deployed forces, allies, and partners. Our missile defense system not only protects the United States, it strengthens the deterrence of war and the assurance of allies and partners.

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

In September 2017, DoD requested the reprogramming of FY2017 funding of more than $400 million to counter the North Korean missile threat. Congress approved this request. A portion of these funds supports important homeland defense activities, including initiating work on the procurement of 20 additional GBIs in Alaska as early as 2023, which will bring the total to 64 fielded interceptors. The reprogramming also funded a service life extension to the COBRA DANE radar in Alaska and software upgrades to the Sea-Based X-band (SBX) radar – both essential elements of our homeland defense. In November 2017, the President submitted an amendment to his FY2018 budget request for $4.0 billion for both capabilities to defeat missiles prior to launch and missile defense which includes construction of a new missile field at Fort Greely, Alaska, and additional procurement funding necessary for the 20 new GBIs.

The FY2019 budget request includes $9.9 billion for the Missile Defense Agency and $3 billion for air and missile defense activities in the Military Departments. This budget funds: a more capable GBI with the Redesigned Kill Vehicle; the deployment of new missile tracking and discrimination sensors in Alaska, Hawaii, and the Pacific region; and a new Space-based Kill Assessment capability. These near term investments will enable us to obtain substantially more performance and efficiency out of the GMD systems necessary to meet the evolving threat.

We are also moving forward to bolster homeland defenses against air and cruise missile threats. In 2018, we will complete the first part of a two-phase effort to provide effective surveillance against these missile threats to the National Capital Region (NCR). Doing so will enhance our ability to detect, track, and investigate suspicious aircraft, as well as cruise missiles, and when

necessary, cue our missile defense systems against the full spectrum of air threats. We are on track to begin the second phase of this effort in FY19, which will expand our capability to detect, ID and take defensive action before air threats can strike potential targets within the NCR. We are also looking into technologies and concepts that could be used to provide scalable and deployable options for expanding this defensive capability.

The Department's FY 2019 budget request also continues deployment of regional missile defenses tailored to meet missile threats to U.S. forces abroad and allies and partners in Europe, the Middle East, and the Indo-Pacific region. The budget enhances our regional missile defense capacity through additional Patriot missiles as well as Terminal High Altitude Defense (THAAD), SM-3 Block IB, and SM-3 Block IIA interceptors. Our focus is on developing and fielding missile defense capabilities that are mobile and relocatable, which allows us flexibility to respond to a crisis or conflict wherever it emerges. Because systems such as Patriot, THAAD, and our Aegis BMD capable ships can be surged when and where required, they make it possible to deploy layered missile defense capabilities that are responsive to regional missile threats as they arise.

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

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

Conclusion

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

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

John C. Rood
Under Secretary of Defense for Policy

John C. Rood serves as the Under Secretary of Defense for Policy. He assumed this position on January 9, 2018. In this role he serves as the principal advisor to the Secretary of Defense for defense policy and leads the formulation and coordination of national security policy within the Department of Defense. Mr. Rood oversees integration of defense polices and plans to achieve desired objectives. He is responsible for efforts to build partnerships and defense cooperation with U.S. friends and allies.

Mr. Rood brings more than three decades of public and private sector experience to this position, including over 20 years of service in the U.S. Government at the Department of State, Department of Defense, National Security Council, Central Intelligence Agency, and as a Staff Member in the U.S. Senate. At the Department of State, he served as Acting Under Secretary of State for Arms Control and International Security, and as Assistant Secretary of State for International Security and Nonproliferation. Mr. Rood served in the Department of Defense as the Deputy Assistant Secretary of Defense for Forces Policy. He served twice at the National Security Council where he was a Special Assistant to the President and Senior Director for Counterproliferation, as well as the Director of Proliferation Strategy, Counterproliferation, and Homeland Defense. At the Central Intelligence Agency, he served as an analyst following missile programs in foreign countries. In addition, Mr. Rood worked as a Senior Policy Advisor to U.S. Senator Jon Kyl of Arizona.

In the private sector, Mr. Rood was Senior Vice President of Lockheed Martin International where he led efforts to grow the corporation's international business. He also served as Vice President for Corporate Domestic Business Development at Lockheed Martin. Prior to joining Lockheed Martin, he was a Vice President at the Raytheon Company.

Mr. Rood holds a Bachelor of Science in Economics from Arizona State University.

STATEMENT OF

GENERAL LORI J. ROBINSON, UNITED STATES AIR FORCE

COMMANDER,

UNITED STATES NORTHERN COMMAND

AND

NORTH AMERICAN AEROSPACE DEFENSE COMMAND

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

STRATEGIC FORCES SUBCOMMITTEE

17 APRIL 2018

Table of Contents

INTRODUCTION

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

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

STRATEGIC ENVIRONMENT

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

NORTH KOREA

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

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

RUSSIA

With a full suite of delivery platforms and weapons systems capable of ranging targets throughout the United States and Canada, Russia remains the only existential air domain threat our two nations face. Russian leaders regularly exercise conflict with the United States and are

investing heavily to modernize their forces and develop novel weapons to ensure their ability to hold the United States and Canada at perpetual risk.

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

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

CHINA

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

This followed the transit of a small group of Chinese ships through the Aleutian Islands in September 2015, the first-ever instance of Chinese naval vessels operating in the Bering Sea.

IRAN

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

USNORTHCOM AND NORAD

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

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

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

between our nations. U.S. and Canadian personnel work side-by-side in the combined USNORTHCOM and NORAD headquarters and in each of the NORAD regions in the United States and Canada.

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

HOMELAND DEFENSE

BALLISTIC MISSILE DEFENSE

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

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

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

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

In light of the mounting challenges of defending the United States against intercontinental ballistic missile attack, I am grateful to the defense committees for approving the Department's FY17 above-threshold reprogramming and supporting the budget amendment that will increase the Ground-based Midcourse Defense system's capacity and capability. That investment in improved target discrimination and more reliable kill vehicles will improve our ability to defend the homeland. I will continue to work with my mission partners in the Missile Defense Agency, the intelligence community, and fellow combatant commands to identify and prioritize additional initiatives that will keep us on or ahead of the threat.

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

defense of the United States, USNORTHCOM will continue to work with our fellow combatant commands to integrate offensive and defensive capabilities as part of a coherent strategy to defeat the missile threats facing our nation.

AEROSPACE WARNING AND AEROSPACE CONTROL

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

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

The ability to deter and defeat threats to our citizens, vital infrastructure, and national institutions starts with successfully detecting, tracking, and positively identifying targets of interest approaching and within U.S. and Canadian airspace. As part of an ongoing effort to defend the United States and Canada against a wide range of airborne threats—from modern strike aircraft and advanced air- and submarine-launched cruise missiles to small drones—

NORAD planners continue to develop a modern three-phase Homeland Defense Design that links advanced sensors capable of detecting and tracking potential threats with weapons systems capable of neutralizing targets identified as hostile.

LOW RADAR CROSS SECTION THREATS

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

CRUISE MISSILE DEFENSE

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

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

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

CANADA

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

In May 2018, NORAD celebrates its 60th birthday defending the United States and Canada in the air domain. We continue to evolve this venerable relationship to keep pace with evolving threats to ensure our bi-national defense can deter, and if necessary, defeat potential

future attacks. NORAD prioritizes interoperability and command and control through regular operations, combined training and exercises, combined planning, information and intelligence sharing, and personnel exchanges to ensure we are capable of conducting operations together, across the spectrum of conflict.

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

CONCLUSION

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

"We have the watch"

General Lori J. Robinson

Gen. Lori J. Robinson is Commander, United States Northern Command and North American Aerospace Defense Command. USNORTHCOM partners to connect 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 Robinson entered the Air Force in 1982 through the ROTC program at the University of New Hampshire. She has served in a variety of positions as an Air Battle Manager, including instructor and Commander of the Command and Control Operations Division at the Air Force Fighter Weapons School, and Chief of Tactics in the 965th Airborne Warning and Control Squadron. She has commanded an operations group, a training wing, an air control wing and deployed as Vice Commander of the 405th Air Expeditionary Wing, leading more than 2,000 Airmen flying the B-1 Lancer, KC-135 Stratotanker and E-3 Sentry aircraft in operations ENDURING and IRAQI FREEDOM. General Robinson was an Air Force Fellow at The Brookings Institution in Washington, D.C., and served at the Pentagon as Director of the Secretary of the Air Force and Chief of Staff of the Air Force Executive Action Group. She has also been Deputy Director for Force Application and Support, Directorate of Force Structure, Resources and Assessment, Joint Staff, the Pentagon, Washington, D.C. Following these assignments, General Robinson was Director, Legislative Liaison, Office of the Secretary of the Air Force, the Pentagon, Washington, D.C. General Robinson also served as the Deputy Commander, U.S. Air Forces Central Command; Deputy, Combined Force Air Component Commander, U.S. Central Command, Southwest Asia, Vice Commander, Air Combat Command, Langley Air Force Base, Virginia.

Prior to her current assignment, General Robinson was Commander, Pacific Air Forces and Air Component Commander for U.S. Pacific Command; Joint Base Pearl Harbor-Hickam, Hawaii.

EDUCATION

1981 Bachelor of Arts degree in English, University of New Hampshire, Durham
1986 Squadron Officer School, Maxwell AFB, Ala.
1986 Distinguished graduate, Air Force Fighter Weapons School, Nellis AFB, Nev.
1992 Master of Arts in education leadership and management, Troy State University, Ala.
1995 Master's degree in national security and strategic studies, College of Naval Command and Staff, Naval War College, Newport, R.I.
2001 Air War College, by correspondence
2002 Air Force Fellow, The Brookings Institution, Washington, D.C.
2005 Senior Executive Fellows Program, Harvard University, Cambridge, Mass.
2013 Leadership at the Peak, Center for Creative Leadership, Colorado Springs, Colo.

ASSIGNMENTS

1. January 1982 - June 1982, Student, Basic Air Weapons Controller School, Tyndall AFB, Fla.
2. June 1982 - January 1983, Air Weapons Controller, Homestead AFB, Fla.
3. January 1983 - January 1985, Instructor Air Weapons Controller and live-fire senior director, 81st Range Control Squadron, Tyndall AFB, Fla.
4. January 1985 - February 1986, Chief of Training; and Chief of Standardization and Evaluation, 848th Air Control and Weapons Squadron, Wallace Air Station, the Philippines
5. February 1986 - September 1986, Air Weapons Controller, Air Weapons Controller Division, Air Force Fighter Weapons School, Nellis AFB, Nev.
6. September 1986 - December 1986, Student, Air Force Fighter Weapons School, Nellis AFB, Nev.
7. December 1986 - October 1989, Instructor and Course Manager, Air Weapons Control Division, Air Force Fighter Weapons School, Nellis AFB, Nev.

8. October 1989 - August 1992, Chief of Current Operations and command briefer, Headquarters Pacific Air Forces, Hickam AFB, Hawaii
9. August 1992 - May 1993, Air Weapons Controller, 552nd Air Control Wing, Tinker AFB, Okla.
10. June 1993 - June 1994, Chief, Weapons and Tactics Branch, 965th Airborne Warning and Control Squadron, Tinker AFB, Okla.
11. July 1994 - June 1995, Student, College of Naval Command and Staff, Naval War College, Newport, R.I.
12. June 1995 - September 1995, Student, Armed Forces Staff College, Norfolk, Va.
13. September 1995 - December 1997, Command, Control and Communications Officer, Deputy Chief of Staff, and executive assistant to the Director, Defense Information Systems Agency, Arlington, Va.
14. December 1997 - June 1998, Student, mission crew commander training, Nellis AFB, Nev.
15. June 1998 - February 2000, Commander, Command and Control Operations Division, Air Force Weapons School, Nellis AFB, Nev.
16. February 2000 - July 2001, Executive Officer to the Commander, Air Combat Command, Langley AFB, Va.
17. July 2001 - June 2002, Air Force Fellow, The Brookings Institution, Washington, D.C.
18. June 2002 - August 2004, Commander, 552nd Operations Group, Tinker AFB, Okla. (March 2003 - May 2003, Vice Commander, 405th Air Expeditionary Wing, Southwest Asia)
19. August 2004 - August 2005, Commander, 17th Training Wing, Goodfellow AFB, Texas
20. August 2005 - September 2006, Director, Secretary of the Air Force and Chief of Staff of the Air Force Executive Action Group, the Pentagon, Washington, D.C.
21. September 2006 - May 2007, Chief, Air Force House Liaison Office, Legislative Liaison, Office of the Secretary of the Air Force, Headquarters U.S. Air Force, the Pentagon, Washington, D.C.
22. May 2007 - August 2008, Commander, 552nd Air Control Wing, Tinker AFB, Okla.
23. September 2008 - October 2010, Deputy Director for Force Application and Support, Directorate of Force Structure, Resources and Assessment, Joint Staff, the Pentagon, Washington, D.C.
24. October 2010 - June 2012, Director, Legislative Liaison, Office of the Secretary of the Air Force, the Pentagon, Washington, D.C.
25. June 2012 - April 2013, Deputy Commander, U.S. Air Forces Central Command; Deputy, Combined Forces Air Component Commander, U.S. Central Command, Southwest Asia.
26. May 2013 - October 2014, Vice Commander, Air Combat Command, Langley AFB, Va.
27. October 2014 - May 2016, Commander, Pacific Air Forces and Air Component Commander for U.S. Pacific Command; Joint Base Pearl Harbor-Hickam, Hawaii.
28. May 2016 - Present, Commander, North American Aerospace Defense Command (NORAD) and United States Northern Command (USNORTHCOM). Colorado Springs, Colo.

SUMMARY OF JOINT ASSIGNMENTS
1. September 1995 - December 1997, command, Control and Communication Officer, Deputy Chief of Staff, and Executive Assistant to the Director, Defense Information Systems Agency, Arlington, Va., as a major
2. September 2008 - October 2010, Deputy Director for Force Application and Support, Directorate of Force Structure, Resources and Assessment, Joint Staff, the Pentagon, Washington, D.C., as a brigadier general
3. June 2012 - April 2013, Deputy Commander, United States Air Forces Central Command and Deputy Combined Forces Air Component Commander, Al Udeid Air Base, Qatar, as a major general
4. May 2016 - present, Commander, North American Aerospace Defense Command (NORAD) and United States Northern Command (USNORTHCOM). Colorado Springs, Colo, as a general.

FLIGHT INFORMATION
Rating: senior air battle manager
Flight hours: more than 900
Aircraft: E-3B/C and E-8C

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal with two oak leaf clusters
Defense Superior Service Medal

Legion of Merit with two oak leaf clusters
Bronze Star Medal with oak leaf cluster
Defense Meritorious Service Medal
Meritorious Service Medal with three oak leaf clusters
Aerial Achievement Medal
Air Force Commendation Medal with two oak leaf clusters

EFFECTIVE DATES OF PROMOTION
Second Lieutenant May 24, 1981
First Lieutenant Sept. 11, 1983
Captain September 11, 1985
Major Jan. 1, 1994
Lieutenant Colonel July 1, 1998
Colonel Aug. 1, 2002
Brigadier General July 22, 2008
Major General May 1, 2011
Lieutenant General May 20, 2013
General Oct. 16, 2014

(Current as of March 2017)

Lieutenant General Samuel A. Greaves, USAF
Director, Missile Defense Agency
Before the
House Armed Services Committee
Strategic Forces Subcommittee
April 17, 2018

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

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

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

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

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

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

The MDA mission is "to develop and deploy a layered Ballistic Missile Defense System to defend the United States, its deployed forces, allies, and friends from ballistic missile attacks of all ranges and in all phases of flight." The MDA budget request of $9.9 billion for FY 2019 will continue the development, rigorous testing and fielding of reliable, increasingly capable, and state-of-the-art defenses for the United States, our deployed forces, and the forces and territories of our allies and partners against current and projected missile threats. This request will maintain current homeland and regional missile defense assets and increase capability and capacity to keep pace with advancing threats. We will continue to collaborate closely with the Warfighter and support the current and future needs of the Combatant Commanders with the development,

testing, deployment, and integration of interceptors, sensors, and the command, control, battle management and communications (C2BMC) system into a multi-domain battle management and command and control system for the Ballistic Missile Defense System (BMDS).

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

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

[1] "The United States is deploying a layered missile defense system focused on North Korea and Iran to defend our homeland against missile attacks." *National Security Strategy of the United States of America*, December 2017, p. 8.
[2] "Investments will focus on layered missile defenses and disruptive capabilities for both theater missile threats and North Korean ballistic missile threats." *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, p. 6.

hypersonic glide vehicle and cruise missile threats and by pursuing advanced technologies, such as directed energy, and making prudent and affordable investments in potentially game-changing capabilities.

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

Missile Threat

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

North Korea is committed to developing a long-range, nuclear-armed missile that is capable of posing a direct threat to the United States. In 2016 and 2017, North Korea conducted over 40 launches of short, medium, intermediate, submarine-launched, and intercontinental-range systems. This past February, North Korea paraded five ballistic missile systems: four of these received their first test launch in 2017. North Korea flight-tested two Hwasong-14 intercontinental ballistic missiles (ICBMs) in July. In their tested configuration, these missiles are capable of reaching North America. In late November 2017, North Korea launched what it described as a new ICBM-the Hwasong-15-which also demonstrated a capability to reach the United States. Pyongyang flew two Hwasong-12 intermediate-range missiles over Japan last

year, placing our allies at potential risk from missile debris. The second of these tests demonstrated a capability to reach over 3,700 kilometers, which can range beyond Guam. The North twice flight-tested a solid-propellant medium-range missile capable of reaching Japan. Based on North Korea's developmental submarine-launched ballistic missile, this system-the Pukguksong-2-is the North's longest-range solid-propellant missile. This advancement is significant because solid-propellant missiles can be prepared for launch more rapidly than liquid-propellant systems. Additional missile launches out of North Korea—from short-range to intercontinental-range—are a near certainty. In addition to further strategic-weapon testing, North Korea has announced that it will focus on producing and deploying nuclear weapons and ballistic missiles in 2018.

Iran has ambitious ballistic missile and space launch development programs and continues to attempt to increase the lethality of its ballistic missile force. Iran is fielding increased numbers of theater ballistic missiles and improving its existing inventory. Its progress on space launch vehicles could shorten a pathway to an ICBM. Iran's ballistic missiles are capable of striking targets throughout the region, ranging as far as southeastern Europe. It has used these missiles in the region, conducting retaliatory strikes on ISIS targets in Syria. Iran has steadily increased its ballistic missile force, deploying next-generation short- and medium-range ballistic missiles (SRBMs and MRBMs) with increasing accuracy and new submunition payloads. Iran is developing, and has publicized the testing of, SRBMs with anti-ship payloads. Iran also continues to proliferate ballistic missiles to states and non-state groups.

Increasing System Reliability through Testing, Warfighter Collaboration, and Cybersecurity

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

MDA executes a continuous program to improve system reliability and manage service life of our BMDS components. An example is the Ground-based Midcourse Defense (GMD) weapon system. A cornerstone of this effort is our stockpile reliability program (SRP) for Ground Based Interceptors (GBIs). Two GBIs have been removed from the fleet this past year, inspected, and tested to gain understanding of how the GBIs age in the silos. Another GBI will be removed this year for the SRP. From testing to date, we have been able to extend the service life of the C1 and C2 boosters. Another key effort is our Service Life Extension program. This program performs lifetime testing on key components in the kill chain enabling MDA to extend the service life beyond the manufacturer's estimate. This testing allows us to avoid unnecessary maintenance actions and control operations and support costs. MDA also pursues reliability improvements through our development activities. We measure availability and reliability data in the field and target improvements in the GBIs and GMD ground system development programs. A key delivery this year was Ground System 7A, which removed obsolete equipment from the kill chain, eliminated cyber defense vulnerabilities, and improved redundancy for the warfighter. Key

future reliability improvements include delivering the Redesigned Kill Vehicle and upgrading the GMD Communications Network, launch support equipment, and the IFICS Data Terminal High Power Amplifier.

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

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

Our system ground-tests are the primary source for system performance data, and they test our capability across a wide range of threats and environments that cannot be replicated affordably in flight tests. The BMDS Operational Test Agency, which provides an independent

operational assessment of the BMDS, relies heavily on the MDA ground-test program to assess independently MDA's operational capability. The ground-tests allow analysts to characterize BMDS performance under varying conditions, with unconstrained red and blue force limitations, and without the safety, fiscal, and hardware availability limitations of flight-testing. Additionally, with warfighters on console, they are able to use ground-tests to refine Tactics, Techniques, and Procedures. All of the data from ground tests are used to inform DOT&E assessments of BMDS capability.

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

Flight-testing uses operational realism to provide data for M&S and demonstrates the performance functions of the system that ground-testing cannot address. One of the key attributes of each flight-test is combining the system under test with the Soldiers, Sailors, Airmen, and Marines that plan to operate the system in wartime under operationally realistic conditions. We also work closely with our allies to prove BMD capabilities are integrated and interoperable before they are fielded. From October 2016 to present, we have executed 27 flight-tests. For the remainder of FY 2018, we will conduct two more flight-tests, and in FY 2019, 12 flight-tests, including the operational test of European Phased Adaptive Approach (EPAA) Phase 3 capabilities and the first salvo test using the Ground-based Midcourse Defense (GMD) system. The Agency also is conducting detailed planning to conduct an Aegis BMD test

against a long-range ballistic missile target and adding an IRBM target to GM CTV-03+ as risk reduction for the homeland defense Redesigned Kill Vehicle (RKV) program. Both tests are planned for FY 2020.

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

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

Attributes as the requirements that guide capability development and future program capabilities necessary to make the system effective against threats in the future.

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

MDA will also continue to provide the Warfighter operational support by performing the routine mission essential functions of BMDS configuration control, asset management, and operational readiness reporting, providing an operational-level interface to United States Strategic Command, Northern Command, European Command, Central Command, and Pacific Command, and facilitating increased Warfighter participation in development of future missile defense capabilities. MDA will continue to provide support for systems like the globally deployed Aegis BMD/Standard Missile (SM)-3 system, AN/TPY-2 radar (Terminal and Forward-Based Modes),

THAAD, and Command and Control, Battle Management and Communications (C2BMC). MDA also will continue to lead the integration of evolving MDA, Service, and COCOM command and control capabilities through systems engineering analysis and development of technical integration requirements and interface control documents to address the fielding of air, missile, and rocket capabilities by U.S. adversaries.

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

Finally, the Missile Defense Agency is cognizant of the growing cyber threat and we continue to work aggressively to ensure the nation's missile defenses are resilient and able to operate in a highly contested cyber threat environment. We are progressively improving the cyber hygiene of our missile defense capabilities by ensuring the cybersecurity infrastructure has the latest security upgrades. MDA remains focused on supporting the DoD Cybersecurity

Campaign through implementation of the DoD Cybersecurity Discipline Implementation Plan -- Four Lines of Effort for: Strong Authentication, Hardening of Systems, Reducing the DoD Attack Surface, and Alignment to Cybersecurity / Computer Network Defense Service Providers across all networks. These four lines of effort are critical to the defense of the MDA networks.

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

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

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

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

We have had a comprehensive ongoing effort since 2010 that I believe will go a long way in providing insight and proof of MDA's commitment to cyber protection and testing as a way of

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

Increasing Engagement Capability and Capacity

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

Homeland Defense

MDA remains committed to operating, sustaining, and expanding our nation's homeland missile defenses and requests $2.2 billion in FY 2019 for the Ground-based Midcourse Defense (GMD) program. We currently have emplaced 44 operational GBIs and, in accordance with the Fiscal Year 2017 Above Threshold Reprogramming and Fiscal Year 2018 Budget Amendment, plan to expand the fielded GBI fleet to 64 as early as 2023. This increase to GBI capacity is a response by the National Command Authority to the rapidly advancing North Korean threat and has been designated as an "emergency requirement" by the President in the FY18 President's Budget Amendment.

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

At the same time, MDA is evaluating the technical feasibility of the capability of the SM-3 Block IIA missile, currently under development, against an ICBM-class target in accordance with Congressional legislation. If proven to be effective against an ICBM, this missile could add a layer of protection, augmenting the currently deployed GMD system. As directed by the FY 2018 NDAA language, we will conduct this demonstration no later than December 31, 2020.

Increasing GBI Capacity

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

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

FTG-15, conducted in May 2017, demonstrated viability of the new 3-Stage Configuration 2 (C2) booster and CE-II Block 1 EKV GBI. This was the first ever intercept of an ICBM-class target. The FTG-15 flight test successfully demonstrated our homeland defenses GMD's systems functioned as predicted against a realistic threat ICBM-range target. The upgraded CE-II Block 1 EKV launched on a C2 booster successfully intercepted and destroyed a

target designed to emulate a projected North Korean threat. FTG-15 proved effective engineering and manufacturing of the new GBI as well as improved discrimination algorithms, missile defense architecture and warfighter command and control.

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

Redesigned Kill Vehicle

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

In 2018 MDA is initiating the GMD portion of MDDE, which will field an additional 20 RKV-equipped GBIs at FGA. MDA will accelerate the RKV production deliveries, construct a new missile field (Missile Field 4) at Fort Greely, install 20 silos, and deliver an additional 20

GBIs tipped with RKVs. We will complete the GMD portion of the MDDE as early as 2023. In addition, MDA will initiate a plan to ensure that no less than 64 GBIs are available to the Warfighter at all times. To accomplish this, MDA will add two silos to MF-1 at FGA and purchase six additional GBI boosters. The additional silos and boosters will enable MDA to deliver an RKV-equipped GBI prior to removing a GBI as we replace the CE-I Kill Vehicles currently in the fleet.

Ground System Upgrades

MDA is continuing with capability upgrades and technology modernization of key ground support and fire control systems components such as the GFC equipment, the GMD Launch Support System, Communications Network, and the In-Flight Interceptor Communication System Data Terminal. The capability upgrades include: GFC-Warfighter interface and logic improvements, 2-/3-stage selectable GBI battle management, discrimination improvements, enhancements to the kill vehicle Target Object Map, and On-Demand Communications for the RKV. Ground system modernization will continue to mitigate obsolescence issues, improve cybersecurity resilience, increase GFC capacity for emerging threat complexity and raid size, reduce life-cycle cost, increase system reliability and operational availability, and simplify the insertion of future technologies.

Defense Sensors

We are investing in radars and developing advanced electro-optical sensors to achieve a diverse sensor architecture that will provide highly accurate midcourse tracking, discrimination and battle damage assessment. We are also leveraging Services' sensors to support the BMD architecture, for example, the Navy's new solid state SPY-6 radar on their Flight III destroyers, the Air Force F-35 Distributed Aperture System, and future Department of Defense and

Intelligence Community space sensors. In this year's budget submission we highlight the continued development of the Long Range Discrimination Radar (LRDR) and Spacebased Kill Assessment (SKA) programs, which will improve system target discrimination and assessment capabilities. Improved sensor coverage and interceptor capabilities will help the Warfighter expand the battle space to reengage threats as needed.

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

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

MDA requests $149.7 million for the SBX radar. The SBX is an advanced mobile radar that provides precision midcourse tracking and discrimination capabilities. The SBX participates in flight tests to demonstrate discrimination and debris mitigation improvements. To address the

continued missile test activity of North Korea, our budget request includes funds to extend time at sea and conduct contingency operations for defense of the homeland in the U.S. Pacific Command and U.S. Northern Command areas of responsibility.

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

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

MDA plans to complete site surveys in FY 2018 and competitively award the Homeland Defense Radar-Pacific (HDR-P) by the end of FY 2019 as the second delivery order on the IDIQ contract. MDA is requesting $33.5 million in FY 2019 for the HDR-P. Both radars will close coverage gaps in the Pacific architecture and provide persistent long-range acquisition and midcourse discrimination, precision tracking, and hit assessment to support the defense of the homeland against long-range missile threats.

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

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

Also, we request $37.0 million for continued operation of the Space Tracking and Surveillance System (STSS) and the Missile Defense Space Center (MDSC) in FY 2019. STSS satellites, which were launched in 2007, have exceeded their life expectancy and have proven to be a good investment. These satellites operate in low earth orbit and continue to collect valuable

test data. The STSS program and the MDSC support concept development activities for future space sensor architecture studies and analyses to address advanced threats.

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

Regional Defenses

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

Terminal High Altitude Area Defense

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

THAAD batteries for a Foreign Military Sales case with the United Arab Emirates (UAE), and continue to deliver interceptors for the UAE inventory and provide maintenance and sustainment support.

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

U.S. Pacific Command initiated the deployment of the THAAD system to the ROK on March 6, 2017, implementing the U.S.-ROK Alliance's July 2016 decision to bring the defense capability to the peninsula. In coordination with the Army's Lower Tier Program Office, MDA began a concerted effort in May 2017 to develop an integrated, phased approach to incrementally field capability, delivering improved BMDS capability to the Korean Peninsula, including integration of existing BMD assets to improve engagement options and coverage. The deployment of THAAD contributes to a layered missile defense system and enhances the U.S.-ROK Alliance's defense against North Korean missile threats.

At OSD direction, the Army and MDA developed a draft Memorandum of Agreement (MoA) for the transfer of the THAAD and AN/TPY-2 programs from MDA to the Army. The draft MoA stipulates that when THAAD transfers to the Army, production operations and sustainment program and funding for THAAD and AN/TPY-2 systems would transfer to the

Army, and Research and Development program funding of THAAD and AN/TPY-2 radars would remain in MDA. The MoA was approved by MDA and is currently being reviewed by the Army.

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

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

MDA requests $874.1 million to continue procurement of THAAD equipment, including 82 THAAD Interceptors in FY 2019. By the end of FY 2019, MDA will deliver 60 additional THAAD Interceptors to the U.S. Army, for a total of 276 interceptors delivered. MDA requests

$61.0 million for Terminal Defense Testing in FY 2019. We also request $92.6 million of Operations and Maintenance funding to support the maintenance and upkeep of all BMDS-unique items of the fielded THAAD batteries and for all THAAD training devices. In FY 2018 MDA will provide support to seven THAAD batteries, including the two forward batteries stationed in the U.S. Pacific Command's area of responsibility and is prepared to support the U.S. Army in any future deployment around the world.

Aegis Ballistic Missile Defense

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

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

In FY 2019, as part of our overall Aegis BMD request we are requesting $232.92 million for the SM-3 Block IIA Program. This includes the continued integration of the SM-3 Block IIA

into the BMD Weapon Systems, as well as pre-production All-Up-Rounds to support the initial deployment for EPAA Phase 3. In February 2017, we completed SFTM-01, a successful developmental flight test, to demonstrate an organic intercept of a MRBM-class target with an SM-3 Block IIA missile from an Aegis Baseline 9.C1 Ship. This was the first intercept flight test of the SM-3 Block IIA missile, which is a cooperative development program with Japan, and supports the initial production decision for the SM-3 Block IIA and the Aegis BL 9.C2 (BMD 5.1) certification effort, which will certify in 2018. In June 2017, with the execution of SM-3 Block IIA Cooperative Development (SCD) Flight Test Mission (SFTM)-02, we conducted a second SM-3 Block IIA missile flight test using an Aegis Baseline 9.C2 ship. Although this second test did not result in an intercept of the MRBM target, significant accomplishments were still achieved. A Failure Review Board (FRB) determined that an operator's actions at a console resulted in early termination of the SM-3 Block IIA missile in flight.

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

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

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

We are strongly committed to further enhancing capability of the Aegis BMD system and continuing to improve the Aegis Weapon System in alignment with Navy requirements. In August 2017, we certified the Aegis BMD 4.1 computer program, delivering BMD 5.0CU capability with Sea Based Terminal defense with the SM-6 missile. We conducted CTV-03 following FS-17 on the Hebrides range, firing a SM-6 Dual I using Aegis BMD 4.1, providing the proper Objective Quality Evidence to certify firing this missile with this computer program. In FY 2018, we will certify Aegis BL 9.C2 (BMD 5.1), that incorporates the SM-3 Block IIA missile and an EoR capability to meet European Phased Adaptive Approach (EPAA) Phase 3 requirements. In FY 2018 we also plan to procure 34 SM-3 Block IBs and 20 SM-3 Block IIAs

(16 SM-3 Block IIAs were requested in the FY 2018 Missile Defeat and Defense Enhancement Budget Amendment and four SM-3 Block IIAs from the FY 2018 President's Budget (PB) submission), and continue efforts on the installation of the Aegis Ashore Deckhouse and equipment in Poland.

In FY 2019, we will continue our commitment to develop, test, and deliver global naval capability to the Warfighter and support defense of our deployed forces and European NATO allies through delivery of EPAA Phase 3 missile defenses. MDA requests a total of $805.8 million in procurement for Aegis BMD, which plays a critical role in both homeland and regional defense. As part of the overall Aegis BMD procurement request, MDA is requesting $411.68 million to procure 37 Aegis SM-3 Block IB missiles and $181.81 million to procure 6 SM-3 Block IIAs, along with associated hardware and support costs. By the end of FY 2019, we plan to have 203 SM-3 Block IBs and 12 SM-3 Block IIAs in inventory. As the part of the procurement budget also requests $97.1 million for Aegis BMD Weapon Systems equipment. Also part of the request, we are asking for $115.21 million for advance procurement for economic order quantities and request permission to enter into a 5-year SM-3 Block IB Multi-Year Procurement (MYP) contract for FY 2019 - FY 2023. MDA will continue to deliver to the Navy SM-3 Block IBs and SM-3 Block IIAs once production has begun, for deployment on land at the Aegis Ashore site in Romania and at sea on multi-mission Aegis ships with BMD capability. In coordination with the U. S. Navy, we continue to expand the Fleet, and by the end of FY 2018 we anticipate having 38 ships (41 by the end of FY 2019) equipped with the Aegis BMD weapon system.

The Navy is working with MDA to integrate the multi-mission Aegis BL 5.3 with Aegis BMD 4.1 into a single computer program. We are actively working with Navy to certify this

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

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

We executed a non-intercept flight test, Flight Test Experimental (FTX)-21 in May 2016 involving the Aegis Sea Based Terminal defense of the fleet capability against an advanced threat representative target. The target, launched from PMRF in Hawaii, was the first flight of the MRBM-class Type 3 Phase 2 target. A U.S. Navy destroyer, an Aegis Baseline 9.C1 (BMD 5.0 CU) configured Arleigh Burke Destroyer, detected and tracked the target. This was a very important step in ensuring the safety of the fleet and demonstrating the Sea Based Terminal capability.

In December 2016, we conducted a detection, tracking, and intercept test (FTM-27) to further assess the capability of Sea Based Terminal Increment 1 in the Aegis Baseline 9.C1 (BMD 5.0CU) Weapon System. During this test we fired a salvo of two SM-6 Dual I missiles

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

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

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

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

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

likelihood of continued schedule erosion and the consumption of all margin. The rebaseline effort is on-going.

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

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

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

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

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

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

International Cooperation

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

MDA continues to emphasize allied and partner investments in their own missile defense capabilities, which create more effective regional security architectures that complement U.S. regional missile defense capabilities. We continue to execute an FMS case with the United Arab Emirates for two THAAD batteries, including launchers, radars, and interceptors. Both batteries have been delivered to the UAE and have achieved Initial Operational Capability (IOC). MDA is actively engaged with several nations, particularly those in the Arabian Gulf region, to provide program information and cost data that may inform future decisions to procure THAAD and other missile defense systems. In 2016, MDA completed a regional Ballistic Missile Early Warning System architecture study for the Gulf Cooperation Council (GCC), analyzing sensor and C4I options for defense of the region. We are continuing to discuss the study's findings with the GCC nations. Additionally, MDA received a Letter of Request from the Kingdom of Saudi Arabia for seven THAAD batteries in April 2017. MDA is working with the Saudis to finalize the Letter of Offer and Acceptance.

MDA has a strong cooperative missile defense partnership with Israel through our continued work with the Israeli Missile Defense Organization. MDA's FY19 request is consistent with the funding Memorandum of Understanding that the United States and Israel

signed in 2016. This budget continues MDA's longstanding support of U.S.-Israeli Cooperative BMD Programs, to include the co-development and co-production of the David's Sling Weapon System and Upper Tier Interceptor, and improvements to the Arrow Weapon System. The Department continues to support co-production efforts for the Iron Dome program to provide critical defense against short-range rockets and artillery.

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

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

Addressing the Advanced Threat

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

space, I believe we can reduce the cost per kill. MDA is developing technology to address gaps in the BMDS and dramatically drive down the cost of defending the homeland.

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

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

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

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

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

We request $120.4 million in FY 2019 for the Hypersonic Defense effort to execute the systems engineering process, identify and mature full kill chain technology, provide analysis and assessment of target of opportunity events, and execute near term space sensor technology and multi-domain command and control capability upgrades to address defense from hypersonic threats. This effort will execute the Defense Science Board's recommendations to develop and deliver a set of material solutions to address and defeat hypersonic threats informed by a set of near-term technology demonstrations. An integrated set of enhancements will provide

incremental capability measured by progress and knowledge points in the following areas: establishment of systems engineering needs and requirements to identify alternative material solutions; execution of a series of sensor technology demonstrations; modification of existing BMDS sensors and the C2BMC element for hypersonic threats; and definition of weapon concepts and investments in key technologies to enable a broad set of solutions, including kinetic and non-kinetic means.

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

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

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

Conclusion

Mr. Chairman and Members of the Subcommittee, in closing, our FY 2019 budget funds comprehensive missile defense development efforts, including several critical capabilities

required by the Warfighter. We will continue to increase the reliability as well as the capability and capacity of fielded homeland and regional missile defense systems and make measured investments in advanced technology to counter the adversary missile threat.

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

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

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

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

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

Lieutenant General Samuel A. Greaves

Lt. Gen. Samuel A. Greaves is the Director, Missile Defense Agency. MDA's mission is to develop, test, and field an integrated, layered, ballistic missile defense system to defend the United States, its deployed forces, allies and friends against all ranges of enemy ballistic missiles in all phases of flight. General Greaves directs the organization spanning 14 time zones with more than 8,000 military, civilian and contract personnel.

General Greaves was commissioned in 1982 through the Reserve Officer Training Corps program after he graduated from Cornell University. He has held a variety of assignments in operational, acquisition and staff units, including assignments at Headquarters Air Combat Command; the National Reconnaissance Office; and on the Air Staff within the Directorate of Operational Requirements and the Air Force Colonel Matters Office. He commanded the 45th Launch Group at Patrick Air Force Base, Florida, the Launch and Range Systems Wing and Military Satellite Communications Systems Wing at Los Angeles AFB, California. The general also served as Vice Commander, Space and Missile Systems Center, Los Angeles AFB, California, and then as Director, Strategic Plans, Programs and Analyses, Headquarters Air Force Space Command, Peterson AFB, Colorado. He was then assigned as the Deputy Director, Missile Defense Agency, Redstone Arsenal, Alabama. Prior to his current assignment, he was the Commander, Space and Missile Systems Center, Air Force Space Command, Los Angeles Air Force Base, California.

He has operational launch crew experience in the space shuttle, Titan, Atlas and Delta space-launch systems. He wears the Command Space Badge.

EDUCATION
1982 Bachelor of Science, electrical engineering, Cornell University, Ithaca, N.Y.
1984 Master of Science, computer science, West Coast University, Los Angeles, Calif.
1986 Squadron Officer School, Maxwell AFB, Ala.
1997 Distinguished graduate, Air Command and Staff College, Maxwell AFB, Ala.
1997 Undergraduate Space and Missile Training, Staff Course, Vandenberg AFB, Calif.
1999 Air War College, by correspondence, with distinction
2001 Master's degree in strategic studies, Air War College, Maxwell AFB, Ala.
2003 Program Managers Course, Defense Systems Management College, Fort Belvoir, Va.
2008 Executive Program Managers Course, Defense Systems Management College, Fort Belvoir, Va.
2010 NSP Executive Course, George Washington University, Washington, D.C.
2010 Systems Acquisition Management Course, Fort Belvoir, Va.
2011 Requirements Executive Overview Workshop, Peterson AFB, Colo.
2015 Cyberspace Operations Executive Course, Maxwell AFB, Ala.

ASSIGNMENTS
1. June 1982 - December 1984, space shuttle avionics engineer, Vandenberg AFB, Calif.
2. December 1984 - June 1986, avionics engineer, Space Shuttle Main Engines, Kennedy Space Center, Fla.
3. June 1986 - October 1987, Chief, Titan Inter-Range Operations, 6595th Aerospace Test Group, Vandenberg AFB, Calif.
4. October 1987 - March 1990, Titan Space Launch Systems Manager, 6595th Aerospace Test Group, Vandenberg AFB, Calif.
5. March 1990 - January 1992, Chief, Spacecraft Test and Launch Operations, SP-11 Program Office, Secretary of the Air Force Office of Special Projects, Los Angeles, Calif.
6. January 1992 - March 1994, Chief, Satellite Engineering, SP-11 Program Office, Secretary of the Air Force Office of Special Projects, Los Angeles, Calif.
7. March 1994 - August 1995, executive officer to the Director, Secretary of the Air Force Office of Special Projects, Los Angeles, Calif.

8. August 1995 - August 1996, National Space Systems Applications Manager, Directorate of Requirements, Headquarters Air Combat Command, Langley AFB, Va.
9. August 1996 - August 1997, student, Air Command and Staff College, Maxwell AFB, Ala.
10. August 1997 - June 1998, Chief, Surveillance and Reconnaissance Requirements, Space and Reconnaissance Division, Directorate of Operational Requirements, Deputy Chief of Staff for Air and Space Operations, Headquarters U.S. Air Force, Washington, D.C.
11. June 1998 - June 1999, executive officer to the Director of Operational Requirements, Deputy Chief of Staff for Air and Space Operations, Headquarters U.S. Air Force, Washington, D.C.
12. June 1999 - July 2000, Deputy Chief, Assignments Division, and Chief, Space, Missile, Acquisition and Technical Assignments, Air Force Colonel Matters Office, Headquarters U.S. Air Force, Washington, D.C.
13. July 2000 - June 2001, student, Air War College, Maxwell AFB, Ala.
14. June 2001 - July 2002, Commander, Air Force Communications Support Facility, White Sands Missile Range, N.M.
15. August 2002 - June 2004, Materiel Group Director, Air Force Satellite Control Network, Space and Missile Systems Center, Los Angeles AFB, Calif.
16. June 2004 - August 2006, Commander, 45th Launch Group, Cape Canaveral Air Force Station, Fla.
17. August 2006 - June 2008, Commander, Launch and Range Systems Wing, Los Angeles AFB, Calif.
18. June 2008 - August 2009, Commander, Military Satellite Communications Systems Wing, Los Angeles AFB, Calif.
19. August 2009 - February 2011, Vice Commander, Space and Missile Systems Center, Los Angeles AFB, Calif.
20. February 2011 - August 2012, Director, Strategic Plans, Programs and Analyses, Headquarters Air Force Space Command, Peterson AFB, Colo.
21. August 2012 – June 2014, Deputy Director, Missile Defense Agency, Redstone Arsenal, Ala.
22. June 2014 – May 2017, Commander, Space and Missile Systems Center and Program Executive Officer for Space, Los Angeles AFB, Calif.
23. June 2017 – present, Director, Missile Defense Agency, Fort Belvoir, Va.

SUMMARY OF JOINT ASSIGNMENTS
1. August 2012 - June 2014, Deputy Director, Missile Defense Agency, Redstone Arsenal, Ala., as a major general
2. June 2017 - present, Director, Missile Defense Agency, Ft. Belvoir, Va., as a lieutenant general

OPERATIONAL INFORMATION
Space Shuttle Missions: 51-C, 51-D, 51-B, 51-G, 51-F, 51-I, 51-J, 61-A, 61-B, 61-C, 51-L
Titan: 34B-66, 34D-15, II-G1, 34D-14, II-G2
Titan IV: B-30
Delta II: NASA MESSENGER, Swift, Deep Impact, GPS IIR-13/GPS IIR-14(M), MiTEx, GPS IIR-15(M), GPS IIR-16 (M), GPS IIR-17 (M), GPS IIR-18 (M), GPS IIR-19(M)
Delta IV: Air Force Heavy Demo, GOES-N, DMSP-17, DSP-23 Atlas II/III: AC-167, NROL-1, AC-206
Atlas V: AMC-16, INMARSAT-IV, NASA MARS Reconnaissance Orbiter, Pluto New Horizons, ASTRA, WGS-1, NRO L-24, NRO L-28, WGS-2

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal
Legion of Merit with oak leaf cluster
Defense Meritorious Service Medal with two oak leaf clusters
Meritorious Service Medal with two oak leaf clusters
Air Force Commendation Medal with two oak leaf clusters
Air Force Achievement Medal

OTHER ACHIEVEMENTS
2008 Lt. Gen. John W. O'Neill Outstanding System Program Director Award
2016 Gen. Bernard A. Schriever National Space Leadership Award

PROFESSIONAL CERTIFICATIONS
1994 Program Management, Level III, Acquisition Professional Development Program
1994 Research and Development, Level III, APDP
1994 Test and Engineering, Level I, APDP

EFFECTIVE DATES OF PROMOTION
Second Lieutenant June 2, 1982
First Lieutenant June 2, 1984
Captain June 2, 1986
Major July 1, 1994
Lieutenant Colonel Feb. 1, 1999
Colonel Aug. 1, 2003
Brigadier General Dec. 9, 2008
Major General July 13, 2012
Lieutenant General June 19, 2014

(Current as of July 2017)

RECORD VERSION

STATEMENT BY
LIEUTENANT GENERAL JAMES H. DICKINSON, USA
COMMANDING GENERAL,
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND/
ARMY FORCES STRATEGIC COMMAND
AND
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, 115TH CONGRESS

FISCAL YEAR 2019 PRIORITIES FOR MISSILE DEFENSE

APRIL 17, 2018

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COMMITTEE ON ARMED SERVICES

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Introduction

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

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

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

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

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

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

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

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

The Workforce—Our Foundation

USASMDC/ARSTRAT and JFCC IMD cannot carry out our wide-ranging national security missions without the dedication of our greatest asset—our people. One of my most important messages to you today is that your continued support is critical to our ability to develop and retain a highly qualified and mission-ready workforce. The recent long-term budget uncertainty impacted our warfighters executing today's missions, as well as our ability to posture for the future. The Service Members, Civilians, and Contractors who make up these commands support the Army

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

and joint warfighter each and every day, in the homeland and deployed across the globe. The budget agreement and the associated increase to the Department's top line budget is very helpful and will ensure we continue to provide trained and ready Service Members and Civilians to operate and pursue advancements in space and missile defense capabilities for our Nation. The extra resources will provide additional interceptor inventory capacity, modernize essential infrastructure, and enhance discrimination and assessment capabilities.

The Increasingly Complex Threat Environment

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

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

In the future, our missile defense systems will encounter more complex electronic and cyber-attacks, as well as directed energy threats that could significantly degrade U.S. missile defense operations. We expect cyber and electronic attacks will be increasingly relied upon in potential adversaries' anti-access/area-denial (A2/AD)

strategies. Our ability to successfully counter these continuously advancing threats will rely heavily on our increased use of space and space-enabled capabilities. Space sensors could expand our capacity to track, discriminate, and successfully engage ballistic, cruise, and hypersonic threats.

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

Strategic Positioning to Counter the Threat

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

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

Over the last year, basing a Terminal High Altitude Area Defense (THAAD) battery in the Republic of Korea bolstered our regional defense capabilities to improve protection of U.S., allied forces, and critical infrastructure on the Peninsula. Additionally, during 2017, MDA completed the emplacement of 14 additional Ground-Based Interceptors (GBIs) at Fort Greely, Alaska to provide improved capacity to defend the Nation against an ICBM attack from North Korea, and potentially Iran in the future.

The Nation now has a total of 44 GBIs and planning is underway to emplace an additional 20 GBIs in a new missile field at Fort Greely, Alaska as is reflected in the Fiscal Year 2019 President's Budget Request.

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 forward-committed PATRIOT, THAAD, and counter rocket, artillery and mortar (C-RAM) forces to enhance our AMD posture, sending a deterrence message to potential adversaries and assurance to our friends. We continue to work with regional partners and allies to increase information and data sharing and we are developing a more robust global AMD force posture that leverages partner nations' growing capabilities. This will result in reducing the strain on our forces while enabling more timely modernization of our AMD assets.

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

--USNORTHCOM SASC Posture Statement
February 2018

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

quickly from concept, to prototyping, to fielding. We are focusing on capabilities that include Mobile Short-Range Air Defense, directed energy, and advanced energetics.

Providing and Enhancing Missile Defense Capabilities

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

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

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

services and support to these Soldiers, Civilians, Contractors, and their Families. With the continued support of Congress, we have already realized substantial quality of life improvements for these remotely-stationed personnel and their families.

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

"...develop a state-of-the-art missile defense system to protect against missile-based attacks. ..."

-- POTUS Statement Making Our Military Strong Again January 2017

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

Space Support to Ballistic Missile Early Warning: Space-enabled capabilities are essential for missile defense operations, providing and enabling communications, positioning, navigation, timing, intelligence, surveillance, reconnaissance, and early

warning. We routinely coordinate and collaborate with USSTRATCOM's National Space Defense Center to ensure that the space assets are poised to support missile defense capabilities.

In support of the joint force commander, USASMDC/ARSTRAT continues to provide ballistic missile early warning within the U.S. European Command (USEUCOM), U.S. Central Command (USCENTCOM), and U.S. Pacific Command (USPACOM) theaters of operations. The 1st Space Brigade's Joint Tactical Ground Station (JTAGS) Detachments, which support the Joint Force Space Component Command (JFSCC), are operated by USASMDC/ARSTRAT space-professional Soldiers who monitor launch activity and other infrared events. They provide essential information to members of the air, missile defense, and operational communities. Our JTAGS Detachments are forward deployed around the globe, providing continuous, dedicated, assured missile warning to USSTRATCOM and GCCs in support of deployed and forward-based forces. We continue to optimize this capability, and this year we gained support from the Government of Italy to relocate the JTAGS in Europe to Sigonella Naval Air Station. This will increase operational missile warning capability.

Space—The Ultimate High Ground

USASMDC/ARSTRAT's second major task is to build and mature future missile defense forces and capabilities. A major component of this function is providing relevant and updated training for our global missile defense systems. During the past fiscal year, USASMDC/ARSTRAT trained approximately 200 Soldiers who execute the missile defense mission of the homeland and our missile defense training courses earned USASMDC/ARSTRAT recertification as an Army Learning Institution of Excellence.

USASMDC/ARSTRAT, as a recognized Army Center for Analysis, also conducts studies to determine how to best meet the Army's assigned missile defense responsibilities. Our analyses support the established and emerging processes the Army uses to document its missile defense needs and pursue joint and Army validation of its requirements. With insights from these studies, we develop and operationalize the

Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy (DOTMLPF-P) requirements to address evolving threats and potential vulnerabilities to the GMD and AN/TPY-2 FBM missile defense systems. This disciplined approach ensures limited resources are applied to achieve maximum operational utility.

Provide Combat Ready Forces and Capabilities

USASMDC/ARSTRAT's third major task is to provide critical technologies to address future needs that will enhance warfighter effectiveness. Our technology development function is primarily focused on the space and high altitude domains. Additionally, although MDA is the principal materiel developer for missile defense capabilities, USASMDC/ARSTRAT carries out supporting missile defense-related materiel development efforts, to include supporting research, development, and testing of an Office of the Secretary of Defense (OSD) sponsored conventional prompt strike capability. In addition to offensive capability development, we are also supporting MDA's concept development for defense against hypersonic threats. These technical capabilities are at the forefront of developing holistic, cost-effective approaches to address the broadening missile defense challenge. The following are brief summaries of two of our research and development efforts, as well as an overview of the capabilities of an essential Army testing range.

High Energy Laser Technology Development and Demonstration: The Army's high energy laser science and technology effort aims to develop ruggedized laser system components and subsystems, integrate them onto an Army vehicle, conduct demonstrations to characterize performance, and transition the technology to a Program Executive Office. A solid-state laser weapon system has the potential to be a low-cost and effective complement to kinetic capabilities in countering rockets, artillery, and mortars (RAM), unmanned aerial systems (UAS), and other threats. The effort builds upon earlier pathfinder demonstrations of a 10-kilowatt (kW) laser system by continuing to develop, integrate, and mature the technology at higher laser power outputs. The Robust Electric Laser Initiative (RELI) fiber laser was delivered to the Army in early 2017 and is being integrated into the High Energy Laser Mobile Test Truck (HELMTT) for a 50-kW laser demonstration against RAM and UAS threats later this year. This

demonstration will be a key knowledge point for the next major phase of high energy laser technology development, the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD). The HEL TVD supports the Army's Indirect Fire Protection Capability Increment 2-Intercept (IFPC Inc 2-I) program, discussed later in this document. It is on schedule to conduct a C-RAM 100-kW demonstration in late 2022 to validate system performance against IFPC Inc 2-I requirements.

USASMDC/ARSTRAT is also starting work this fiscal year on the Multi-Mission High Energy Laser (MMHEL) as an Army Technology Maturation Initiative (TMI). The TMI will integrate a 50-kW laser system on a Stryker platform and culminate in an operational demonstration that informs Maneuver–Short Range Air Defense (M-SHORAD) requirements. Supporting this effort is the Mobile Experimental High Energy Laser (MEHEL), a 5-kW laser on a Stryker. Over the past few years, MEHEL has participated in Maneuver Fires Integration Experiments and recently participated in a Joint Warfighting Assessment in Germany. MEHEL is helping warfighters develop tactics, techniques, and procedures, as well as concepts of operations for future high energy laser weapons.

Adapt Leap Ahead Concepts and Technologies

Low-Cost Target Development: The Army is engaged in a technology effort to develop a suite of threat-representative targets for lower tier missile defense testing at a substantially reduced cost. Over the past year, we completed three detailed target designs and successfully demonstrated two of the configurations, which leverage excess solid rocket motors. The first Sabre target was successfully launched and intercepted in June 2017, meeting all performance objectives. The second Sabre target was launched and successfully intercepted in November 2017. These missions were critical operational tests of the new PATRIOT interceptor. Development of a two-stage ballistic missile target, known as Black Dagger, continues with a risk reduction launch scheduled for mid-2018. The Black Dagger target is meant to mimic a broader range of short-range ballistic missile threats by achieving longer range, higher altitude, and increased velocity. The Zombie suite of targets has missions planned for PATRIOT and Integrated Air and Missile Defense (IAMD) over the next few years. The goal remains to reduce DoD's overall test execution costs.

Missile Defense Testing Range: USASMDC/ARSTRAT operates the Ronald Reagan Ballistic Missile Defense Test Site (RTS). RTS, located on the U.S. Army Garrison—Kwajalein Atoll in the Republic of the Marshall Islands provides critical testing support to both offensive and defensive missile testing requirements for programs such as GMD and U.S. Air Force strategic ballistic missile systems. RTS retains preeminent ballistic missile testing capabilities used in validating the Nation's ability to sustain a strong, credible ballistic missile deterrent as a key element of national security and the security of U.S. allies and partners.

RTS supported 10 missile defense developmental flight tests in 2017. The Army conducted three of those tests with the Patriot system. MDA and the Army conducted two THAAD flight tests; MDA and the Navy conducted four test flights of the Standard Missile (SM-3 and SM-6); and MDA conducted one test of the Ground-Based Interceptor (GBI). Homeland and regional defense tests have grown ever more challenging and complex, providing a means to replicate missile defense architectures superimposed over this Pacific test site.

RTS also supports offensive ballistic missile testing for Air Force Global Strike Command. During Fiscal Year 2017, RTS supported four Minuteman III test launches to successfully validate and verify the effectiveness, readiness, and accuracy of the weapon system.

In concert with its testing mission, RTS conducts continuous deep space surveillance and space object identification operations to increase national capabilities and reduce expenditures for both mission sets. During the past year, the U.S. Air Force began construction of their most advanced surveillance system—Space Fence. In a few years, this improved surveillance capability will enable proactive space situational awareness while complementing existing systems at the RTS.

Army Contributions to the Nation's Missile Defense Capabilities

AMD is an enduring Army core function. AMD units serve as a key strategic enabler—an essential component of the Army mission to provide wide area security and support to joint campaigns. In addition to defense against ballistic missiles, the Army's current AMD strategy seeks to develop a more comprehensive portfolio of Integrated Air

and Missile Defense (IAMD) capabilities. AMD is one of six Army modernization priorities and, as such, recent Army investments in missile defense have significantly increased. The Program Executive Office for Missiles and Space (PEO MS) is the Army's materiel developer for these capabilities and works closely with the other Services, the Joint Staff, and MDA toward joint IAMD capabilities. To ensure the mission of providing trained and ready Army AMD forces, we are engaged in developing an updated Army AMD strategy. A summary of the Army's AMD strategic direction and major programs follows:

Air and Missile Defense Readiness: Readiness is the Army's top priority, and the challenge to sustain the readiness of the total Army AMD force requires constant vigilance and senior leader focus. The operational demand to meet the requirements of joint warfighters continues to stress the Army AMD force, impacting both current and future readiness, as well as modernization initiatives. With over 50 percent of the AMD force either forward stationed or deployed, the Army continues to take action to mitigate this stress to the force and restore strategic flexibility. An Army Campaign Plan strategic effort to implement a Sustainable Readiness Model supports characterization of the challenge. A recent study on striking a balance between operational demand and modernization led to the activation of an AMD test detachment in Fiscal Year 2018. This study also supports normalization of AMD rotations to a 9-month cycle rather than the current 12-month cycle; we expect to achieve the shorter rotation cycle in the near future.

Mission Command: Closely linked to the challenge of sustaining AMD readiness is the ability to provide low density/high demand AMD mission command elements. The mission command elements are especially critical to support the integration of Army AMD forces into joint command and control architectures. Operationally, the Army recently activated a third National Guard air defense brigade headquarters assigned to the South Carolina Army National Guard to support mission command rotations for the National Capital Region integrated air defense mission. The Army completed the development and procurement of five Dismounted PATRIOT Information Coordination Centrals (DPICC) for the Army Air and Missile Defense Commands (AAMDC), which

mitigates the requirement to deploy a PATRIOT Battalion Headquarters element with each one- or two-battery deployment.

Army Integrated Air and Missile Defense (AIAMD): In addition to providing defense against ballistic missiles, the current AMD strategy continues to develop a more comprehensive portfolio of AIAMD capabilities to provide protection against other adversary threat systems and capabilities. The Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) integrates current and future AMD components into an Integrated Fire Control (IFC) system, provides a single integrated air picture, increases defended area, and provides flexibility in deployment. IBCS, the foundation for Army AMD modernization, is an Army priority. The program will field a common IFC system for Army AMD forces to defend against cruise missiles, manned and unmanned aircraft, air-to-ground missiles, tactical ballistic missiles, and RAM attacks. The IBCS network will operate with air surveillance and fire control capabilities across Services, and with coalition partners that provide joint warfighters with more decision space and lethality. When fielded, IBCS will enhance the lethality of the AMD force, breaking the current system-centric control paradigm, which will dramatically increase capability and also facilitate open industry competition in support of the AMD community. Additional efforts are currently underway to integrate the Army's IBCS and MDA's BMD System Command, Control, Battle Management, and Communications (C2BMC) to fully support IAMD interoperability with the ballistic missile defense system (BMDS).

As noted, the IBCS and indirect fire protection efforts will provide the future force with a capability to defend against a wide range of threats. Recent conflicts highlight the growing threat of UAS in support of tactical operations. They pose an increasing risk to the Army's combined arms team who are operating where the strategic and operational advantage of highly technical stand-off weapons have limited utility. Efforts are underway to close the risk gap to protect our maneuver forces with short range defense capability.

PATRIOT/PATRIOT Advanced Capability-3 (PAC-3) Missile Segment Enhancement (MSE): The Army PATRIOT force remains the cornerstone of AMD protection for our deployed forces, friends, and allies. GCCs' increasing AMD requirements drive the operational tempo and stress on the PATRIOT force. To meet

requirements, reduce stress, and avoid adversary overmatch, the Army is improving PATRIOT capability against the near-term evolving threat while we move toward the IBCS architecture including the IFPC Inc 2-1 and a new Lower Tier Air and Missile Defense Sensor (LTAMDS).

Lower Tier Air and Missile Defense Sensor (LTAMDS): The LTAMDS program will provide sensing capabilities in the lower tier portion of the ballistic missile defense battlespace. LTAMDS will expand MSE battlespace, serve as a sensor node on the IAMD battle command system network, address capability gaps, modernize technology, reduce operations and sustainment cost, mitigate obsolescence, and increase reliability and maintainability. To enable the development of LTAMDS, the Army is leveraging the competitive nature of the Other Transaction Authority (OTA) to mature and integrate technologies, reduce risk, and to manufacture the LTAMDS.

PATRIOT must continually modernize through software and hardware upgrades to avoid obsolescence and to take advantage of the expanded battlespace afforded by the PAC-3 MSE interceptor. To counter the near-term threat, the Army is in the process of delivering the next PATRIOT software build, Post Deployment Build - 8 (PDB-8). PDB-8 software provides combat identification enhancements, addresses upper tier debris mitigation, improves performance of the PAC-3 Missile Segment Enhancement (MSE) interceptor, and enhances PATRIOT and THAAD interoperability. To accelerate the modernization upgrades of the 35th Air Defense Artillery Brigade, the PBD-8 Urgent Materiel Release (UMR) was approved in July 2016. Initial Operational Test & Evaluation (IOT&E) was completed in September 2017, and the PDB-8 Full Materiel Release is planned for later this year.

Terminal High Altitude Area Defense System (THAAD): THAAD, a key component of the BMDS architecture, is designed for area defense of deployed and allied forces, population centers, and critical infrastructure against short-, medium-, and intermediate-range ballistic missiles. THAAD is a mobile and globally transportable, low density/high demand asset. A fully operational THAAD battery consists of 95 Soldiers, an AN/TPY-2 radar, six launchers, a fire control and communications element, a battery support center, and a support element. THAAD has a unique endo- and exo-atmospheric intercept capability using proven hit-to-kill technology. There are now six

available THAAD batteries, and a seventh will be operational by the end of 2018. As noted earlier, THAAD batteries are deployed to Guam and the Republic of Korea in response to the North Korean nuclear and missile threat.

Indirect Fire Protection Capability Increment 2 – Intercept Block 1 (IFPC Inc 2-I): As the end of the operational lifecycle approaches for short-range AMD capabilities such as Avenger, the Army is developing new capabilities to defeat air threats. The IFPC Inc 2-I, currently under development, is a mobile, ground-based AMD weapon system designed to provide 360-degree protection against cruise missiles and UAS threats for fixed and semi-fixed sites, with the capability to launch multiple missile types. A block acquisition approach is being used to provide this essential capability. The Block 1 baseline system consists of a new launcher and the existing Sentinel A3 radar, integrated with IBCS. An engineering demonstration of the IFPC system was successfully completed in March 2016. The Block 1 baseline system, providing counter-UAS/cruise missile capability, is currently planned to begin fielding in Fiscal Year 2021. The addition of a second missile to provide an initial C-RAM capability is planned within the next five years. The Block 2 System is planned to provide a full C-RAM capability. The Army is pursuing a complementary mix of kinetic and directed energy weapons for this mission area.

Army Low-Cost Portable Surveillance (ALPS): The ALPS passive sensor will integrate into the IBCS network and provide continuous, 360-degree, long-range surveillance against fixed and rotary wing aircraft, UAS, and cruise missile threats.

Maneuver-Short Range Air Defense (M-SHORAD): The Army is increasing capabilities to address increasing short-range air threats to our deployed forces and allies. Plans are in execution to expand M-SHORAD capabilities, not only with additional forces but also with new equipment, especially in the European theater. Per Army Chief of Staff direction, we have fielded Stinger teams to protect maneuver forces and are on schedule to deliver two Avenger battalion equipment sets to USEUCOM this year in support of the European Deterrence Initiative. The equipment will be followed by personnel and infrastructure resulting in an active component Avenger Battalion next year. We are also exploring the feasibility of procuring an interim M-SHORAD capability. Fielding of four M-SHORAD battalions is slated to occur over Fiscal Years

2021 and 2022. While the current M-SHORAD systems, Avenger and Stinger missiles, provide capabilities today, we must develop and field more advanced systems to outpace the threat. Continued R&D investments in lasers, high-power microwaves, and electronic warfare are essential to increase M-SHORAD capabilities in support of the maneuver force.

Joint Functional Component Command for Integrated Missile Defense (JFCC IMD)—Integrating and Synchronizing Missile Defense

JFCC IMD is one of the geographically dispersed elements for which I serve as commander. It is USSTRATCOM's missile defense integrating element, formed to execute Strategic Command's Unified Command Plan (UCP) assigned missile defense mission and enable the headquarters to focus on integration and advocacy. Headquartered at Schriever Air Force Base in Colorado Springs, Colorado, JFCC IMD is manned by a cohesive team of Army, Navy, Air Force, Marine Corps, Government Civilians, and Contractor personnel.

As the Secretary of Defense and various Combatant Commanders have previously testified, warfighters remain confident in our ability to protect the Nation against missile attacks. However, as the global missile threat continues to evolve, we must invest in holistic approaches to defeat adversary missiles before launch or while in flight, as well as implement mitigations should an attack succeed in penetrating our defenses. JFCC IMD's principal mission is to coordinate with and operationally support the joint warfighters at the GCCs, and advocate for their requirements with the materiel developers at MDA and the Services. On behalf of the GCCs and USSTRATCOM, JFCC IMD champions warfighter priorities and capability needs, including continued development of a robust sensor network, integrated discrimination capabilities, resilient command and control

"This request supports additional efforts to detect, defeat, and defend against any North Korean use of ballistic missiles…"

-- POTUS Fiscal Year 2018 DoD Budget Amendment November 2017

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 executes support to designated UCP responsibilities along four lines of effort:

- Synchronizing global missile defense planning, global force management and missile defense security cooperation activities.
- Conducting global missile defense operations support, to include: asset management, alternate execution authority, federated intelligence support, and network monitoring and protection.
- Executing above element joint and combined global missile defense training, exercises, and experimentation.
- Advocating for and recommending acceptance of global missile defense capabilities, conducting analysis and assessments of current and future capabilities, and supporting ground & flight tests.

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

Expansion and Integration of the Missile Defense Architecture: In response to the evolving strategic environment, we continue to bolster homeland and regional missile defense capabilities. In development of the global missile defense mission, we are supporting the advancement of the new capabilities such as Aegis Ashore in Poland; the Standard Missile 3 Block IIA under co-development with Japan; Long Range Discrimination Radar at Clear Air Force Station, Alaska; 20 additional GBIs in a new missile field at Fort Greely, Alaska; Homeland Defense Radar–Hawaii; Homeland

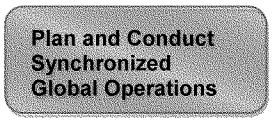
Defense Radar–Pacific; Space-based Kill Assessment, and various other capabilities. Given the many challenges associated with implementation of these architectures, JFCC IMD, in support of USSTRATCOM's coordinating role for global missile defense, collaborates with the GCCs to assess and address cross-regional gaps in the areas of planning, policy, capabilities, and operations.

Multi-Regional Missile Defense Asset Management: JFCC IMD, in coordination with USSTRATCOM and the GCCs, manages the availability of missile defense assets to balance operational readiness posture, coordinates the scheduling of missile defense system maintenance activities, and supports MDA and Service test requirements. The asset management process allows us to continually assess our readiness to defend against missile attacks and to recommend adjustments to optimize the overall MD architecture.

Cybersecurity of the Ballistic Missile Defense System: JFCC IMD, in coordination with USSTRATCOM and MDA, conducts the Cybersecurity Service Provider (CSSP) mission for the BMDS to ensure cyber defenses and operations are planned and executed across the globe. JFCC IMD works with key stakeholders to enhance the cyber defense posture of our missile defense operational architecture against malicious activity. We are collaborating with our mission partners to incorporate realistic cybersecurity testing in support of the warfighter capability acceptance process. JFCC IMD also works closely with the Joint Staff, Combatant Commanders, and MDA to educate, train, and exercise cybersecurity protocols to ensure the highest levels of readiness.

Global Planning and Assessment: As regional and global missile threats continue to increase in number and complexity, JFCC IMD works with the missile defense community to refine processes designed to synchronize trans-regional, global missile defense planning and operations. Codified in periodic revisions to the Global Missile Defense Concept of Operations, these processes ensure unity of effort and mitigate potential seams and gaps across geographic areas of responsibility. Consistent with the Department's transition to planning based on adversary problem sets, we have continued to refine our process for adversary-centric plans assessment, and completed further objective analysis of missile defense risks across multiple GCC

plans. This assessment methodology identifies systemic risk, informs recommendations for shortfall mitigation, and increases effectiveness in future missile defense planning efforts. The output of this analysis will inform our biennial Global Integrated Air and Missile Defense Assessment (GIAMDA) which shapes recommendations for global force management and future capability advocacy efforts. Looking forward, we will focus our efforts with the warfighter community to establish approaches and processes necessary to enable increased integration and a more holistic approach to missile defense.



Global Force Management: USSTRATCOM, as the designated Joint Functional Manager for missile defense, relies upon JFCC IMD to evaluate and recommend to the Joint Staff sourcing of missile defense requirements based on assessed risk. Due to the low density/high demand nature of missile defense assets, all sourcing decisions have a direct and significant impact on other Combatant Commanders' campaign and contingency plans. We continue to refine our approach to prioritize steady-state global missile defense requirements. This Global Prioritized Defended Asset List (Global PDAL) categorizes the GCCs' critical assets based on global risk. It informs our recommendations in the Global Force Management process, enabling senior leaders to make informed decisions on allocation of low density missile defense forces.

Allied and Partner Missile Defense Integration: Given that we will never have enough active defense capacity, integrating allies into a common and mutually supportive architecture is a critical warfighter priority. In support of those efforts, our Global Missile Defense CONOPS includes an International Engagement Framework which provides a common approach to identify potential partners, a model to identify a level of maturation, and an assessment mechanism. This approach formed the analytical basis for the Department's 2017 Report to Congress on Allied Integration. Another venue aimed at promoting increased cooperation is the NIMBLE TITAN campaign, a biennial series of multinational missile defense experiments. NIMBLE TITAN brings together policy and military subject matter experts from allies and partner nations to explore collaborative missile defense, synchronize policy and military initiatives, and identify potential future concepts. Today, ministries of foreign affairs and

defense representatives from 24 nations, NATO, three additional multinational organizations, as well as DoD, OSD, Joint Staff, Combatant Commands, and MDA convene quarterly to exchange views and insights, experimenting collectively with policy and operational concepts. The NIMBLE TITAN campaign provides a unique forum to advance U.S. missile defense policies and Combatant Commanders' regional security objectives. As the free world's premier strategic military and policy focused missile defense event, this campaign provides participating nations with critical opportunities for multinational and cross-regional discussions. The 28 member nations and international organizations work collectively to produce practical missile defense concepts and solutions to policy-military challenges; many of which influence and inform real-world missile defense policies and multinational planning.

"We must strengthen our collaboration with our allies and explore further integration of our collective capabilities toward an effective mutual defense."

– USSTRATCOM HASC Posture Statement March 2018

The NIMBLE TITAN 2018 campaign culminated in the Capstone Conflict Event this March. In September, NATO will host a subsequent senior leader forum. This campaign addressed IAMD, deterrence and de-escalation, left-of-launch actions, passive defense, advanced technologies, interoperability, regional defense planning, alliance and coalition cohesion, and harmonized strategic messaging—challenges of concern to all participants. NIMBLE TITAN has been a gateway for the U.S. to establish crucial relationships with allies and partners. It also informs the missile defense policies of the participating nations and international organizations. Events like NIMBLE TITAN foster greater confidence in combined missile defenses and provide a means to advance U.S. efforts in collaboration, integration, interoperability, and burden sharing with our allies and partners.

Additionally, we have successfully integrated allies directly into the JFCC IMD staff through the Foreign Liaison Officer (FLO) program. Our first FLO, a German Air Force officer, has been an integral player in NIMBLE TITAN, NATO BMD Training, and allied and partner modeling and simulation efforts. We are seeking to add additional

Foreign Liaison Officers to increase our understanding of allied missile defense policies, capabilities, and planning in order to optimize missile defense planning and force allocation.

Joint Missile Defense Training: In coordination with USSTRATCOM, the Joint Staff, Combatant Commands, and the Services, we continue to develop comprehensive and innovative training programs to close gaps between Service, joint, and regional missile defense training and education. JFCC IMD's Joint Ballistic Missile Defense Training and Education Center, or JBTEC, expanded its curriculum to meet warfighter demands. It now offers 15 mission-oriented resident and Mobile Training Team (MTT) courses, and online courses to include orientation, staff basic, and asset management training. Over the past year, JFCC IMD instructors executed 233 courses, training over 4,200 students worldwide. Additionally, in keeping with Joint Vision 2020, JFCC IMD provided training courses to our allies and partners through military-to-military and Foreign Military Sales training venues.

Warfighter Capability Acceptance and Integrated Master Test Plan: As missile defense architectures mature, warfighters require a credible, comprehensive assessment of new capabilities to inform operational acceptance into the global BMDS. The warfighter relies on a robust and operationally relevant test campaign to confidently field and integrate new capabilities into their existing IAMD architectures. As noted previously, warfighters supported the May 2017 FTG-15 GBI test which demonstrated the first ever Exo-atmospheric Kill Vehicle (EKV) intercept of an ICBM-class target. Also in 2017, JFCC IMD supported a successful intercept flight test of the U.S. and Japanese co-developed SM-3 Block IIA interceptor for Phase III of the European Phased Adaptive Approach (EPAA) architecture. In Fiscal Year 2019, the Department has an Aegis BMD and Aegis Ashore intercept test planned that will demonstrate the multiple simultaneous engagement of two IRBMs using the same EPAA Phase III architecture. The Navy and MDA will demonstrate fleet defense using a salvo of two SM-6 missiles. Additionally this year, we plan to demonstrate coordinated THAAD and Patriot interceptors in a simulated engagement using a live target.

In summary, JFCC IMD continues to expand our Nation's global missile defense architecture and explores future capabilities to maintain operational advantage against

current and future threats. Competitive edge is maintained through integrated planning and operational support, deliberate investments in our capability developments by MDA and the Services, investments in our warfighters through education and training, and expansion of collaboration with our allies and partners.

Conclusion

Chairman Rogers and Ranking Member Cooper, as a member of the joint missile defense community, the Army continues to pursue enhancements to the Nation's IAMD systems, from the tactical to the strategic levels of warfare. As outlined here, USASMDC/ARSTRAT and JFCC IMD perform a broad set of critical national security missions. These missions include providing professional warfighters and capabilities to support current operations, ensuring they are prepared for tomorrow's fight, and developing new technologies required to maintain a technological advantage against the adversary threat. Our trained and ready Soldiers, operating GMD elements in Colorado, Alaska, New York, California, and from remote, globally deployed locations, remain on point to defend the homeland against an ICBM attack. As a force provider to the GCCs, our Soldiers provide essential regional sensor capabilities, ballistic missile early warning, and satellite communications. Our regional forces continue to leverage allied collaboration and planning efforts in developing integrated and interoperable defenses against the various threat sets. USSTRATCOM, through the JFCC IMD, continues to integrate BMDS capabilities to counter global missile threats and to protect our Nation, deployed forces, allies, and partners.

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

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

LTG James H. Dickinson
Commanding General USASMDC/ARSTRAT

Lieutenant General James H. Dickinson assumed command of the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command and Joint Functional Component Command for Integrated Missile Defense on Jan. 5, 2017. Commissioned in 1985 as a Second Lieutenant, he has held leadership positions, from platoon leader to Commanding General of an Army Air and Missile Defense Command.

He most recently served as the Chief of Staff, U.S. Strategic Command, Offutt Air Force Base, Nebraska. He was previously assigned as the Director for Test at the Missile Defense Agency, Redstone Arsenal, and as Deputy to The Inspector General in the Office of the Secretary of the Army.

LTG Dickinson was the Commanding General of the 32nd Army Air and Missile Defense Command at Fort Bliss, Texas, from July 2012 to March 2014, and Commanding General of the 94th Army Air and Missile Defense Command at Fort Shafter, Hawaii, from August 2011 to July 2012.

Additional command assignments include: Battalion Commander, 1st Battalion, 7th Air Defense Artillery, 32nd Air and Missile Defense Command, Fort Bliss, Texas, where the battalion deployed in support of Operations Enduring Freedom and Iraqi Freedom; and Brigade Commander, 35th Air Defense Artillery Brigade, Eighth United States Army, Republic of Korea.

Previous staff assignments include: Operations Officer, 5th Battalion, 52nd Air Defense Artillery, 11th Air Defense Artillery Brigade, Fort Bliss, Texas, and Operation Southern Watch, Saudi Arabia; Operations Officer, 11th Air Defense Artillery Brigade, Fort Bliss, Texas; Senior Emergency Actions Officer and Senior Operations Officer, National Military Command Center, J-3, Joint Staff, Washington, D.C.; Chief of Operations, G-3, later Assistant Chief of Staff, G-3, 32nd Army Air and Missile Defense Command, Fort Bliss, Texas; Chief, Commander's Initiatives Group, United Nations Command/Combined Forces Command, U.S. Forces Korea, Republic of Korea; and Deputy Director for Operations, National Military Command Center, J-3, Joint Staff, Washington, D.C.

His awards and decorations include the Distinguished Service Medal (oak leaf cluster), Defense Superior Service Medal (two oak leaf clusters), Legion of Merit (two oak leaf clusters), Bronze Star Medal, Defense Meritorious Service Medal, Meritorious Service Medal (two oak leaf clusters), Army Commendation Medal (two oak leaf clusters), Joint Service Achievement Medal, Army Achievement Medal (three oak leaf clusters), Parachutist Badge, Master Space Badge, and Joint and Arm y Staff Identification Badges.

LTG Dickinson graduated from Colorado State University with a Bachelor of Science in mechanical engineering and from the Colorado School of Mines with a Master of Science in operations research and systems analysis (engineering). He later earned a master's degree in strategic studies from the United States Army War College.

January 2018

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

APRIL 17, 2018

QUESTIONS SUBMITTED BY MR. LAMBORN

Mr. LAMBORN. The FY17 NDAA expanded existing language from the Missile Defense Act of 1999 to move our national missile defense policy beyond simply defense of a "limited ballistic missile attack." Is the Department embracing the revised direction to provide a robust, layered defense against the increasingly complex missile threat posed by our peer adversaries (meaning hypersonics and cruise missile threat)? And, how will the upcoming missile defense review clearly demonstrate this commitment?

Secretary ROOD. As the National Defense Strategy (NDS) points out, the United States, allies, and partners confront a security environment that is more complex and volatile than any we have experienced in recent memory. Today, more than 20 States possess offensive missiles, and potential adversaries are expanding their missile capabilities in 3 different directions simultaneously. They are increasing the capabilities of their existing missile systems, adding new and unprecedented types of missile capabilities to their arsenals, and integrating offensive missiles more thoroughly in their coercive threats, military exercises, and war planning. The Department's missile defense posture, program and budget requests over the last 2 years, and policy as articulated in the current NDS illustrate our strong commitment to enhance current capabilities and explore advanced technologies for a layered missile defense system. The Department is continuing to focus on increasing system reliability to build warfighter confidence, increase engagement capability and capacity, and address the more complex and advanced threat. We are also moving forward to bolster homeland defenses against air and cruise missile threats. In 2018, we will complete the first part of a two-phase effort to provide effective surveillance against these missile threats to the National Capital Region (NCR). Doing so will enhance our ability to detect, track, and investigate suspicious aircraft, in addition to cruise missiles, and, when necessary, cue our missile defense systems against the full spectrum of air threats. We are on track to begin the second phase of this effort over the next year, which will expand our capability to detect, identify, and take defensive action before air threats can strike potential targets within the NCR. We are also looking into technologies and concepts that could be used to provide scalable and deployable options for expanding this defensive capability. As directed by statute, the Missile Defense Agency (MDA) is currently conducting an Analysis of Alternatives to assess architectures to defeat hypersonic threats. For the boost phase, we are exploring advanced technology, including improved discrimination in our missile defense system sensor architecture and lasers to intercept offensive missiles during their most vulnerable boost phase of flight, and we are evaluating new space-based sensor concepts. The Missile Defense Review (MDR) will be consistent with the NDS and the National Security Strategy (NSS), reinforcing our commitment to layered defense.

Mr. LAMBORN. In Lt Gen Greaves' testimony, he wrote, "scalable, efficient, and compact high-energy lasers could change future missile defense architectures." Laser scaling is a critical technology to achieve next-generation missile defense. Without it, there is likely no boost-phase kill. I understand MDA's Directed Energy money was transferred in FY19 to an overall effort in the Department that is addressing high energy laser technology. MDA's portion of the budget request of $5M is nowhere near what is needed to scale the two lab lasers (Lincoln and Livermore Labs) being developed for boost phase kill. Is MDA able to use the OSD PE for laser scaling, and how can you get access to that money? Are there areas that are not being addressed by the Department's high energy laser advanced development program that are specific to what MDA had intended to use funds for in FY19 that would delay missile defense capability?

Secretary ROOD. I defer this question to Lt Gen Greaves as he is better positioned to answer the specifics related to laser scaling.

Mr. LAMBORN. In September last year, General Hyten said of boost phase missile defense, "the traditional boost-phase defense construct, whch is missiles, is not a technical question. It's actually an easier technical problem to hit a missile in boost phase than it is in terminal phase." With this in mind, would you agree that space-based missile defense is a policy rather than a technical capability question? From

a war fighting perspective, would space-based missile defense (whether that's interceptors, directed energy, or both) increase the overall effectiveness of our missile defense architecture?

Secretary ROOD. The boost phase is the initial layer of missile defense (followed by midcourse and terminal). It is the ideal time to intercept a threat missile since it has not yet deployed either its warhead or countermeasures. Further, interception during the boost phase has many benefits. It allows us to defeat missile threats over an adversary's territory rather than our own, negating the threat far from its intended target and reducing the number of interceptors required to counter the missile. Finally, the more missiles intercepted at the boost phase means there will be fewer missiles to engage in mid-course or terminal phases. There are many benefits to missile defense by basing capabilities in space. It provides an ideal medium to address rapidly advancing threats across multiple regions of interest. Space provides access to and persistence in areas of the globe we could not obtain by other means. Tracking, discriminating, cueing, and targeting missile threats from space would enable more efficient and effective use of our interceptor inventory. The Department is exploring the development of a space-based sensor system to provide warning, tracking, and discrimination of evolving ballistic missile threats launched from anywhere in the world. A space-based sensor layer would enable the United States to use the interceptor inventory more efficiently and more effectively, and to counter a broader array of threats. We are also evaluating space-based sensors to support tracking of advanced threats such as hypersonic-glide vehicles (HGVs). It also makes sense to explore the technologies and concepts for a space-based intercept layer to determine whether they will work, and whether they are cost-effective and affordable. This may involve on-orbit demonstrations and experiments. Intercept capabilities could include kinetic or different types of directed energy, and could engage in the boost phase of flight when a missile is most vulnerable over an adversary's own territory, or in the mid-course phase of flight. We should examine different forms of directed energy, such as high-energy lasers, which may also address hypersonic missiles in a glide phase in the atmosphere. Our adversaries have made and continue to make advances in their regional offensive missile threat capabilities. We must be prepared to examine the full range of military capabilities to improve our defenses, including thorough development of space-based sensors and thorough exploring of space-based interceptors as we utilize the space domain and the unique capabilities of space-based assets to counter these threats.

Mr. LAMBORN. In Lt Gen Greaves' testimony, he wrote, "scalable, efficient, and compact high-energy lasers could change future missile defense architectures." Laser scaling is a critical technology to achieve next-generation missile defense. Without it, there is likely no boost-phase kill. I understand MDA's Directed Energy money was transferred in FY19 to an overall effort in the Department that is addressing high energy laser technology. MDA's portion of the budget request of $5M is nowhere near what is needed to scale the two lab lasers (Lincoln and Livermore Labs) being developed for boost phase kill. Is MDA able to use the OSD PE for laser scaling, and how can you get access to that money? Are there areas that are not being addressed by the Department's high energy laser advanced development program that are specific to what MDA had intended to use funds for in FY19 that would delay missile defense capability?

General GREAVES. MDA is currently in discussion with the Office of the Secretary of Defense on the division of funding and how best to pursue in parallel both laser technologies that are scalable to higher power for strategic applications, and lasers that are limited to lower power for tactical applications. Yes, there are MDA specific technology requirements that are not being addressed by other Department of Defense laser programs. A boost phase kill capability is dependent upon both funding and technology development. We need to increase power levels achieved in the laboratory by at least ten times in order to achieve a boost phase kill capability. Thus, we are pursuing multiple technologies in parallel to reduce development risk. In the fiscal year (FY) 2019 budget just signed into law, MDA received a plus up of $85 million (M) above the $5M budget request. With the plus up, MDA's funding is sufficient to pursue our strategic laser scaling plan for missile defense for FY 2019. However, a similar level of funding will be required in FY 2020 to keep the competitive development program on track.

Mr. LAMBORN. Lt Gen Greaves, I was happy to read in your testimony when you stated, "We must make investments in advanced technology today to prepare for tomorrow's threats." Given that our near-peer adversaries are consciously targeting the gaps and seams in our current missile defense architecture, I agree that it is critically important for us to develop and deploy our next generation missile defense capabilities as soon as possible. This includes Multi-Object Kill Vehicle technology, boost-phase intercept, and hypersonic defense among other things. In your profes-

sional military opinion, what is the limiting factor in the development of these technologies? With greater resources available, how much faster could we develop and deploy these systems?

General GREAVES. Since each of the next generation missile defense capabilities listed above are quite different and have different limiting factors, they will be addressed individually. Development of these capabilities can be accelerated in varying degrees, provided the required resources are available to invest in the technologies identified below. Multi-Object Kill Vehicle (MOKV): The threat is projected to outpace, in number and complexity, our current defensive capability. MOKV will provide a force multiplier effect by increasing Warfighter BMD kill vehicle capacity without increasing the number of interceptors and provide the ability to outpace the evolving threat. This new capability places multiple kill vehicles on a single interceptor to increase the number of likely lethal objects engaged per interceptor, thereby reducing interceptor usage for any given threat. Technology development at the levels resourced has been a key factor limiting development. Boost Phase Intercept (BPI): BPI can significantly benefit the ballistic missile defense by eliminating or thinning out waves of inbound threats. Destroying an accelerating booster before it reaches the midcourse phase of flight prevents the reentry vehicle from reaching its target and potential countermeasures from deploying, effectively removing several objects from midcourse with one intercept. However, BPI operational challenges remain hard problems, including: short engagement timelines, sensor support, the need for continuous coverage, maneuvering targets, cloud cover, and threat country geography. Air-launched kinetic interceptors are the only viable BPI capability that can be delivered in the near-term. The capability of this class of interceptor is limited however, requiring indications and warning to position aircraft into operating areas and overflight of adversary territory for engagement of certain trajectories. With adequate funding, we could provide an interim air-launched BPI kinetic capability by 2023. In the mid-to-far term, more robust BPI solutions are directed energy weapons including airborne- or space-based lasers and space-based Neutral Particle Beam (NPB) technology; and space-based kinetic interceptors. To expedite achieving these capabilities, we need increased investments in scaling a lightweight electric laser to the megawatt class power required for boost phase kill with high electrical-to-optical efficiency and excellent beam quality; and demonstrating the precise beam pointing stabilization required in flight at high altitude or on a spacecraft. With adequate funding, we could demonstrate using a laser against a surrogate booster target by 2024 and scale a laser to megawatt class by 2025; conduct a space laser feasibility demonstration by 2027; demonstrate NPB beam propagation by 2023 and complete a subscale prototype experiment by 2028; and complete a Space Based Interceptor Functional Demonstration by 2022 and a follow-on Technology Demonstration by 2024. Hypersonic Defense: Hypersonic maneuvering missiles are unique as an emerging weapon capability which have only recently become a credible threat. Our defensive systems, to include how we think about missile defense, must evolve to address them. The defense against hypersonic missile threats is challenging, but the primary limiting factor is resources. With additional resources, and smart investments in key technology development and integration, our current missile defensive capability can be evolved to quickly address this threat class. For the near-term, continued investments in our existing C2BMC, fire control, and sensors are required to ensure our systems are optimized for the detection and tracking of the hypersonic threat as soon as it breaks the sensor horizon. We need weapon systems coupled with the sensor network that are capable of high data rate, low latency communications that can overmatch the maneuvering capability of hypersonic threats. In the mid-term, we need investments to extend our ability to detect and maintain track of hypersonic threats over the horizon and to cover large areas using satellite systems. New interceptor types must be highly maneuverable yet able to engage hypersonic threats at much greater ranges during the threat's glide phase where its maneuvering capabilities are limited. We also need new command and control systems that employ tailored communication systems to provide low latency in-flight updates to interceptors challenging hypersonic threats over the horizon. MDA is currently delivering an FY19 NDAA report that discusses the acceleration of specific hypersonic threat defense capabilities.

Mr. LAMBORN. In September last year, General Hyten said of boost phase missile defense, "the traditional boost-phase defense construct, which is missiles, is not a technical question. It's actually an easier technical problem to hit a missile in boost phase than it is in terminal phase." With this in mind, would you agree that space-based missile defense is a policy rather than a technical capability question? From a war fighting perspective, would space-based missile defense (whether that's interceptors, directed energy, or both) increase the overall effectiveness of our missile defense architecture?

General GREAVES. Developing and deploying a spaced-based missile defense system presents a number of technical, resource, and policy issues that must be thoroughly examined. Therefore, DOD plans to undertake an updated examination of the concepts and technology for space-based missile defenses in order to inform potential future decisions. In the 2018 and 2019 National Defense Authorization Acts, Congress directed MDA to submit a plan to develop a space-based ballistic missile intercept layer to the ballistic missile defense system. MDA is currently finishing this plan and will deliver it later this year. This plan defines a program that addresses the technical challenges, demonstrates the required key capabilities, procures and begins fielding an operational capability within a 10-year timeframe. Yes, adding an effective, tested and proven space-based missile defense layer would increase the overall effectiveness of our missile defense architecture. In the 2018 and 2019 National Defense Authorization Acts, Congress directed MDA to submit a plan to develop a space-based ballistic missile intercept layer. MDA intends to deliver this report to Congress by the December 12, 2018 deadline.

QUESTIONS SUBMITTED BY MS. STEFANIK

Ms. STEFANIK. With new claims from Russia about their cruise missile capabilities and the ongoing concern about Iran's future nuclear capabilities, how prepared do you currently feel we are to protect the east coast of the United States from missile attacks?

Secretary ROOD. With respect to Russia's claims on cruise missile capabilities, we are bolstering our homeland defenses against cruise missile threats. In 2018, we will complete the first part of a two-phase effort to provide effective surveillance against these missile threats to the National Capital Region (NCR). Doing so will enhance our ability to detect and track cruise missiles and, when necessary, cue our missile defense systems. We are on track to begin the second phase of this effort over the next year, which will expand our capabilities within the NCR. We are also looking into technologies and concepts that could be used to provide scalable and deployable options for expanding this defensive capability. Today, the Ground-Based Midcourse Defense (GMD) sites in Alaska and California provide protection against rogue State intercontinental ballistic missile (ICBM) threats. The United States is expanding and modernizing the GMD system, which will further strengthen our ability to track and counter emerging rogue nation ICBM threats to the United States. We are closely monitoring Iran's long-range missile programs. Should an ICBM threat emerge, we are positioned to proceed with an additional site. We have completed Environmental Impact Statements on four potential interceptor sites: two sites located at Fort Custer, Michigan; one site at Camp Ravenna, Ohio; one site at Fort Drum, New York), reducing deployment time by up to two years. We also are maintaining an active ground-based interceptor production capacity. The National Defense Authorization Act for Fiscal Year 2018 (Section 1680) also directs DOD to conduct a test to assess the feasibility of an SM–3 Block IIA interceptor against an ICBM-class target by 2020. Long-term, we will explore advanced technologies such as a space-based sensor layer and kinetic and directed energy for boost-phase intercept that offer broad benefits for homeland defense.

Ms. STEFANIK. Do you feel that a Ground Based Interceptor site on the east coast would contribute to deterrence of an attack? If not what technologies, current or emerging would best enhance the coverage of the east coast?

Secretary ROOD. The Ground-Based Midcourse Defense (GMD) system is capable of effectively defending against an intercontinental ballistic missile (ICBM) attack from regimes such as North Korea and Iran. There are planned increases in interceptor inventory and system performance. U.S. policy is to improve the capabilities and capacity of the current homeland missile defense system to enable the system to engage more advanced missiles from these States. To stay ahead of the threat, we are investing in technologies and programs to address emerging threats more effectively over the next decade.

Ms. STEFANIK. The Army invested billions of dollars in the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), an aerostat sensor technology used to establish persistent over-the-horizon surveillance and early warning capabilities against cruise missiles. That mission was derailed due to a breakaway incident that led to funding being pulled from the project. a. What are some of the positive results from the research and development that was conducted during that project? b. Is there any discussion of leveraging the advantages of aerostat technology for sensors in the future? If not, what do you plan to use to compensate for the loss in capability that JLENS provided?

General ROBINSON. The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS) was one of several sensors at that time that were being assessed to improve cruise missile detection in and around the National Capital Region (NCR). During the exercise when the JLENS surveillance aerostat was aloft, it demonstrated greater surveillance coverage than currently exists in the NCR. However, unfortunately, it was not aloft 24x7 as a persistent capability due to weather and maintenance. There is not one single solution to address advanced cruise missile threats. NORAD is working within the Department of Defense for a phased, layered capabilities approach to expand cruise missile defense capabilities in the United States and Canada. Indications and warning are also critical to detect the advanced cruise missile at greater ranges, providing more decision time and intercept options before the missiles reach North America. We continue to pursue improvements to indications and warning, surveillance, and engagement capabilities to meet the evolving challenges posed by these advanced cruise missile threats.

Ms. STEFANIK. With new claims from Russia about their cruise missile capabilities and the ongoing concern about Iran's future nuclear capabilities, how prepared do you currently feel we are to protect the east coast of the United States from missile attacks?

General ROBINSON. I am confident that we can defend the East Coast against current assessed Iranian and North Korean ballistic missile capabilities, but we must complete necessary improvements with a sense of urgency if we are to remain in a position of relative advantage. The current and emerging cruise missile threats constitute a real challenge to our air defense architecture and we rely on a layered capabilities approach to defend against cruise missiles. Our capabilities against cruise missile threats in the National Capital Region include Sentinel radars, limited surveillance coverage from advanced sensors, Aerospace Control Alert fighters, and ground-based air defense for engagement. However, without indications and warning, this provides a very limited cruise missile defense capability. Today, NORAD is leading a three-phased, layered capability Homeland Defense Design within the Department of Defense to expand the Department's cruise missile defense architecture, and I am confident in the way-ahead for these expanded capabilities.

Ms. STEFANIK. Do you feel that a Ground Based Interceptor site on the east coast would contribute to deterrence of an attack? If not what technologies, current or emerging would best enhance the coverage of the east coast?

General ROBINSON. The currently fielded system provides ballistic missile defense against North Korean and Iranian capabilities. A third site, if deployed based on threat maturation, may increase operational flexibility for engaging threats from both North Korea and Iran by increasing engagement timelines and enhancing ground-based midcourse defense redundancy and survivability by geographically dispersing interceptors.

Ms. STEFANIK. The Army invested billions of dollars in the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), an aerostat sensor technology used to establish persistent over-the-horizon surveillance and early warning capabilities against cruise missiles. That mission was derailed due to a breakaway incident that led to funding being pulled from the project. a. What are some of the positive results from the research and development that was conducted during that project? b. Is there any discussion of leveraging the advantages of aerostat technology for sensors in the future? If not, what do you plan to use to compensate for the loss in capability that JLENS provided?

General GREAVES. The JLENS fire control radar had some similar hardware components and tracking algorithms used in the Army Navy/Transportable Radar Surveillance and Control Model-2 (AN/TPY–2) radar. These similarities enabled the Army and Missile Defense Agency to leverage their respective radar development programs. Aerostat technology for sensors is not being considered for Ballistic Missile Defense. Aerostat technology is beneficial for low altitude cruise missile defense, but it is of limited benefit to ballistic missile defense, which focuses on high altitude, exoatmospheric threats.

Ms. STEFANIK. With new claims from Russia about their cruise missile capabilities and the ongoing concern about Iran's future nuclear capabilities, how prepared do you currently feel we are to protect the east coast of the United States from missile attacks?

General GREAVES. [The information referred to is classified and retained in the committee files.]

Ms. STEFANIK. Do you feel that a Ground Based Interceptor site on the east coast would contribute to deterrence of an attack? If not what technologies, current or emerging would best enhance the coverage of the east coast?

General GREAVES. A Ground-based Interceptor (GBI) site and additional GBIs on the east coast would enhance deterrence by increasing an adversary's uncertainty that a missile attack would be effective against the United States (U.S.). The Department of Defense (DOD) is preparing a congressionally mandated Environmental Impact Statement (EIS) evaluating candidate sites for a potential additional Continental United States (CONUS) Interceptor Site; the EIS is directed by Section 227 of the fiscal year 2013 National Defense Authorization Act. There has been no decision to deploy an additional GBI site in the U.S. The current GBI sites at Fort Greely, Alaska, and Vandenberg Air Force Base, California, provide the capability necessary to protect the U.S. homeland against an Intercontinental Ballistic Missile (ICBM) threat from North Korea as well as a future Iranian ICBM threat, should it emerge. An additional site located within the CONUS would add potential battle space and interceptor capacity; however, it would come at significant material development and service sustainment costs. Investment in Ballistic Missile Defense System (BMDS) discrimination and sensor capabilities may yield more cost-effective near-term improvements to U.S. homeland missile defense. In addition to evaluating an additional GBI site, DOD is evaluating potential sensor enhancements that will improve the BMDS kill chain and increase threat discrimination.

Ms. STEFANIK. The Army invested billions of dollars in the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), an aerostat sensor technology used to establish persistent over-the-horizon surveillance and early warning capabilities against cruise missiles. That mission was derailed due to a breakaway incident that led to funding being pulled from the project. a. What are some of the positive results from the research and development that was conducted during that project? b. Is there any discussion of leveraging the advantages of aerostat technology for sensors in the future? If not, what do you plan to use to compensate for the loss in capability that JLENS provided?

General DICKINSON. (a.) The JLENS deployment demonstrated the capability of elevated sensors to provide surveillance, track and precision cueing beyond ground radar ranges. The JLENS did become an integral part of the National Capital Region Integrated Air and Missile Defense System (NCR–IADS), demonstrating the capability of an elevated sensor to provide timely data for prosecution of threats. (b.) There is high interest in elevated sensors. The US Army is using tethered aerostats with multi-mission sensors to provide long endurance intelligence, surveillance, reconnaissance (ISR) and communications in support of coalition forces in Iraq and Afghanistan. Two aerostats used by the Army are the Tethered Aerostat Radar System (TARS) and aerostat-based Persistent Threat Detection System (PTDS). TARS is a low-level, airborne ground surveillance system that's used for active surveillance and early-warning base defense. The aerostat-based PTDS is one of the ISR tools the Army uses to detect improvised explosive devices buried along roadsides. The need to replace the JLENS capabilities was documented in the NCR–IADS Tiger Team Report to Congress in 2016. Recommendations made in the report are classified; but, no one system seems to be capable of replacing JLENS at this time.

Ms. STEFANIK. With new claims from Russia about their cruise missile capabilities and the ongoing concern about Iran's future nuclear capabilities, how prepared do you currently feel we are to protect the east coast of the United States from missile attacks?

General DICKINSON. We have confidence in homeland defense against Intercontinental Ballistic Missile (ICBM) threats from emerging nations; however, these systems are not capable of defending against Russia's large arsenal of advanced ICBMs. To ensure continued protection of the homeland, we must make investments in technology today to evolve our missile defense capabilities to outpace the growing and increasingly complex threats, including advanced cruise missiles, from all potential adversaries.

Ms. STEFANIK. Do you feel that a Ground Based Interceptor site on the east coast would contribute to deterrence of an attack? If not what technologies, current or emerging would best enhance the coverage of the east coast?

General DICKINSON. An east coast site would contribute to deterrence by increasing our capability to address the future ballistic missile threat. However, we strongly believe that the limited ballistic missile defense resources should continue to be prioritized to improving the sensor architecture and increasing interceptor reliability.