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OVERVIEW

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Missile Defense Agency

The Missile Defense Agency (MDA) mission is "to develop and deploy a layered Missile Defense System to defend the United States, its deployed forces, allies, and friends from missile attacks in all phases of flight." MDA's budget request of $9.187 billion in Fiscal Year (FY) 2021 will continue the development, rigorous testing and fielding of reliable, increasingly capable, 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. The Agency's priorities for missile defense development and fielding are as follows: 1) build warfighter confidence through focus on readiness and sustainment; 2) increase engagement capability and capacity to outpace emerging threats; and 3) increase speed of delivery of new capability to address the evolving threat. MDA will continue to collaborate closely with Combatant Commanders and the Services to support current and future needs for missile defense capabilities. MDA and these key stakeholders will leverage the existing all-domain Missile Defense System (MDS) to develop integrated architectures and capabilities to counter not only ballistic missiles but also hypersonic and cruise missile threats to the Homeland in the future. This budget request maintains operational missile defense capacity and capabilities for existing homeland and regional defense forces and will continue to increase interceptor inventory while improving existing sensors, command and control, battle management and communications (C2BMC) system, and kill vehicle capabilities to address evolving threats.

MDA remains vigilant of the growing cyber threat and continues to work aggressively to ensure the nation's missile defenses are hardened, resilient, and able to operate in a highly contested cyber threat environment. MDA is strengthening the cyber defensive posture of missile defense capabilities by ensuring the cybersecurity infrastructure has the latest upgrades, and 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 Service Providers (CSSP) across all networks and, where applicable, MDS weapon systems. MDA defends its networks against the advanced persistent cyber threat through its Cybersecurity Emergency Response Team (CERT). This team provides 24/7 network monitoring and defense of over 24 thousand network devices and continues to expand its breadth of coverage. MDA has continuously supported DoD cyberspace efforts by providing timely MDA situational awareness.

I. Missile Threat

Nearly all adversaries are developing more capable ballistic and cruise missiles, due in part to the proliferation of advanced technologies, resulting in systems with global reach, increased speed, and greater accuracy. New ballistic missile systems feature multiple independently targetable reentry vehicles (MIRV) and maneuverable reentry vehicles (MaRV), leading to unpredictable flight paths; along with countermeasures such as decoys and jamming devices, these challenge existing defensive systems. New versions of older missiles are showing improved sensors and maneuver capability for maneuver and precision strike. Some weapon systems have characteristics of both ballistic and cruise missiles, such as ballistic missile-launched hypersonic glide vehicles (HGVs), also called boost-glide systems, essentially unpowered cruise missiles. The combination of high speed, maneuverability, and relatively low altitude makes them challenging targets for missile defense systems (sensors and interceptors). The 2019 Missile Defense Review (MDR) underscored the evolving missile threat, including non-ballistic missiles, emphasizing that missile defense must remain a high priority investment in the National Defense Strategy. The MDR also underscored the Department's continued pursuit of cooperative relations with allies and partners to field interoperable and effective regional missile defenses.

The following discussion summarizes the highlights of the major Program Elements (PE), but does not necessarily examine all funding and activities included within each PE.

II. Homeland Defense

MDA remains committed to developing, delivering, sustaining, and improving the nation's homeland missile defenses. The budget request includes:

- **Ground-Based Midcourse Defense (GMD) *(PE 0603882C).*** MDA is requesting $1.004 billion in FY 2021 for GMD. The GMD element of the Missile Defense System (MDS) provides combatant commands (CCMDs) with a continuously available (24 hours a day, 7 days a week, 365 days a year) capability to defend the homeland against limited Intercontinental Ballistic Missile (ICBM) attacks. The GMD capability consists of Ground Based Interceptors (GBI), GMD Fire Control system (GFC), GMD Communication Network (GCN), In-Flight Interceptor Communications System Data Terminals (IDTs) and ground Launch Support Systems (LSS).

MDA will continue developing, testing and fielding of a Ground System 8 software build that provides a selectable 2/3 stage capability for employment of GBIs, discrimination improvements, integrates Long Range Discrimination Radar with GMD Fire Control, improves Cybersecurity posture, and supports GCN and IDT modernization. MDA will complete the acquisition of five boosters to support flight testing which will ensure the number of fielded GBIs does not decrease through the FYDP. MDA will continue development, testing and integration of the Fort Greely, Alaska (FGA) Missile Field 4 and a new Launch Support System with GMD Ground Systems to increase Silo capacity and modernize Silo Interface Vault equipment in existing Silos.

- **Improved Homeland Defense Interceptors *(PE 0604874C)*.** MDA is requesting $664.1 million in FY 2021 for the Next Generation Interceptor (NGI). On May 23, 2019, Under Secretary of Defense (Research and Engineering) directed the MDA to stop work on the Redesign Kill Vehicle (RKV) development program in order to examine alternatives to the RKV. The analysis determined that the preferred approach is to begin development on a Next Generation Interceptor (NGI). The NGI allows trades between boost vehicle and payload, improves system survivability, and improves performance against projected threats. The Government terminated the RKV program for convenience on August 22, 2019. MDA intends to leverage the valuable technical information developed under RKV to positively influence future designs. In FY 2021, MDA will continue design and development activities for two competitive interceptor development contracts scheduled to be awarded in July 2020. The request will fund initial requirements analysis, design, development, prototyping, and relevant environment testing to mature the booster, payload, sensor(s), and design-specific critical technologies and technology elements.
- **Ground-Based Midcourse Defense Test *(PE 0604887C)*.** MDA is requesting $67.1 million in FY 2021 for the GMD test program, which supports the Integrated Master Test Plan (IMTP) v 21.1. On March 25, 2019, MDA successfully intercepted an advanced ICBM-class target with countermeasures (FTG-11). This was the first salvo engagement resulting in an intercept of a threat representative ICBM-class target with countermeasures by a salvo of two Ground-Based Interceptors launched from Vandenberg Air Force Base (VAFB) missile field in California. All system elements functioned as designed. MDA is developing the capability for the GMD Fire Control to command Interceptor launches in a 2-stage mode in addition to the existing 3-stage mode. This approach

will provide additional homeland defense performance by improving battle-space capability through shorter engagement times without the added expense of a separate 2-stage boost vehicle development program which is scheduled to be flight tested in GM BVT-03 in 1st quarter FY 2021. Although no flight tests will be executed for the NGI until the 2026 timeframe, continued ground testing is an essential requirement to support this critical MDS capability.

- **GMD Maintenance and Sustainment**. MDA is requesting $158.1 million in FY 2021 for the Operation and Maintenance (O&M) of the GMD weapon system. In addition to operation, maintenance and sustainment of the GMD weapon system and operational and support facilities at Fort Greely, Alaska; VAFB; Fort Drum, NY; Schriever AFB, Colorado; and Eareckson Air Station, Alaska, this request includes Warfighter training, wargames, and exercises to maintain readiness.
- **Sea-Based X-band (SBX) Radar *(PE 0603907C*).** MDA is requesting $118.3 million in FY 2021 for the SBX. SBX is an advanced sea-mobile radar that provides precision midcourse tracking and discrimination capabilities. The SBX participates in flight tests to demonstrate discrimination and debris mitigation improvements, as well as operations for homeland defense. The budget request includes funds to continue extended operations for defense of the homeland in the U.S. Indo-Pacific Command (USINDOPACOM) and U.S. Northern Command (USNORTHCOM) areas of responsibility. To address the continued missile threat from North Korea, the budget request includes funds to extend time at sea and conduct contingency operations for defense of the homeland. Specifically, SBX plans approximately 305 days at sea and 60 days for in-port maintenance in FY 2021, and approximately 330 days at sea annually from FY 2022-2025. The budget request also continues the x86 X-Band Radar (XBR) superdome replacement to address obsolete equipment and increase the XBR processing capabilities. The replacement superdome will be fielded in the 2021 timeframe.
- **Long Range Discrimination Radar (LRDR) (*PE 0604873C*).** MDA is requesting $137.3 million in FY 2021 for the LRDR, which will provide persistent long-range midcourse discrimination, precision tracking and hit assessment to support the GMD capability against long-range missile threats from the Pacific theater. LRDR's improved discrimination capability in the Pacific architecture increases the defensive capacity of the homeland defense interceptor inventory by enabling conservation of GBIs. LRDR includes threat discrimination improvements to enhance MDS effectiveness against the evolving threat. LRDR also supports other mission

areas, including Space Situational Awareness. Initial fielding of the LRDR is planned for 2020 leading to an Operational Acceptance by the Warfighter in the 2022 timeframe. MDA's request includes funding for software Independent Verification and Validation (IV&V), Modeling and Simulation (M&S) efforts, and development of software for tracking and discrimination improvements and refined space intelligence data.

- **Aegis Homeland Defense Tier *(PE 0603892C)*.** As part of the overall Aegis BMD budget request, MDA is requesting $39.2 million in FY 2021, to provide greater depth of defense to the homeland consistent with the approach of fielding a layered Missile Defense System. MDA plans to assess the Aegis BMD weapon system to determine whether it can be upgraded to augment homeland defenses by supplementing the GMD system to defeat ICBM threats.
- **THAAD Homeland Defense Tier *(PE 0603881C)*.** As part of the overall BMD Terminal Defense budget request, MDA is requesting $139.0 million in FY 2021. MDA will initiate the development and demonstration of a new interceptor prototype to support Contiguous United States Defense as part of the tiered homeland defense effort. This effort will develop prototype software and hardware and perform a series of demonstrations to prove the technologies to enable expansion of engagement options and coverage areas for the THAAD weapon system in a flight test in FY 2023.

III. Regional Defense

There are hundreds of theater-range missile systems deployed worldwide. The FY 2021 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 Short-Range Ballistic Missiles (SRBMs), Medium-Range Ballistic Missiles (MRBMs), and Intermediate-Range Ballistic Missiles (IRBMs) and potentially regional hypersonic offensive weapon systems. 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 tracking capability. Aegis BMD capitalizes on and evolves the existing United States Navy Aegis Weapons System (AWS) and Standard Missile (SM) infrastructures. Aegis BMD provides a forward-deployable, mobile capability to detect and track ballistic missiles of all ranges, and has the ability to destroy SRBMs and MRBMs in

both the midcourse and terminal phases of flight and IRBMs in the midcourse phase of flight. The FY 2021 budget request supports continued advancement of the Aegis BMD system to counter growing and more complex threats, including improvements in system reliability and missile reliability as well as increases in Aegis BMD engagement capacity and lethality. MDA continues to support the European Phased Adaptive Approach (EPAA) as the U.S. contribution to the North Atlantic Treaty Organization's (NATO's) BMD capability, providing coverage and protection of NATO's European territory, populations, and forces against the increasing ballistic missile threat from outside the Euro-Atlantic region. Currently, there is an operational Aegis Ashore site located in Romania and another under construction in Poland. Additional U.S. contributions to NATO BMD include a forward-based AN/TPY-2 radar in Turkey, four BMD-capable Aegis destroyers with SM-3 missiles, homeported in Rota, Spain, and a command-and-control node at Ramstein Air Base, Germany. Continued provocations from North Korea demonstrate the serious threat North Korea poses to the Republic of Korea (ROK), Japan, the Asia-Pacific region, and U.S. forward-deployed forces. MDA continues to provide training, maintenance and supply support to the THAAD batteries (including its Terminal Mode AN/TPY-2 radar) stationed in the USINDOPACOM area of responsibility. THAAD is a rapidly deployable missile defense system that can augment the MDS globally as demonstrated in the Dynamic Employment to South Korea, Israel and Romania. MDA also supports U.S. forward deployed forces with Navy Aegis BMD ships stationed in Japan.

Both the Aegis BMD and THAAD systems continue to be key components of the Nation's regional defense for our deployed forces, allies, partners and friends. MDA proposes to continue funding the development, procurement, testing, operations and sustainment of these systems. The budget request includes:

- **Aegis *(PE 0603892C)*.** MDA requests $814.9 million in FY 2021 for Aegis BMD (includes funding for Aegis Homeland Defense Tier). The program includes the integration of the SM-3 Block IIA into the Aegis BMD weapon system, transition of the Kinetic Warhead hardware commonality effort to system integration testing, and pre-production of all-up-rounds to support initial deployment. MDA is strongly committed to maintaining and enhancing the Aegis BMD weapon system capability, in alignment with Navy requirements, to improve performance against SRBMs, MRBMs, and IRBMs, as well as demonstrate capability against

ICBM threats. Utilizing improved radar discrimination, Aegis BMD will increase capability against longer range and more sophisticated threats across three main weapon system product lines: BMD 5.1, BMD 4.2, and BMD 6.0. MDA continues to provide additional software capability development to upgrade Integrated Air and Missile Defense (IAMD) Baseline 9.C2 (BMD 5.1) in support of countering advanced threats and capabilities. MDA also continues software development for Aegis Baseline 5.4.1 (BMD 4.2) and the IAMD Baseline 10 (BMD 6.0). Both Baselines bring enhanced weapon system functionality using more capable radars. BMD 4.2 is a joint effort with the U.S. Navy that refurbishes existing ship AN/SPY-1 radar arrays with the installation of antenna Low Noise Amplifiers (LNAs) to provide increased radar sensitivity, discrimination improvements, and an increased threat set. The BMD 6.0 computer upgrade will integrate BMD capability with data provided by the Advanced Air and Missile Defense Radar (AMDR), also known as the AN/SPY-6, for enhanced engagement capability and increased raid capacity. Additionally, MDA continues upgrading the SM-3 Block IB hardware and software to leverage the capability of the SM-3 Block IIA.

- **Land Based SM-3 *(0604880C).*** MDA is requesting $56.6 million in FY21 to modernize, develop, and test Aegis Ashore capability improvements at the Aegis Ashore Missile Defense Test Complex (AAMDTC) in Hawaii for implementation at operational sites. Funding also supports operations at the site in Romania and completion of construction at the site in Poland. In FY 2021 MDA will initiate High-Altitude Electromagnetic Pulse (HEMP) Combat System hardening in Romania. Land Based SM-3 provides an Aegis Ashore exo-atmospheric defense against short to intermediate-range ballistic missile threats in the later stages of flight.
- **Aegis Testing *(PE 0604878C).*** MDA is requesting $170.9 million in FY 2021 for the Aegis BMD test program, which supports IMTP v 21.1. Aegis BMD Flight Test Program performs comprehensive testing of Aegis BMD components and demonstrates their interoperability with the MDS. Using accredited Modeling and Simulation (M&S), the ground test program provides the evidence required to transition the capability to the Operational Capacity Baseline. MDA will conduct a flight test (FTM-44) to meet the 2018 NDAA requirement to demonstrate an Aegis SM-3 Block IIA capability against an ICBM-class threat that, if proven, would provide additional, complementary homeland protection to supplement the currently operational GMD system. MDA will conduct this demonstration no later than December 2020.

- **Aegis Procurement**. MDA requests a total of $619.4 million in FY 2021 for SM-3 Procurement. The request procures 34 Aegis SM-3 Block IB and 6 Aegis SM-3 Block IIA missiles. Each missile variant can be used on Aegis BMD ships and at the Aegis Ashore sites in Romania and Poland. The request provides a five-year Multiyear Procurement for Aegis SM-3 Block IB missiles ending in FY 2023. The procurement budget also requests $104.2 million for Aegis BMD weapon systems consisting of Aegis shipset equipment, software, and installation materials. The budget also requests $39.1 million for installation of the combat system and combat structure adaptation at the Aegis Ashore site in Poland.
- **Aegis Maintenance and Sustainment.** MDA is requesting $80.4 million in FY 2021 in Operation and Maintenance (O&M) funding. The Aegis BMD program will perform missile recertification, repair efforts, and Ordnance Assessment/Surveillance. This funding also supports sustainment of BMD Computer Programs, Ship Equipment, and Aegis Ashore Romania, as well as Fleet integration support.

Also key to regional defense capability is the Terminal High Altitude Area Defense (THAAD) weapon system. THAAD is a globally-transportable, ground-based missile defense system that is highly effective against short-, medium-, and limited intermediate-range ballistic missile threats inside and outside the atmosphere in the terminal phase of flight. THAAD provides unique, cost-effective, and rapidly deployable capability to the Combatant Commanders to deepen, extend, and complement MDS homeland and regional defenses. MDA currently supports forward-deployment of two batteries stationed in the USINDOPACOM area of responsibility.

Specific to THAAD, MDA's request includes:

- **Terminal Defense *(PE 0603881C)*.** MDA is requesting $412.6 million for THAAD development efforts in FY 2021 (includes funding for THAAD Homeland Defense Tier). MDA will continue the development of multiple, independent THAAD software upgrades to address the evolving threat, improve the Warfighter's defense planning and, improved capability to engage SRBM, MRBM, and limited IRBM threats. THAAD development and integration will provide enhanced debris mitigation capability, and improved interoperability with other MDS elements. MDA continues development efforts that provides enhanced THAAD capability against specific USINDOPACOM threats, integrates THAAD's capability to detect and track threat ballistic missiles at

longer ranges with the Patriot Advanced Capability-3 Missile Segment Enhancement (PAC-3 MSE) to take advantage of its full kinematic capability, and integrates MSE launchers and missiles into the THAAD weapon system.

- **Terminal Defense Testing (*PE 0604876C*)**. MDA requests $7.8 million for Terminal Defense Testing in FY 2021, which supports IMTP v 21.1. This includes flight testing, ground testing, test operations and infrastructure, wargames and exercises. THAAD will also start preparation, in FY 2021, for a flight test to demonstrate a simultaneous engagement of an IRBM and a MRBM using a THAAD interceptor and a Patriot MSE interceptor.
- **THAAD Procurement**. MDA is requesting $495.4 million for THAAD procurement in FY 2021 for 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 cyber threats.
- **THAAD Operations and Maintenance.** MDA is requesting $90.5 million for Operations and Maintenance (O&M) in FY 2021 to support the maintenance and upkeep of all MDS-unique items of the fielded U.S. THAAD batteries and for all THAAD training devices. In FY 2021, MDA will provide support to seven THAAD batteries, including the two forward-batteries stationed in the USINDOPACOM area of responsibility and is prepared to support the U.S. Army in any future deployments around the world.

IV. Developing New Capabilities

MDA is investing in advanced technology today to prepare for tomorrow's threats by improving system performance and effectiveness. This budget request will continue development of technology improvements for the current MDS, along with breakthrough technologies for integration into future missile defense architectures. These efforts include, but are not limited to, advanced discrimination techniques, and hypersonic defense technology. MDA is investigating solutions that reduce the cost per kill while addressing MDS performance gaps, to improve homeland defense performance at dramatically reduced cost.

- **Hypersonic Defense *(PE 0604181C)*.** MDA requests $206.8 million for FY 2021 for Hypersonic Defense. MDA continues to define concepts and develop engineering requirements for future missile defense configurations that keep pace with evolving threats. MDA will pursue a Regional Glide Phase Weapon System for hypersonic defense and leverage existing systems, while developing and

maturing technologies that augment future hypersonic defense architectures. These integrated sets of enhancements will provide incremental capabilities measured by progress and knowledge points.

- **Technology Maturation Initiatives (*PE 0604115C*)**. MDA is requesting $67.4 million in FY 2021 for Technology Maturation Initiatives (TMI). TMI includes demonstration of sensor capabilities against ballistic targets and advanced threats to improve tracking performance and operational utility. MDA will begin integration of an advanced sensor system on an aircraft mounted pod and conduct active ground tests and subsystem level flight tests to improve tracking precision to Aegis engage-on-remote and discrimination performance levels with the goal of integrating the advanced sensor technologies into future missile defense platforms and architectures.
- **Advanced Research Program *(PE 0603180C)*.** MDA is requesting $18.7 million in FY 2021, to conduct innovative research and development with small businesses, universities, and international partners to seek emerging technology and advance future missile defense capabilities. MDA continues to capitalize on the creativity and innovation of the nation's small business community, academia, and other partners to enhance missile defense.
- **Common Kill Vehicle Technology *(PE 0603294C)*.** MDA is requesting $11.1 million in FY 2021, to pursue multiple component and weapon system technology risk reduction efforts. The efforts pursued under the Common Kill Vehicle Technology program element will develop weapon systems concepts, identify key technology gaps, and mature technologies that reduce or eliminate these performance gaps. In addition, these efforts will help in the development of system requirements that are feasible and affordable for the engineering, manufacturing and development of future missile defense weapon systems.
- **Advanced Concepts & Performance Assessment *(PE 0603176C)*.** MDA is requesting $14.9 million in FY 2021 to centralize advanced technology concept modeling, simulation, and performance analysis. Advanced Concepts & Performance Assessment's focus is on the exploration of novel and emerging capabilities that may have the potential to enhance missile defense. The request will fund independent government assessments of industry sensor, directed energy, and weapon system technology concepts and mature related tracking, discrimination, and sensor fusion algorithms. Assessment activities include development of Hypersonic

Defense, Artificial Intelligence and Machine Learning Initiatives, and Left-through-Right Integration key technology areas. The innovative structured concept definition and assessment methodology enables MDA to validate focus areas, verify contractor technology solutions, and evaluate promising concepts for use in future missile defense architectures. This program element supports the monitoring and tracking of cybersecurity mitigations, as well as the exploration of cyber effects on emerging technology.

V. Space

- **Space Program *(PE 1206895C).*** MDA is requesting $32.1 million in FY 2021 for BMD Space Programs. This request funds the Spacebased Kill Assessment (SKA) project, which uses a network of fast rate infrared sensors hosted on commercial satellites to deliver a hit and kill assessment capability for homeland defense. As MDA's pathfinder program to host military payloads on commercial satellites, SKA proved that commercial hosting can deploy assets on orbit quickly – around half the time of the average traditional space program – and at significant cost savings. SKA sensors on orbit today have participated successfully in a variety of MDA flight tests and engineering activities, to include the collection of data for hit assessment in FTG-11. In FY 2021 MDA will develop and ground test hit assessment algorithms, and continue integration of SKA messages into the MDS in support of its efforts to add the SKA capability to the operational MDS.
- **Space Tracking and Surveillance System (STSS) satellite operations and sustainment (*PE 1206893C*).** MDA is requesting $34.1 million in FY 2021for STSS operations and sustainment. STSS consists of two satellites operating in Low Earth Orbit and provides risk reduction data for a future operational MDS tracking and surveillance constellation in the areas of sensor management, target signatures, discrimination, scene characterization, and fire control loop closure. STSS will continue participating in MDA test events and data collections providing battlespace awareness, technical intelligence, and space situational awareness to the Warfighter. This request also funds the Missile Defense Space Center (MDSC), which provides a collaborative environment to exploit and integrate STSS and other national security space assets for ballistic missile defense. Both the STSS program and the MDSC also support concept development activities for space sensor architecture studies and analyses to address advanced threats.

VI. Other Program Highlights

- **Radars Program Maintenance and Sustainment** supports both homeland and regional defense missions. MDA is requesting $176.9 million in FY 2021 to sustain AN/TPY-2 radars, COBRA DANE, and the Upgraded Early Warning Radars (UEWR). The Services and Combatant Commands, with logistical support from MDA, operate AN/TPY-2 (Forward Based Mode) radars in Japan (two radars), Israel, Turkey, and United States Central Command (USCENTCOM) in support of regional defense. MDA continues to support the AN/TPY-2 radar (Terminal Mode) as part of forward-deployed THAAD batteries in the USINDOPACOM area of responsibility.
- **Sensors *(PE 0603884C*).** MDA is requesting $282.0 million in FY 2021 to provide software updates for the AN/TPY-2, COBRA DANE, SBX, and UEWR radars to counter evolving threats, and to develop future radar capabilities through system engineering, software development, and testing. MDA is investing in a robust sensor architecture that supports MDS weapons systems built on a foundation of ground-based fire control radars to provide highly accurate midcourse tracking, discrimination and battle damage assessment for homeland missile defense. The request includes funding for the development of advanced discrimination algorithms for the AN/TPY-2 and SBX radars to counter evolving threats. The improvements will develop and field integrated capabilities to improve the MDS ability to identify lethal and non-lethal objects.
- **Sensors Test (*PE 0604879C)*.** MDA is requesting $76.5 million in FY 2021 for Sensors testing. This includes planning, analysis and execution of MDS flight test events, including pre- and post-test efforts such as Digital and Hardware-in-the-Loop (HWIL) System Pre-Mission Tests and System Post-Flight Reconstruction. Sensor tests also provides planning, analysis and execution in accordance with the ground test Concept of Operations (CONOPS) for MDS-level ground tests identified in the IMTP v 21.1, as well as support to HWIL infrastructure.
- **Command and Control, Battle Management and Communication (C2BMC) *(PE 0603896C)*.** MDA is requesting $593.4 million in FY 2021 for 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. MDA's C2BMC capabilities support Warfighter command, control and battle management needs across the globe by providing the Combatant

Commander with management and user nodes, the BMD planner, situational awareness tools, and battle management capability to support global missile defense situational awareness, coalition operations, weapons release authority for homeland defense, and to control and task a variety of MDS radars. C2BMC operators and maintainers deploy to some of the world's most threatening regions, and continue to provide around-the-clock support to the local commanders. In FY 2021, MDA will sustain the C2BMC fielded capability (Spiral 8.2-3) in USNORTHCOM, USINDOPACOM, USEUCOM and USCENTCOM Areas of Responsibilities, which includes the following capability: Mobile Sensor Phase 1 and BMDS Overhead Persistent Infra-Red Architecture (BOA) 6.1 track data to the MDS; support for Space Situational Awareness with Hardened AN/TPY-2 radars; and Aegis engage-on-remote, which can provide a seven-fold increase in defended area coverage when compared to individual weapon system organic capability; and provide Protected Anti-Scintillation Anti-Jam Net-Centric support for continued communications between sites and Combatant Commands. MDA will continue development of Spiral 8.2-5, which integrates LRDR into the MDS for support of homeland defense. This spiral provides initial situational awareness and tracking capability for hypersonic threats; significantly expands Space Domain Awareness capabilities for the Air Force with LRDR; integrates the Army's IAMD Battle Management System into the MDS; and develops Initial MDS System Track for homeland defense. MDA will initiate development tasks for Robust Post Intercept Assessment supporting our homeland defense focus and MDS shoot-assess-shoot capability. MDA continues to improve the MDS 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, using the BOA. Finally, MDA will continue to update its architecture to increase cybersecurity by assessing the risk of C2BMC architecture against possible attack. C2BMC capabilities will be involved in multi-agency cyber-focused tests and assessments planned for in FY 2021 to identify and correct cyber vulnerabilities.

- **MDA Engineering *(PE 0603890C, Budget Projects MD24, MD31, MT23)*.** MDA is requesting $317.7 million in FY 2021 to perform the system-level engineering required to design, build, test, assess and field the integrated MDS. MDA Engineering defines missile defense architectures and functional requirements for integrated MDS capabilities to defeat the evolving threats, enables

interoperability between U.S. forces and international partners, and drives future capability development from a system perspective to maximize the effectiveness of missile defense technologies. MDA Engineering also performs pre- and post-mission analysis for MDS tests, and assesses MDS performance in order to deliver capabilities to the warfighter. MDA employs system-level and element-level models and simulations to verify MDS performance and assess MDS capability to engage and defeat complex threats across a spectrum of scenarios that cannot be demonstrated in flight tests. As a result, MDA is able to deliver evolving, integrated, and layered MDS capabilities to the Warfighter that have been thoroughly assessed and validated through testing and Modeling and Simulation. In this budget, MDA is continuing to improve both system-level digital simulation and integrated system-level ground test simulations.

- **MDA Testing**. MDA plans and executes a fully integrated test program that synchronizes the system under test with the Warfighters trained to operate the system under varying wartime conditions against current and emerging threats. In collaboration with stakeholders, the IMTP identifies and incorporates all testing requirements into a comprehensive, highly integrated, cost-effective series of flight tests, ground tests, cybersecurity tests, exercises, and wargames. IMTP Stakeholders, who are also signatories, include: Director, Operational Test & Evaluation (DOT&E); Deputy Director, Developmental Test, Evaluation and Prototyping (DDTE&P); Commander, Joint Functional Component Command for Integrated Missile Defense (JFCC IMD) representing Combatant Commands (CCMD); Commander, Army Test and Evaluation Command (ATEC); Commander, Air Force Operational Test and Evaluation Center (AFOTEC); Commander, Operational Test and Evaluation Force (COMOPTEVFOR); and Commander, Joint Interoperability Test Command (JITC). For flight testing, the Agency incorporates the nine operational realism criteria defined by the Ballistic Missile Defense System Response to National Defense Authorization Act Section 234, for Fiscal Year 2005, Increasing Operational Realism. For system-level ground testing, all tests culminate in operational testing with Warfighters on console and independent operational assessments by the MDS Operational Test Agency Team. This ensures that MDS capabilities are credibly demonstrated and validated prior to delivery to the Warfighter. IMTP v 21.1 supports MDA's programming strategy and test priorities. This test program captures new Flight Tests for SM-3 Block IIA production cut-in as well as demonstrations

against targets with countermeasures; a flight test in support of THAAD 4.0 Global Materiel Release to maintain THAAD annual test cadence; operational tests for Aegis BMD Baseline 5.4.1 and a demonstration of regional/theater air and missile defense capabilities; updates on planning for cybersecurity testing through the Future Years Defense Plan (FYDP); refinements on test planning for system-level ground testing; updates to reflect the GMD test program plan; and an investment in the development of the Modified Ballistic Re-entry Vehicles (MBRV) Front End for future testing. MDA also allocates funding for hypersonic partner flight tests in FY 2021 to be identified, requirements defined, and assets deconflicted.

- **Israeli Programs.** MDA's work with the Israeli Missile Defense Organization is a testament to the strong missile defense partnership we maintain with Israel. MDA is requesting $500 million for Israeli programs in FY 2021. This funding level remains consistent with the Memorandum of Understanding that the United States and Israel signed in 2016. This budget continues MDA's longstanding support of U.S.-Israeli Cooperative Programs, to include the co-development and co-production of the David's Sling Weapon System 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. In FY 2021, the MDA budget will also support several flight tests across the Israeli portfolio. These continued joint efforts provide Israel with a three-tiered defense to defend itself from ballistic missiles, rockets, and cruise missiles and ensures Israel maintains its qualitative military edge against its advisories.

VII. Summary

MDA requests $9.187 billion in FY 2021 for comprehensive missile defense development efforts to build warfighter confidence through focus on readiness and sustainment, increase capability and capacity of fielded homeland and regional defense systems, and increase the speed of delivery of advanced technology to counter the advanced missile threat.