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Good morning, Chairman Cooper, Ranking Member Turner, distinguished Members of the subcommittee. I appreciate this opportunity to testify before you today. The Missile Defense Agency budget request of $9.187 billion for Fiscal Year (FY) 2021 will enable the continued execution of the MDA mission to design, develop and deploy a layered Missile Defense System to defend the United States, deployed forces, allies, and friends from missile attacks in all phases of flight. Working together with the Services, international partners, and industry, the highly skilled and dedicated MDA government and contractor workforce stands ready to develop and deliver ready, reliable, and effective defenses the Nation needs to counter the proliferating and increasingly sophisticated missile threat.

Missile Threat – A Significant Inflection Point for Missile Defense

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

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

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

Approach to Addressing the Advanced Threat

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

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

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

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

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

Improving Warfighter Readiness

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

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

Delivering Capability to Build Combatant Command and Service Capacity

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

Ground-Based Weapon Systems

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

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

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

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

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

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

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

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

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

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

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

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

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

Sea-Based Weapon Systems

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

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

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

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

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

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

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

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

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

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

Terrestrial and Space Sensors

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

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

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

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

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

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

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

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

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

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Command and Control

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

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

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

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

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

Developing Technology for the Future

With the emergence of new and more advanced threats, MDA's base investment requires a significant technology boost in order to develop newer innovative and disruptive technologies to defeat these threats. MDA's previous missile defense technology investments have transitioned into weapon systems and vastly improved interceptor seeker capability, increased the speed and range of intercept with advances in propulsion, and increased the probability of single-shot kill using multifaceted tracking and discrimination algorithms. MDA will increase the speed of delivery of new capability to address evolving threats.

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

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

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

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

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

Conclusion

Mr. Chairman and Members of the Subcommittee, in closing, our FY 2021 budget funds comprehensive missile defense development efforts, including several critical capabilities required by the Warfighter. We will continue to increase the readiness as well as the capability and capacity of fielded homeland and regional missile defense systems while investing in advanced technology to counter adversary ballistic and non-ballistic missile threats. MDA will continue to execute a robust and aggressive test program critical to system development.

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

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

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

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