Unclassified Statement of

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Good afternoon, Chairman Rogers, Ranking Member Cooper, distinguished Members of the subcommittee. I appreciate this opportunity to testify before you today. The Missile Defense Agency (MDA) budget request of $7.9 billion for Fiscal Year (FY) 2018 will continue the development of reliable, increasingly capable, and state-of-the-art defenses for our Nation, deployed forces, allies, and international partners against ballistic missiles. The FY 2018 missile defense program will continue to support the Warfighter and 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 for the Ballistic Missile Defense System (BMDS).

Ballistic Missile Threat

The ballistic missile threat is growing more sophisticated as countries continue to improve their missiles by increasing the range, incorporating ballistic missile defense (BMD) countermeasures, and making them more complex, survivable, reliable, and accurate. Maneuvering threats continue to be developed and fielded. Although hypersonic glide vehicles and missiles flying non-ballistic trajectories were first proposed as far back as World War II, technological advances are only now making these systems practicable. Both Russia and China announced successful hypersonic glide vehicle launches in 2016.

Space-launch activities involve multistage systems that further the development of technologies for intercontinental ballistic missiles (ICBMs). In addition to the Taepo Dong 2

space launch vehicle/ICBM, North Korea is developing and has paraded the KN08 road-mobile ICBM and a new road-mobile ICBM. Over the past year North Korea conducted an aggressive testing campaign, launching at least seven Musudan intermediate-range ballistic missiles (IRBMs), which have a range greater than 3,000 kilometers. It also conducted multiple test launches of a new submarine-launched ballistic missile. In February 2017 North Korea publicized the launch of a new solid-propellant missile that appeared to be a land-based variant of its submarine-launched ballistic missile. Most recently North Korea conducted a near-simultaneous ballistic missile salvo launch of four missiles into the Sea of Japan and announced the units firing the missiles had the mission of targeting U.S. bases in Japan. Today North Korea fields hundreds of Musudan, No Dong, and Scud missiles that can reach U.S. forces forward deployed in the Asia-Pacific region.

Iran has successfully orbited small satellites and announced plans to orbit a larger satellite using the Simorgh space launch vehicle, which could be configured to be an ICBM. Progress in Iran's space program could shorten a pathway to an ICBM because space launch vehicles use similar technologies, with the exception of their payloads. Iran continues to develop more sophisticated missiles and improve the range and accuracy of current missile systems, deploying next-generation short- and medium-range ballistic missiles (SRBMs and MRBMs), some with maneuvering reentry vehicles and new submunition payloads. Iran demonstrated its capability to modify currently deployed ballistic missile systems by flight-testing a Fateh-110 ballistic missile with a seeker in an anti-ship role, which would enable Iran to threaten maritime activity throughout the Persian Gulf and Strait of Hormuz.

Support for the Warfighter

Our priority is to continue to deliver greater missile defense capability and capacity to the Warfighter in support of Combatant Command priorities and defense strategy. This budget maintains the commitment to emplace 44 Ground Based Interceptors (GBIs) by the end of this year for homeland defense and enhance the overall reliability and performance of the GBI fleet. To strengthen regional defenses, we plan to deliver a total of 36 Standard Missile (SM)-3 Block IBs to the Navy in FY 2018 for use on Aegis BMD ships and at the Aegis Ashore site in Romania, for a total of 182 delivered since December 2013. MDA also plans to deliver in FY 2018 an additional 52 Terminal High Altitude Area Defense (THAAD) interceptors to the Army, for a total of 210 delivered since May 2011. We will also press forward with plans to identify, develop, and field cost-effective solutions to enhance BMDS sensors and discrimination for homeland and regional defenses.

Aegis Ashore Missile Defense System Romania is mission-capable today. In a ceremony held May 12, 2016, U.S. European Command's naval component, U.S. Naval Forces Europe-Africa/U.S. 6th Fleet, deemed Aegis Ashore Romania as operationally certified. In the 2018 timeframe, we will further enhance defensive coverage for NATO Europe against medium- and intermediate-range threats with the deployment of an Aegis Ashore site in Poland and the delivery of the SM-3 Block IIA and associated Aegis BMD weapon system upgrades for Aegis BMD ships and Aegis Ashore sites.

MDA routinely provides Warfighter operational support by performing the mission essential functions of BMDS configuration control, asset management, and operational readiness reporting and by providing an operational-level interface to United States 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 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. We also are working with the Office of the Secretary of Defense on the Ballistic Missile Defense Review, which was mandated in the January 27, 2017 Presidential Memo on Rebuilding the U.S. Armed Forces and the Missile Defense Report.

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 that BMDS capabilities are credibly demonstrated and validated prior to delivery to the Warfighter. We continue to work closely with independent testers within DoD -- the Director, Operational Test and Evaluation; Deputy Assistant Secretary of Defense, Developmental Test & Evaluation; Service Operational Test Agencies; and Combatant Commands, represented by the Joint Forces Component Command for Integrated Missile Defense -- to develop an Integrated Master Test Plan to execute a robust, cost-effective test program.

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 affordably replicated in flight tests. In addition to 27 element-level ground tests, we conducted six developmental and operational system-level ground tests from October 2015 to present. There are three more system-level ground tests scheduled for this fiscal year and seven more planned for FY 2018. 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 provides data for our modeling and simulation and demonstrates the performance functions of the system that ground testing cannot address. The flight test program

continues to increase in operational realism with each successive test as the BMDS matures. 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 with our allies to prove BMD capabilities are integrated and interoperable before they are fielded. From October 2015 to present, we have executed 18 flight tests. For the remainder of FY 2017 we will conduct 10 more flight tests, and in FY 2018 11 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.

This budget takes several steps to improve the effectiveness of the BMDS to defeat increasingly dynamic missile threats and thereby grow the Warfighter's confidence in the system. It increases the capability and capacity of the current missile defense systems. It supports our work with the Combatant Commands and Services to address the growing and highly challenging hypersonic glide vehicle threat today. This budget also pursues advanced technologies in a measured way that leads us to make prudent and affordable investments in game-changing capabilities. We will also continue to engage our allies on contributions to regional missile defense missions, which not only encourages our international partners to take on a greater share of the defense cost burden, but it also helps grow our missile defense capability and capacity.

Homeland Defense

MDA remains committed to operating, sustaining, and expanding our nation's homeland missile defenses and requested $1.5 billion in FY 2018 for the Ground-based Midcourse Defense (GMD) program. We currently have emplaced 36 operational Ground Based Interceptors (GBIs) and plan to expand the GBI fleet to 44 by the end of 2017. The Agency will continue flight and system ground testing of our homeland defenses, continue Redesigned Kill Vehicle (RKV)

development, enhance the Stockpile Reliability Program, and expand the GBI battle space. We will continue developing GMD ground systems hardware/software upgrades and fire control and kill vehicle software to improve discrimination capabilities. We also will add precision and confidence in our reliability assessments by performing failure modes and process analyses, reliability testing, short-circuit and grounding analyses, and verification of our on-going reliability model development efforts.

Increasing GBI Capacity

We fielded eight new Capability Enhancement (CE)-II GBIs in 2015 using the cradled Inertial Measurement Unit upgrade we successfully flew on the June 2014 FTG-06b interceptor. We then removed eight previously delivered CE-II GBIs from the fleet and upgraded them to the configuration proven in FTG-06b. Emplacement of the eighth and final upgraded CE-II GBI was completed in November 2016. We delivered all sixteen of these GBIs, and they are currently available to US Northern Command as part of the operational fleet.

The May 30, 2017 FTG-15 intercept flight test against an ICBM-range target demonstrated the new CE-II Block 1 Exo-atmospheric Kill Vehicle (EKV) and Configuration 2 (C2) 3-stage booster. MDA will begin deliveries in 2017 of nine new GBIs configured with CE-II Block 1 EKVs with the new alternate divert thrusters and three-stage C2 booster vehicles following this successful intercept flight test of those new components. Last year we completed refurbishment of Missile Field 1 at Fort Greely, AK, which provides the additional six silos required to support the 44 GBI total.

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 to provide 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 2019, after which it will be fielded on all boost vehicle configurations.

GMD Testing

The GM CTV-02+ flight test, executed on January 28, 2016, successfully achieved its primary objectives and provided the necessary data to evaluate the performance of the EKV alternate divert thruster and conduct early evaluation of Near Term Discrimination Improvements for Homeland Defense for multiple elements of the BMDS. FTG-15 demonstrated and evaluated the performance of the new CE-II Block 1 EKV and the C2 booster. It also was the first intercept of an ICBM-range target by the GMD system or any other BMDS element. Success of this test will allow MDA to meet the commitment to deliver 44 GBIs by the end of 2017. We plan to conduct the FTG-11 operational intercept flight test in the fourth quarter of FY 2018, which will demonstrate the capability of the GMD system with a two GBI salvo engagement of an ICBM-range target; a 3-stage CE-II Block 1 and 3-stage CE-II salvo will attempt the intercept of a threat representative ICBM target launched from Reagan Test Site, Kwajalein using GBIs launched from Vandenberg Air Force Base, CA.

Redesigned Kill Vehicle and C3 GBI Booster

Reliability is a critical part of how the Warfighter decides upon a shot doctrine, that is, the estimation of how many shots it will take to defeat a credible threat. With a highly reliable interceptor, fewer shots would be required. 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 enhance Combatant Commanders' situational awareness via hit/kill

assessment messages. The program schedule achieves 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 2022 timeframe.

Ground System Upgrades

MDA is continuing with capability upgrades and technology modernization of key ground support and fire control systems components such as the GMD Fire Control (GFC) equipment, Command and Launch Equipment, the GMD Communications Network, and the In-Flight Interceptor Communication System (IFICS) Data Terminal (IDT). This past year the Warfighter accepted the newly constructed IDT at Fort Drum, NY. 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 required for the RKV. Ground system modernization will mitigate obsolescence issues, improve cybersecurity resilience, increase GFC capacity for emerging threat and raid size, reduce life-cycle cost, increase system reliability and operational availability, and simplify the insertion of future technologies.

Homeland Defense Sensors

We are investing in radars and developing advanced electro-optical sensors to achieve a diverse sensor architecture that eventually will provide highly accurate midcourse tracking and discrimination. In this year's budget submission we highlight the continued development of the Long Range Discrimination Radar (LRDR) and our advanced discrimination sensor technology and space-based kill assessment programs that we believe will improve system target

discrimination and assessment capabilities. Improved sensor coverage and interceptor capabilities will help the Warfighter expand the battle-space in order to reengage threats as needed.

We requested $191.1 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 MDA, operate AN/TPY-2 (Forward Based Mode) radars in Japan (one radar at Shariki and the other radar at Kyogamisaki), Israel, Turkey, and U.S. Central Command in support of homeland and regional defense.

We requested $213.5 million to continue the development of advanced discrimination algorithms for the AN/TPY-2, Sea-Based X-band (SBX), and the UEWR radars to counter evolving threats. The discrimination improvement effort will develop and field integrated Element 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. Additionally, MDA is conducting a study to assess the feasibility of a long-range discrimination radar or other appropriate tracking and discrimination sensor capabilities in a location optimized to support the defense of the United States against emerging long-range ballistic missile threats from Iran. MDA requested $84.2 million for 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 requested $130.7 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 at-sea time from 120 to 230 days-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 requested $357.7 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 that provided $155 million for a Shielded Mission Control Facility and Radar Foundation. MDA will begin 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 planned for 2020 leading to an Operational Readiness Acceptance by the Warfighter in the 2022 timeframe.

The BMDS currently provides persistent missile defense of Hawaii through the existing sensor network, C2BMC, and the GMD system. The Sensor Analysis of Alternatives (AoA), conducted by the Department to assess the most cost-effective options for enhanced sensor capability to increase GBI effectiveness against future, more complex threats, found that a next critical near-term step to optimizing tracking and discrimination capabilities in the Pacific is to deploy a radar in the Pacific. The Department is now developing an operational assessment of the

solutions, which includes a radar in Hawaii, the results of which will inform the President's Budget for 2019. We requested $21 million in FY 2018 for the Homeland Defense Radar – Hawaii (HDRH) to conduct source selection activities. This radar will provide a persistent capability, augmented by other sensors to mitigate the effects of the evolving threats to the BMDS, optimize discrimination capability in the Pacific architecture, and increase the defensive capability of GBIs for the enhanced defense of Hawaii.

Regional Defenses

There are hundreds of ballistic missiles within range of U.S. forces and allies worldwide. Our FY 2018 budget request continues to resource the deployment of regional defenses to protect our 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 stage of flight. THAAD provides Combatant Commanders a rapidly deployable capability to deepen, extend, and complement BMDS homeland and regional defenses. THAAD is now 13 for 13 in flight testing. MDA is conducting New Equipment Training for the 6th Battery, which will be ready for operational support later this calendar year. We continue to deliver interceptors for the U.S. inventory and ground equipment for the 6th and 7th U.S. Batteries. We are also executing a Foreign Military Sales case with United Arab Emirates for two THAAD Batteries. MDA continues to provide maintenance and supply support of the first deployed THAAD battery (comprising the THAAD system and AN/TPY-2 radar) in Guam.

Recent provocations further demonstrate the serious threat North Korea poses to the Republic of Korea (ROK), the Asia-Pacific region, and our forward deployed forces. U.S. Pacific

Command deployed the first elements of the THAAD system to the ROK on March 6, implementing the U.S.-ROK Alliance's July 2016 decision to bring the defense capability to the peninsula. The deployment of THAAD (to include the Terminal Mode AN/TPY-2 radar) contributes to a layered missile defense system and enhances the U.S.-ROK Alliance's defense against North Korean missile threats.

The Army and MDA are developing a Memorandum of Agreement (MOA) to transfer the THAAD and AN/TPY-2 systems from MDA to the Army. Research and development of THAAD and AN/TPY-2 radars would remain in MDA. The MOA will address the alignment of lifecycle responsibilities, resources and authorities. The current plan is for the Army and MDA to present the MOA status to the Missile Defense Executive Board later in 2017.

MDA requested $230.2 million across the FYDP for THAAD development efforts. We will continue development of THAAD software upgrades, concept development, and risk reduction activities for THAAD Follow-On that would have advanced capabilities against emerging threats, to include complex scenes and countermeasures. These activities will explore and mature the expansion of THAAD system interoperability with air and missile defense systems to extend THAAD battlespace and defended area. MDA also requested $36.2 million for Terminal Defense Testing. This includes Flight Test Operational-03 Event 2 (FTO-03 E2) in FY 2018 at the Pacific Spaceport Complex-Alaska on Kodiak Island, which will further demonstrate, in an operational scenario, THAAD's ability to conduct coordinated engagements with Aegis BMD and PATRIOT operating with C2BMC and a forward-based AN/TPY-2 radar while engaging an IRBM. THAAD also will execute a flight test tracking event (FTX-35) in FY 2018 at White Sands Missile Range, which will prove THAAD software build 3.0 and test a new

AN/TPY-2 radar configuration with a THAAD battery. This event also will support the Army's Materiel Release.

In FY 2017 THAAD will participate in two flight tests, FTT-18 and FTT-15. In FTT-18 THAAD will demonstrate an intercept of a separating IRBM target using the THAAD radar, launcher, fire control and communication, interceptor operations and engagement operations. FTT-15 will demonstrate the capability of the system to do an endo-atmospheric data collect against an MRBM target with associated objects.

MDA requested $451.6 million to continue procurement of THAAD equipment, including 34 THAAD interceptors in FY 2018. By the end of FY 2018, MDA will deliver 52 additional THAAD interceptors to the U.S. Army, for a total of 210 interceptors delivered. MDA received an incremental production decision in the fourth quarter of FY 2016 for THAAD, authorizing continued production of at least 79 additional interceptors through FY 2020. MDA also requested $78.8 million of Operations and Maintenance funding to support the maintenance and upkeep of all BMDS unique items of the fielded THAAD batteries as well as for all THAAD training devices. In FY 2018 MDA will provide support to seven THAAD batteries.

Aegis Ballistic Missile Defense

Aegis BMD continues to be the backbone 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 2018 budget request supports continued advancement of the system to counter the growing threats.

In FY 2016 we completed three Aegis BMD Weapon System installations on Aegis ships: one Aegis BMD 3.6 to 4.X upgrade and two Aegis BMD 3.6 to Aegis Baseline (BL) 9.C1 (BMD 5.0CU) upgrades. 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 Aegis BMD 3.6 to 4.X destroyer upgrade with completion dates in FY 2017. In FY16, we delivered 33 Standard Missile -3 (SM-3) Block IB missiles. In FY 2017 we began an additional three Aegis BMD Weapons Systems installations on Aegis ships: one Aegis BMD 3.6 to 4.X, one Aegis BMD 3.6 to Aegis BL 9C.1 (BMD 5.0CU), and the first Aegis BL 9.C2 (BMD 5.1) on a non-BMD capable ship. Additionally, we plan to deliver 54 SM-3 Block IB production rounds to the Fleet.

In May 2016, we completed two very successful developmental flight tests to verify the SM-3 Third Stage Rocket Motor Nozzle Engineering Change Proposal (ECP). SM Controlled Test Vehicle (CTV)-01a and SM CTV-02 successfully fired two SM-3 Block IB missiles from an Aegis BMD destroyer at Pacific Missile Range Facility (PMRF) in Hawaii. This ECP successfully addressed the FTM-16 Event 2 and FTM-21 (Missile 2) Failure Review Board recommendations by implementing nozzle design modifications. MDA executed these tests as mandatory prerequisites to both the ECP production cut-in and a future production decision for the SM-3 Block IB program. MDA also plans to execute FTM-26 later this year as an additional intercept flight test of the SM-3 Block IB to support the full production decision.

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. As previously stated, Aegis BMD's FY 2017 milestones include three BMD ship upgrades, 54 SM-3 Block IB missile deliveries, four ground test campaigns, and eight flight tests, including the initial intercept testing of the SM-3 Block IIA missile. We are also planning for the early certification of Aegis BMD 4.1 delivering BMD 5.0CU capability with Sea Based Terminal defense with the SM-6 missile, the installation of the Aegis Ashore Deckhouse and equipment in Poland, and the receipt of an SM-3 Block IB full rate production decision. In FY 2018, we will begin developing

the capability to upgrade the SM-3 Block IB hardware and software to leverage the enhanced capability of the SM-3 Block IIA.

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 delivery of European Phased Adaptive Approach (EPAA) Phase 3 missile defenses. MDA requested a total of $624.1 million in procurement for Aegis BMD, which plays a critical role in both homeland and regional defense. MDA is requesting $425.03 million to procure 34 Aegis SM-3 Block IB missiles along with associated hardware and support costs in FY 2018. By the end of FY 2018, we plan to have 167 Block IBs in inventory. The procurement budget also requested $160.3 million for Aegis BMD Weapon Systems equipment. MDA requested $38.7 million for advance procurement for economic order quantities beginning in FY 2018. MDA will continue to deliver SM-3 Block IBs to the Navy 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 2017 we anticipate having 33 (36 by the end of FY 2018) ships 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 in to a single computer program. We will deliver Aegis BL 5.4 in FY 2019. 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 also will continue computer program development for BMD 6.X 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 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 critical non-intercept flight test (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 the Pacific Missile Range Test Facility (PMRF) in Hawaii, was the first flight of the MRBM Type 3 Phase 2 target. The USS John Paul Jones (DDG 53), an Aegis Baseline 9.C1 (BMD 5.0 CU) configured 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 target launched out of PMRF. In this no-notice test, the sailors on the consoles aboard the USS John Paul Jones 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 gives us greater confidence in the reliability and performance of our Sea Based Terminal defense capabilities. We are planning an additional test of the Sea Based Terminal Increment 1 capability in 2017.

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 in March 2016 for the SM-6 Dual II Sea-Based Terminal defense interceptor and will conduct 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 requested $335.3 million for the SM-3 Block IIA program, to include $9.7 million for the Cooperative Development effort with the Japan Ministry of Defense. 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 December of 2015, a second SM-3 Block IIA controlled flight test was conducted to further test the Kinetic Warhead and Throttleable Divert and Attitude Control System. Then, in February 2017, we successfully conducted an intercept test (SFTM-01) with the SM-3 Block IIA that resulted in the intercept of the MRBM target. This success supports the initial production decision for the SM-3 Block IIA and the Aegis BL 9.C2 (BMD 5.1) certification effort. It was the first intercept by the SM-3 Block IIA from an Aegis BMD ship and the first use of the Aegis BL 9.C2 weapon system. We will conduct a second intercept test in the third quarter of FY 2017 (SFTM-02). Following that test, we will transition to testing the SM-3 Block IIA within the BMDS architecture with the upgraded Aegis Baseline 9 weapon system and BMD 5.1, for at sea and ashore deployment.

We conducted the operationally realistic FTO-02 E1a intercept test in December 2015. The Aegis Ashore Missile Defense Test Complex at PMRF fired the SM-3 Block IB missile to intercept and destroy an air-launched MRBM target. This operational flight test was the first to demonstrate an intercept using the Aegis Ashore test complex and demonstrated important modernization updates to the Aegis Weapon System. 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 operational readiness of EPAA Phase 2 and delivery of Phase 3, which includes delivery of the Aegis Ashore site in Poland. MDA requested $59.7 million in procurement funds to address the multiple actions required to declare technical capability of the Aegis Ashore site in Poland by the end of the calendar year 2018, keep the individual components up to date with the Navy's destroyer modernization plan, and install modifications as required to enhance co-existence with Broadband Wireless Access systems in the European theater.

European Phased Adaptive Approach

We will continue to support the European Phased Adaptive Approach (EPAA) 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. Our efforts to develop, test, and deploy EPAA capabilities enabled NATO Heads of State and Government to declare the achievement of NATO BMD Initial Operational Capability at the July 2016 Warsaw Summit.

Aegis Ashore-Romania is mission capable today. The U.S. Navy operates the site as an integral part of NATO's BMD architecture, which includes 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 operated from Ramstein Air Base, Germany.

EPAA Phase 3 will improve defensive coverage against medium- and intermediate-range threats with the deployment of a second operational Aegis Ashore site in Poland, equipped with the upgraded Aegis Baseline 9 weapon system with BMD 5.1 and capability to launch SM-3 Block IIAs. The 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 the

C2BMC network and AN/TPY-2 sensors, enabling Engage on Remote capability and extended defensive coverage for NATO Europe. Aegis Ashore site construction in Poland began in FY 2016 and MDA will complete its technical capability declaration to meet Phase 3 commitments in the 2018 timeframe.

Command, Control, Battle Management, and Communications

We requested $430.1 million in FY 2018 for Command, Control, Battle Management and Communications (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. 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 the third quarter of FY 2018 C2BMC Spiral 8.2-1 becomes operational in U.S. Northern Command and Pacific Command in support of Enhanced Homeland Defense. Spiral 8.2-1 is a complete hardware update to the C2BMC system that allows C2BMC to integrate data from multiple AN/TPY-2 radars, SBX, UEWR, Upgraded Cobra Dane, and the BMDS Overhead Persistent Infrared (OPIR) architecture. Enhancements include system raid size and tracking capacity increased by a factor of five and improved system Information Assurance/cybersecurity posture. We will complete testing and deployment of C2BMC Spiral 8.2-3 in support of Aegis BMD Engage-on-Remote functionality and EPAA Phase 3. We will continue development of

C2BMC Spiral 8.2-5 to support integration of the LRDR into the BMDS by 2021 to support a Robust Homeland Defense capability. Finally, 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.

Sensors

We are requesting $17.0 million for the Spacebased Kill Assessment (SKA) experiment. Using fast frame, infrared sensors, SKA will deliver an experimental kill assessment capability for GMD defense of the homeland as part of an integrated post intercept assessment solution requested in the FY 2014 NDAA. A network of SKA sensors is to be hosted on commercial satellites. Installation of the SKA payloads onto the host satellites started in December 2016 and will continue into 2017. The DoD/commercial collaboration has proceeded very smoothly and the full SKA network will be on orbit in FY 2018, according to the latest plans from the commercial host.

Also, we requested $34.9 million for continued operation of the Space Tracking and Surveillance System (STSS) and the Missile Defense Space Center (MDSC) in FY 2018. STSS satellites, which were launched in 2007, have far exceeded their life expectancy and have proven to be a very good investment. These satellites operate in low Earth orbit and continue to collect valuable test data. Both the STSS program and the MDSC are also supporting concept development activities for future space sensor architecture studies and analyses to address advanced threats.

The Services and COCOMs, with logistical support from MDA, operate forward-based X-band radars (AN/TPY-2 (Forward Based Mode)) in Japan, Israel, Turkey, and United States Central Command. The AN/TPY-2 (Forward Based Mode and Terminal Mode) radars contribute to regional defense and the defense of the U.S. homeland. For FY 2018, we are requesting $191.1 million to sustain COBRA DANE, the Upgraded Early Warning Radars, and the AN/TPY-2 fleet. MDA continues to support the seven AN/TPY-2 (Terminal Mode) radars delivered to THAAD batteries, including the forward deployed THAAD battery on Guam.

Developing New Capabilities

MDA is making critical investments in technology that we believe will significantly improve system performance and effectiveness. By improving reliability, enhancing discrimination, and expanding battle space, I believe we can reduce the cost per kill. We also need to investigate solutions that reduce reliance on expensive kinetic interceptors. MDA is developing technology to address gaps in the BMDS and dramatically drive down the cost of defending the homeland. With this budget request, we will invest in persistent discrimination in the BMDS sensor architecture, high power lasers, multi-object kill vehicles, and other breakthrough technologies.

MDA requested $5.5 million in Weapons Technology to conduct demonstrations of the technological foundation for a laser system capable of defeating advanced threats and raids more efficiently than existing missile interceptors. We made outstanding progress with high brightness, high efficiency electric laser research at Lawrence Livermore National Laboratory and MIT Lincoln Laboratory over the last several years. In FY 2018, our directed energy program completes key laser scaling and packaging tests at the laboratories and shifts the center of gravity

for our laser research from the laboratory to industry. Laser scaling continues under Technology Maturation Initiatives as part of our unmanned aerial vehicle (UAV)-borne laser program.

We requested $128.4 million for Technology Maturation Initiatives to build on the foundational successes in Weapons Technology and Discrimination Sensor Technology. MDA participated in the Pacific Dragon test campaign in June 2016 with two Reaper aircraft to support improving missile tracking capabilities during the boost phase. In addition, we successfully tested new advanced sensor technology from our ground test beds at MIT Lincoln Laboratory's Firepond facility and at the Mt. Wilson Aerospace facility, tracking objects at operational distances with unprecedented accuracy. In FY 2018 we will integrate an advanced sensor into the tactically proven Multispectral Targeting System and MQ-9 Reaper combination to address precision track of advanced threat weapon systems and discrimination performance of airborne sensors. MDA will continue the design and begin fabrication of a UAV-borne laser for boost phase missile defense. Adding a boost phase layer of sensors and weapons to the missile defense architecture could dramatically increase the performance and efficiency of the BMDS.

MDA requested $259.4 million for the Multi-Object Kill Vehicle (MOKV) Program 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. Last year, through industry partnership, we developed concepts to destroy several objects within a threat complex with multiple kill vehicles deployed from a single interceptor. Based on three prime contractor defined kill vehicle concepts, MDA will invest in technology that reduces risk for the product development phase.

We requested $75.3 million 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 sensor and command and control capability upgrades to address defense from hypersonic threats. To address the hypersonic threat, MDA will perform sensor and weapon technology demonstrations from radars, high altitude drones and then in a space layer. 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 provides incremental capability measured by progress and knowledge points in the following areas: establishes systems engineering needs and requirements to identify alternative material solutions; executes a series of sensor technology demonstrations with small, inexpensive satellites including an overhead miniature sensor experiment for tracking to inform the development strategy; modifies existing BMDS sensors and C2BMC element for hypersonic threats; and defines weapon concepts and investments in key technology to enable a broad set of solutions including kinetic and non-kinetic means both right and left of launch. MDA will execute a series of ground, airborne, and space-based technology demonstrations tracking representative advanced hypersonic threats.

MDA requested $20.2 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. Advanced Research successfully conducted the following tests: a series of structural bend and drop tests for the proposed SM-3 Block IIA lightweight unitary nosecone; a hot fire test for a long duration hot gas valve propulsion system; radiation source testing to improve radiation hardness

of optical components for kill vehicle seeker development; and demonstration of a new insulation material for thermal batteries to improve heat containment. We partnered with industry to develop a Kill Vehicle Modular Open Architecture compliant nanosat testbed for validating kill vehicle component technology. Additionally, we awarded 161 new Small Business Innovation Research and Small Business Technology Transfer contracts for innovative new research in such areas as, sensor resource management, mission assurance, modeling and simulation, big data processing and correlation, propulsion technology, and improved seekers. We conducted research projects with fourteen domestic universities in areas such as combustion instability, counterfeit parts detection, and systems of systems modeling. We are fostering cutting edge research between U.S. and foreign universities of allied nations through international cooperative technology development projects.

We requested $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.

International Cooperation

The FY 2018 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, including joint analyses, partner missile defense acquisition decisions, cooperative research and development projects, deployment of BMD assets, Foreign Military Sales (FMS), and co-production efforts.

The investments of our allies and partners in their own missile defense capabilities allow us to build more effective regional security architectures that complement U.S. regional missile defense capabilities. We are currently executing 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 Initial Operational Capability (IOC) has been declared for the first battery. Site construction for the second battery is ongoing. Once completed, IOC for the second battery is expected in summer 2017. 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 Ballistic Missile Early Warning Study report for the Gulf Cooperation Council (GCC), analyzing sensor and C4I architecture options for defense of the region. We are continuing to discuss the study's findings with the GCC nations.

MDA works with the Israeli Missile Defense Organization (IMDO) in accordance with jointly signed international agreements, and we continue to have a very strong cooperative missile defense partnership with Israel. This budget continues MDA's longstanding support of the 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. Over the past year, IMDO and MDA successfully completed the fifth series of tests of the Stunner Interceptor for the David's Sling Weapon System. Additionally, IOC was declared for Arrow 3 in January 2017 and for David's Sling Weapon System in April 2017. The Department also continues to support coproduction efforts for the Iron Dome program to provide critical defense against short-range rockets and artillery.

We are making significant progress with our Japanese counterparts on the SM-3 Block IIA, our largest co-development effort. The development work and follow-on production efforts, which remain on track for first delivery of the missile in the 2018 timeframe, will support extended deterrence to our friends and allies and establish an important vehicle for closer defense cooperation ties. 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.

Cybersecurity

The Missile Defense Agency is cognizant of the growing cyber threat and we are aggressively working to ensure the Nation's missile defenses are resilient and able to operate in a highly contested cyber environment. We continue to improve the cyber hygiene of our missile defense capabilities by ensuring the cybersecurity infrastructure has the latest security upgrades and patches. 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 further safeguards and enhanced vigilance. As part of these safeguards, MDA has engaged with our defense industrial base corporate partners to ensure cybersecurity is addressed and enforced at all levels of the supply chain. These measures include 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/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 we face, 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 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 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 Commands we are planning for more realistic BMD system level cybersecurity testing in the upcoming ground test campaign and incorporating cybersecurity into future wargaming and exercises as well as more realistic cybersecurity testing for our RDT&E systems. 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 have an impact.

Conclusion

Mr. Chairman and Members of the Subcommittee, in closing, our budget request for Fiscal Year 2018 will continue to increase the capability and capacity of fielded homeland and

regional missile defense systems and make measured investments in advanced technology to reverse the adversary's numerical advantage. 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. Their professionalism and dedication to excellence in the performance of the missile defense mission are unmatched in the world. Our Nation is fortunate to have such a capable fighting force.

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