MISSILE DEFENSE AGENCY

FISCAL YEAR (FY) 2019 BUDGET ESTIMATES

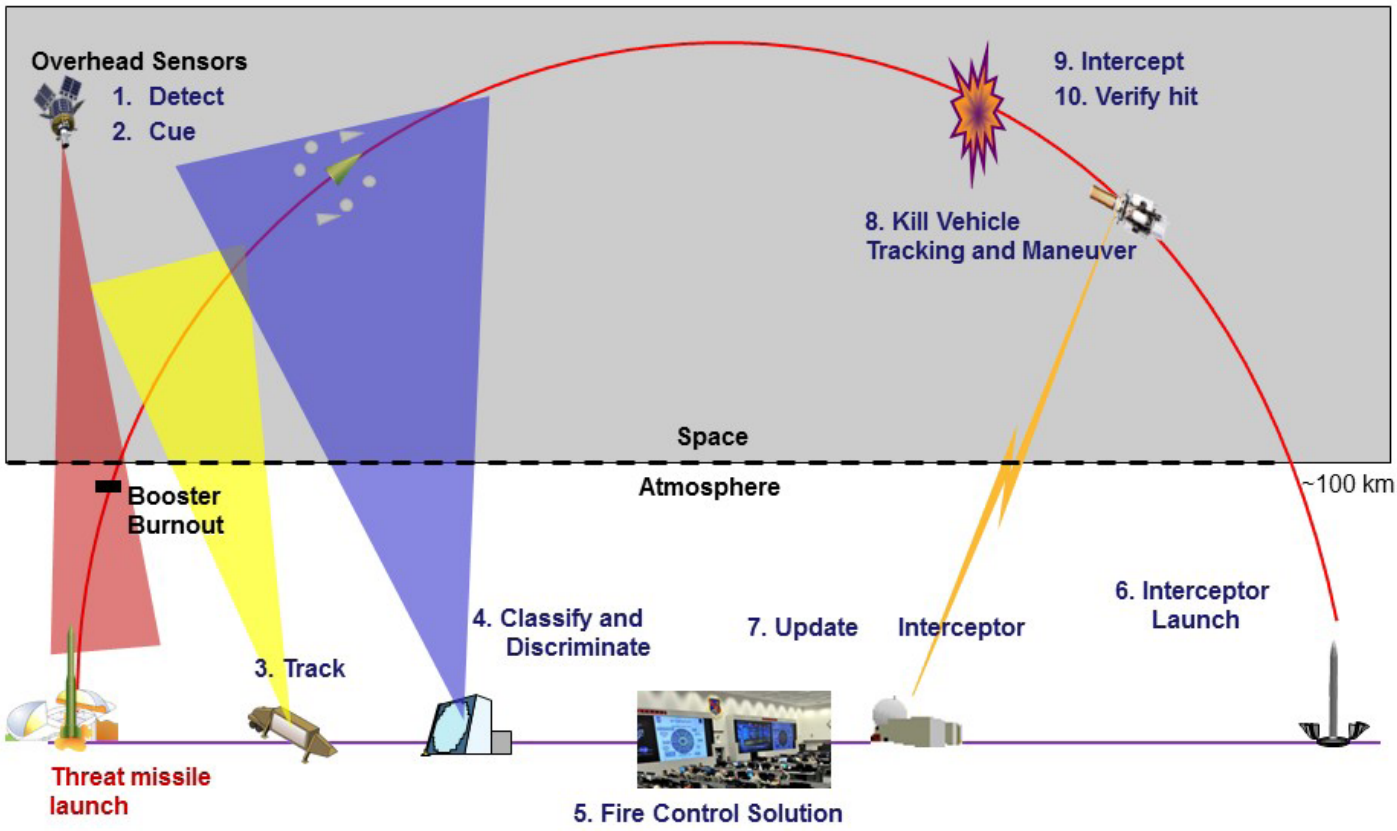
OVERVIEW

Approved for Public Release
Public Release 18-MAR-9507 – President's Budget Overview

The Missile Defense Agency (MDA) Requests $9.9 Billion in Fiscal Year (FY) 2019

MDA fully supports the National Defense Strategy with its FY 2019 President's Budget request, allowing the nation to: Compete, Deter, and Win. MDA will support the strategy with the continued development and deployment of an integrated, layered missile defense system to defeat current and projected missile threats.

An ICBM can travel at extremely high speeds—at times more than 15,000 mph, or almost 20 times the speed of sound. Kinetic energy interceptors can travel fast enough to create closing speeds exceeding 25,000 mph. The speeds, trajectories, and points of launch that must be considered always change. In missile defense, everything is about precision. The BMDS must not only work in terms of milliseconds, but the missiles and warheads the system is targeting have bull's-eyes measured in centimeters.



10 Steps To Missile Intercept

The FY 2019 request supports missile defense acceleration initiated in the FY 2017 Above Threshold Reprogramming (ATR) and the FY 2018 Budget Amendment (BA). The BA addresses the rapidly developing threat by increasing current capacity, expanding the sensor network and accelerating missile defense technology development. Recent escalation of the threat from North Korea has demonstrated an advanced and accelerated capability. The FY 2018 Budget Amendment request, for MDA, is in direct response to this increased threat.

North Korean ICBM Launch – 2017

Nearly all of our adversaries are concerned with U.S. missile defenses and are devising various means aimed at complicating missile defense operations. North Korea is committed to developing a long-range, nuclear-armed missile that is capable of posing a direct threat to the United States. In July 2017, North Korea launched two Hwasong-14 intercontinental ballistic missiles (ICBMs) that impacted in the Sea of Japan, and on 28 November it launched another, larger Hwasong-15 ICBM on a highly-lofted trajectory that, at a lower trajectory, could theoretically reach all of the continental United States. Over the past year North Korea conducted an aggressive intermediate-range ballistic missile testing campaign and is developing a cold-launched, solid-fueled submarine-launched ballistic missile. Today North Korea fields hundreds of Scud and No Dong missiles that can reach U.S. forces forward deployed to the Republic of Korea and Japan. Iran is fielding increased numbers of theater ballistic missiles, improving its existing inventory, and is developing technical capabilities to produce an ICBM, and this effort is benefiting from its ballistic missile and space launch vehicle programs. Iran's ballistic missiles are capable of striking targets throughout the region, ranging as far as southeastern Europe.

Iranian Simorgh Space Launch – 2017

The FY 2019 MDA request strengthens and expands the defenses for our nation, deployed forces, allies, and international partners against increasingly capable missile threats. The missile defense program will continue to support the warfighter and needs of the Combatant Commanders with the development, testing, deployment, integration and sustainment of interceptors, sensors, and the command, control, battle management and communications (C2BMC) system for the Ballistic Missile Defense System (BMDS). The program continues to invest in homeland and regional missile defense priorities and in advanced technology development and future capabilities to counter the proliferation of increasingly complex and diverse threats. The Missile Defense Agency is aware of the growing cyber threat and is aggressively working to ensure the nation's missile defenses are resilient and able to operate in a highly

contested cyber environment. MDA remains focused on supporting the DoD Cybersecurity Campaign through implementation of the DoD Cybersecurity Discipline Implementation Plan.

The following discussion provides a summary of highlights of the major program elements, but does not necessarily examine all funding and activities included within each program element.

I. HOMELAND DEFENSE

With this budget request, MDA expands homeland defense while operating, sustaining, and improving our nation's homeland missile defenses. The request includes:

- **Ground-based Midcourse Defense (GMD) (PE 0603882C).** MDA is requesting $926.4 million in FY 2019. MDA will work to strengthen and expand homeland missile defense by continuing a new missile field (MILCON funded in FY18 BA) and deploying 20 additional Ground-Based Interceptors (GBI) at Ft. Greely, Alaska (FGA) bringing the total deployed GBIs from 44 to 64 in the 2023 timeframe. Additionally, MDA will ensure the number of fielded GBIs is sustained at 64 while performing GBI sustainment, upgrades and maintenance by adding two additional silos in Missile Field #1 at FGA and purchasing six additional Configuration 2 (C2) boost vehicles.

Capability Enhancement-II GBI Emplacements

- The construction associated with addition of two silos will be accomplished with $8 million of FY 2019 MILCON funds. MDA continues the development and expansion of long-range GMD capabilities. In November 2017, MDA emplaced the 44th GBI at Fort Greely, which completed the work to increase the number of operational GBI from 32 to 44, with 40 GBIs currently deployed at FGA, and four GBIs at Vandenberg Air Force Base (VAFB) in California. MDA will upgrade the capability of key Ground Systems and Fire Control systems components such as the GMD Fire Control (GFC) equipment, the GMD Communications Network (GCN).

Missile Field 1 – Fort Greely, Alaska

- The GFC upgrades will enable On-Demand Communications (ODC) required for the Redesigned Kill Vehicle (RKV), BMDS System Track, 2- or/3-stage selectable GBI battle management, Mid-Term Discrimination

East Coast In-Flight Interceptor Communication System Data Terminal

enhancements, and other GFC-Warfighter interface and logic improvements. Technology modernization will mitigate obsolescence issues, improve cybersecurity resilience, increase GFC capabilities for emerging threat and raid size, reduce life-cycle cost, increase system reliability and operational availability, and simplify the insertion of future technologies. Additionally, this PE provides funding for System Engineering and Integration to include requirements development and analysis, modeling and simulation (M&S) development, M&S verification, validation, and accreditation, and software independent verification and analysis.

Ground Based Interceptor Missile Field, Fort Greely, Alaska

- **Improved Homeland Defense Interceptors (PE 0604874C).** MDA is requesting $561.2 million in FY2019. The RKV will make homeland defenses more robust, help address the evolving threat, enhance kill vehicle reliability, improve in-flight communications to better leverage off-board sensor data, and enhance Combatant Commanders' situational awareness via additional hit/kill assessment messages. We anticipate deploying the RKV beginning in the 2021 timeframe in the new missile field at Fort Greely, AK. MDA is also beginning the development of a new booster, the Configuration 3 (C3) booster, which improves upon the C2 booster design by addressing obsolescence and enhancing survivability.
- **GMD Procurement.** MDA is requesting $524 million in FY 2019 to support the construction of 20 additional silos and the emplacement of 20 additional GBIs at Fort Greely, AK.

- **Ground-based Midcourse Defense Test (PE 0604887C).** MDA is requesting $81.9 million in FY 2019. This GMD Test program supports the Integrated Master Test Plan (IMTP). On May 30, 2017, MDA successfully intercepted an intercontinental ballistic missile target with countermeasures during a test of the GMD element of the BMDS. The test demonstrated a GBI configuration with a three-stage C2 booster vehicle and a CE-II Block 1 Exo-atmospheric Kill Vehicle (EKV) that contains alternate divert thrusters. This budget request includes funding a GBI salvo test in FY 2019. MDA will also conduct a Controlled Test Vehicle test, a non-intercept flight characterization mission using an air-launched intermediate range ballistic missile to collect RKV flight environment data using a GBI launched from VAFB in FY 2020. The budget also includes execution of ground test campaigns to support fielding of new BMDS capabilities.

- **GMD Maintenance and Sustainment.** MDA is requesting $147.2 million in FY 2019 for the Operation and Maintenance (O&M) of the GMD weapon system. This includes operations, maintenance and sustainment of the GMD weapon system and operational and support facilities at FGA and VAFB. It also includes Warfighter training, wargames, and exercises to improve readiness.

- **Long Range Discrimination Radar (LRDR) (PE 0604873C).** MDA is requesting $164.6 million in FY 2019. The LRDR is a midcourse sensor that will improve BMDS target discrimination capability while supporting more efficient use of the GMD interceptor inventory. In FY 2019, MDA will complete the receipt of LRDR hardware, manufacturing and assembly of Array #1 and #2 and factory acceptance testing (FAT) on the arrays. MDA will initiate emplacement/installation and calibration of the first delivered array on-site at Clear Air Force Station (CAFS), AK. The LRDR site will be constructed as two separate military construction (MILCON) projects. Phase 1 ($155 million, FY 2017) funded a Shielded Mission Control Facility and Radar Foundation. MDA began military construction of Phase 1 in FY 2017. Phase 2 ($174 million, FY 2019) funds the shielded Power Plant that includes fuel storage, a maintenance facility, and associated site support, beginning in FY 2019. Initial fielding of the LRDR is planned for 2020 leading to an operational readiness acceptance by the warfighter in the 2022 timeframe.

Long-Range Discrimination Radar
Clear Air Force Station, Alaska

- **Pacific Discriminating Radar (PE 0604673C).** MDA is requesting $95.8M in FY19 to design and build two discriminating radars in the Pacific. For the first radar, called the Homeland Defense Radar - Hawaii (HDR-H), MDA is requesting $62.2 million in FY 2019 (Budget Project MD41). The HDR-H radar will provide a persistent long-range acquisition and discrimination capability, augmented by other sensors, to mitigate the effects of evolving threats to the BMDS. The HDR-H optimizes discrimination capability in the Pacific architecture and increases the ability of GBIs to enhance the defense of Hawaii. The radar also supports additional mission areas including Space Situational Awareness. MDA plans to competitively award this radar by the end of FY 2018 as delivery order #1 on a fixed-price indefinite delivery/indefinite quantity (IDIQ) contract to manage, develop, build and integrate, test, and field the radar prime mission equipment. Scope includes options for limited term sustainment during transition and transfer to the lead service. The radar prime contractor will deliver a full technical data package which will enable the government to effectively and affordably sustain the system. The HDR-H will complete initial fielding in FY 2023 for BMDS integration, testing and readiness for operations. MDA will begin military construction for the HDR-H in FY 2021. The radar will be constructed in two phases: Phase 1 (FY 2021, $138 million) funds a shielded Mission Control Facility and will begin military construction in FY 2021 and Phase 2 (FY 2022, $183 million) funds the shielded power plant including fuel storage and associated site support. MDA is also requesting $33.5 million in FY 2019 for the Homeland Defense Radar - Pacific (HDR-P) radar (Budget Project MD51). In FY 2019, MDA will initiate prime contract award and developmental engineering for radar hardware, software and equipment shelter. The HDR-P provides persistent midcourse discrimination, precision tracking, and hit assessment to support the defense of the homeland against long-

range missile threats. Siting surveys efforts are planned to satisfy warfighter requirements and determine the final recommended site(s). The radar also supports additional mission areas including space situational awareness upon approval. The military construction for the Pacific radar is planned for the FY 2022 timeframe and the HDR-P is scheduled to complete initial fielding in the FY 2024 timeframe.

- **Sea-Based X-band (SBX) (PE 0603907C).** MDA is requesting $149.7 million in FY 2019. The SBX radar provides precision midcourse tracking, debris mitigation, and discrimination capabilities. The SBX is an integral component in our flight test programs. To address the increased missile threat from North Korea, our budget request includes funds to extend at-sea time and conduct operations for defense of the homeland in the U.S. Pacific Command and U.S. Northern Command areas of responsibility. MDA continues with 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. We will also complete implementation of a DoD regional clock for the BMDS to improve warfighter readiness by ensuring integrity and availability of timing data.

Sea Based X-band Radar

II. REGIONAL DEFENSE

The FY 2019 President's Budget reflects the Department's commitment to building regional missile defense forces that are interoperable with systems deployed by international partners. MDA responded to the U.S. Forces Korea Commander's urgent requirement requesting integration of the Lower Tier and Upper Tier missile defense systems to improve defensive capability through a more efficient and effective use of the systems available in theater. This requirement is supported by United States Strategic Command (USSTRATCOM) and approved by the Chairman of the Joint Chiefs of Staff (CJCS). MDA continues this urgent work for the U.S. Pacific Command (USPACOM) Joint Emergent Operational Need (JEON). In coordination with the Army's Lower Tier Program Office, MDA began a concerted effort in May 2017 to develop an integrated, phased approach to incrementally field capability. This JEON will deliver improved BMDS capability to the Korean Peninsula, including integration of existing BMD assets to improve engagement options and coverage.

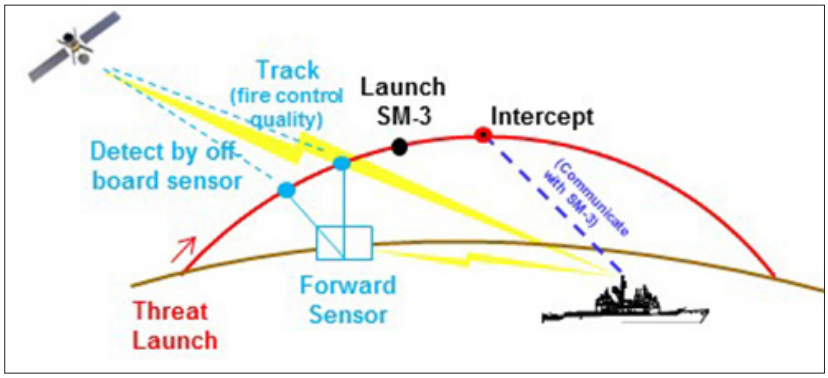
We continue to support the European Phased Adaptive Approach (EPAA) designed to protect U.S. deployed forces and NATO allies in Europe from ballistic missile attacks from the Middle East. EPAA Phase 2, including Aegis Ashore Missile Defense System Romania is mission-capable today. MDA will further enhance defensive coverage for NATO Europe against medium- and intermediate-range threats with the completion of EPAA Phase 3, including deployment of an Aegis Ashore site in Poland and the delivery of the Standard Missile (SM)-3 Block IIA and associated Aegis BMD weapon system upgrades for Aegis BMD ships and Aegis Ashore sites. The U.S. Navy will continue to operate the Aegis Ashore site in Romania as an integral part of NATO's BMD architecture, which includes a forward-based Army Navy/Transportable Radar Surveillance System (AN/TPY-

2) in Turkey, BMD-capable Aegis destroyers homeported in Rota, Spain, SM-3 interceptors, and a command-and-control node operated from Ramstein Air Base, Germany. MDA proposes funding the development, testing, operations and sustainment of the Aegis BMD Program. The request includes:

- **Aegis BMD (PE 0603892C).** MDA requests $767.5 million in FY 2019. 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 for EPAA Phase 3. MDA is strongly committed to maintaining and enhancing the Aegis BMD weapon system capability alignment with Navy requirements to improve performance against SRBM, MRBM, and IRBM threats. Utilizing improved radar discrimination, Aegis BMD will increase capability against longer range and more sophisticated threats. MDA continues software development for Integrated Air and Missile Defense (IAMD) Baseline 9.C2 (BMD 5.1) in support of EPAA Phase 3 and the IAMD Baseline 10 (BMD 6.0). The BMD 6.0 computer upgrade will integrate BMD capability with Advanced Air and Missile Defense Radar (AMDR) data, 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.

European Phased Adaptive Approach Phase 4 Aegis BMD Ships + 2 Aegis Ashore Sites + 1 AN/TPY-2

- **Aegis BMD Testing (PE 0604878C).** MDA is requesting $95.8 million in FY 2019. Aegis BMD Flight Test Program performs comprehensive testing of Aegis BMD components and demonstrates their interoperability with the BMDS. Using accredited modeling and simulation (M&S) the ground test program provides the evidence required for MDA and the Combatant Commanders to transition the capability to the operational capacity baseline. MDA plans to conduct flight tests using Aegis BMD weapon system 5.1 and the SM-3 Block IIA missiles. These development and operational tests support the U.S. Navy certifications as well as EPAA commitments. MDA will also conduct a flight test using Aegis Baseline 9.C2 SW demonstrating a data collection test against an MRBM with countermeasures.



Engage on Remote (EoR)

- **Aegis Procurement.** MDA requests $820.8 million in FY 2019 in procurement, including associated hardware and support costs. We request $708.7 million to procure 37 SM-3 IB missiles and six SM-3 IIA

missiles and $15M to complete combat system and combat structure adaption for the Aegis Ashore site in Poland. Each variant can be used on Aegis BMD ships and at the Aegis Ashore sites in Romania and Poland. The total SM-3 IB missile buy, across the FYDP, is 204 missiles. The total SM-3 IIA buy across the FYDP is 39 missiles. The request contains a five-year Multiyear Procurement, for SM-3 IB missiles, beginning in FY 2019 and ending in FY 2023. The procurement budget also requests $97.1 million for Aegis BMD weapon systems consisting of Aegis shipset equipment, software and installation materials.

- **Operation and Maintenance (O&M.)** MDA is requesting $83.8 million in FY 2019 to fund Aegis maintenance and support. The Aegis BMD program will perform missile recertification, repair efforts, demilitarization, and Ordnance Assessment / Surveillance. This funding supports BMD Computer Program, Ship Equipment, Aegis Ashore - Romania sustainment, and Fleet integration support.

Also key to regional defense capability, Terminal High Altitude Area Defense (THAAD) is a globally transportable, ground-based missile defense system that defends against short-, medium-, and intermediate-range ballistic missiles in the terminal stage of flight, both inside and outside the atmosphere. THAAD provides Combatant Commanders a rapidly deployable capability to deepen, extend, and complement BMDS homeland and regional defenses. MDA supports forward-deployment of one THAAD battery in Guam and one THAAD Battery in the Republic of Korea (ROK).

- **Terminal Defense (PE 0603881C).** MDA is requesting $214.2 million for THAAD development efforts in FY 2019. Our THAAD development efforts include software upgrades to address threat packages and defense planning, as well as improved capability to engage SRBM, MRBM and IRBM threats. Our development and integration will provide enhanced debris mitigation capability, improved interoperability with other BMDS elements, and expanded defended area footprints via remote operation of THAAD launchers. We will also complete developmental efforts to replace current global positioning system antennas to ensure the integrity and availability of positioning, navigation, and timing data for the THAAD weapon system. Finally, we continue efforts associated with the USFK JEON that provides enhanced THAAD capability against specific USFK threats, improved radar energy allocation, improved THAAD performance against debris and in complex environments, and an accelerated initial capability to increase its defended area.

7 THAAD Batteries

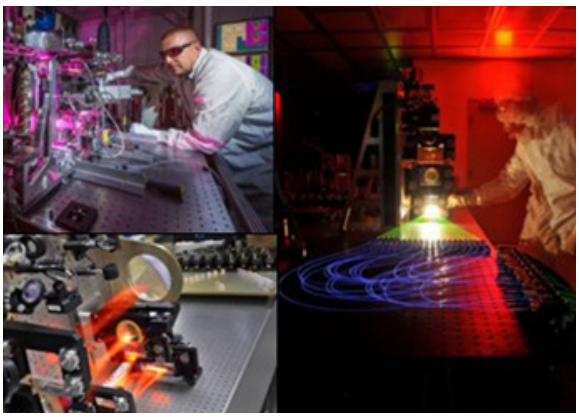
- **Terminal Defense Testing (PE 0604876C).** MDA is requesting $61.0 million for THAAD Testing in FY 2019. THAAD will participate in an operational flight test to demonstrate regional / theater integrated air and missile defense capabilities. This flight test incorporates THAAD Software Build 3.0, to include increased debris mitigation Phase 2, which will further demonstrate, in an operational scenario, THAAD's ability to conduct coordinated engagements with the Aegis BMD and PATRIOT weapon systems operating with command and control, battle management and communications (C2BMC) and forward-based AN/TPY-2 while engaging an IRBM with countermeasures. The operational flight test will also demonstrate interoperability with Patriot and respond to the 2016 National Defense Authorization Act for interoperability

between US BMDS systems. We will also initiate pre-mission planning for a flight test to be conducted in FY 2020, to include key long- lead activities such as range safety and weapon system performance analysis.

- **THAAD Procurement**. MDA is requesting $874.1 million in FY 2019 for THAAD interceptor procurement, obsolescence mitigation and equipment. MDA plans to procure 82 THAAD interceptors in FY 2019 for a total buy of 196 THAAD interceptors across the FYDP.

- O**perations and Maintenance (O&M).** MDA will sustain and support the THAAD weapon system. MDA requests $92.6 million in FY 2019 to support the maintenance and upkeep of all BMDS unique items in fielded THAAD Batteries, as well as for all THAAD training devices. In FY 2019 and throughout the FYDP MDA plans to provide support to seven THAAD batteries, including batteries deployed to Guam and ROK.

III. DEVELOPING NEW CAPABILITIES



Laser Experiments

A high priority / high payoff is developing advanced BMD technologies that can be integrated into the BMDS to adapt to future threat changes. The investment strategy for these technologies balances the need to address the most dangerous current threats with the need to position the U.S. to respond to threat developments in the future. Areas for technology investment include: persistent discrimination in the current and future BMDS sensor architecture, high power laser scaling for Boost Phase Intercept (BPI), Multi Object Kill Vehicle technology and other advanced technology for high-risk/high-pay off breakthroughs. The advanced technology investments are informed by capability gap assessments and focus on concepts that bring upgraded capability to the warfighter. The goal is to provide transformative capabilities that enable the future BMDS to keep pace with new and evolving threats.

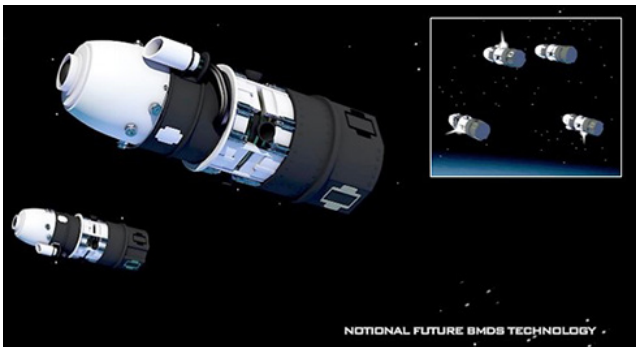
- **Hypersonic Defense (PE 0604181C).** MDA is requesting $120.4 million in FY 2019. MDA will execute a rigorous systems engineering process, identify and mature full kill chain technology, provide analysis and assessment of target of opportunity events, and execute near term sensor and command and control capability upgrades to address defense from hypersonic threats. This effort will execute the Defense Science Board's recommendations to develop and deliver a set of material solutions to address and defeat hypersonic threats informed by a set of near-term technology demonstrations. An integrated set of enhancements will provide incremental capability measured by progress and knowledge points in the following areas: establishment of systems engineering needs and requirements to identify alternative material solutions; execution of a series of sensor technology

Hypersonic Glide Vehicle

demonstrations; modification of existing BMDS sensors and the C2BMC element for hypersonic threats; and definition of weapon concepts and investments in key technologies to enable a broad set of solutions, including kinetic and non-kinetic means across left and right of launch.

- **Technology Maturation Initiatives (PE 0604115C).** MDA requests $148.8 million to build on the foundational successes in Weapons Technology and Discrimination Sensor Technology. MDA will integrate an advanced sensor into the tactically proven Multispectral Targeting System and MQ-9 combination to address precision track and discrimination performance of this technology with the goal of eventually migrating to a space sensor layer. MDA's plan is to continue the design to begin fabrication of a UAV-borne laser to address boost phase missile defense risks. Scalable, efficient, and compact high-energy lasers can be game –changing capabilities within missile defense architectures.

- **Common Kill Vehicle Technology Program (PE 0603294C).** MDA requests $189.8 million to establish the technology foundation for killing multiple lethal objects from a single interceptor. MDA is on contract with three major primes for a three year, competitive program to reduce the technical risk for MOKV product development.



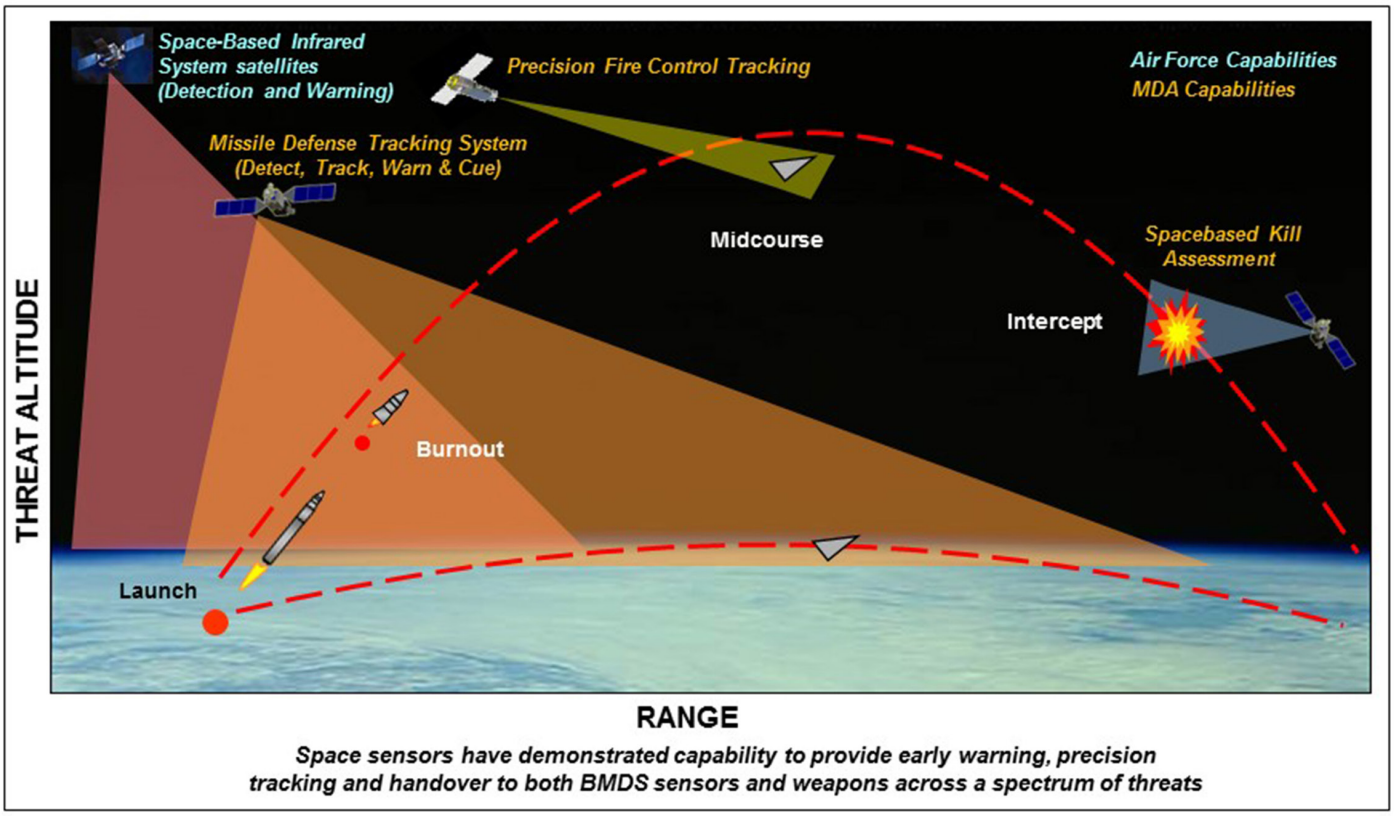
Multi Object Kill Vehicles

- **Advanced Research Program (PE 0603180C).** MDA requests $20.4 million to conduct innovative research and development with small businesses, universities, and international partners to create and advance future missile defense capability. MDA continues to capitalize on the creativity and innovation of the nation's small business community and academia to enhance the BMDS.

- **Advanced Concepts & Performance Assessment (PE 0603176C).** MDA also requests $13.0 million for Advanced Concepts & Performance Assessment efforts, which develops 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. The request will fund the digital simulation and hardware-in-the-loop infrastructure required for testing of an airborne advanced sensor, Kill Vehicle Modular Open Architecture testbed, pre- and post-mission performance predictions and assessments, and mature related tracking, discrimination, and sensor fusion algorithms.

IV. SPACE

- **BMD Space Program (PE 1206895C).** MDA is requesting $16.5 million in FY 2019. This request funds the Space-based Kill Assessment (SKA) experiment, which will use a network of high sample rate, infrared sensors to deliver a kill assessment capability to the BMDS tailored for homeland defense. This request supports SKA integration into the BMDS, SKA participation in MDA test events and the development of kill assessment algorithms required to add SKA to the operational BMDS. The full SKA network is currently planned to be on orbit in FY 2018. This request also supports development of kill assessment algorithms required to add SKA to the operational BMDS.



BMDS Space Sensor Vision

- **Space Tracking and Surveillance System (STSS) (PE 1206893C).** MDA is requesting $37.0 million in FY 2019 for satellite operations and sustainment. The satellites which were launched in 2007, have far exceeded their life expectancy and have proven to be a very good investment. STSS consists of two satellites operating in Low Earth Orbit and provides risk reduction data for a potential operational BMDS tracking and surveillance constellation in the areas of sensor management, target signatures, discrimination, 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. The STSS program and the MDSC are also supporting concept development activities for future space sensor architecture studies and analyses to address advanced threats.

V. OTHER PROGRAM HIGHLIGHTS

- **Command and Control, Battle Management and Communication (C2BMC) (PE 0603896C).** MDA is requesting $475.2 million in FY 2019 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. During a recent flight test, C2BMC demonstrated EPAA Phase 3 engage-on-remote capability by integrating overhead sensors, AN/TPY-2 and Aegis BMD within the regional communications architecture. 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 FY 2019, we will complete testing and deployment of C2BMC Spiral 8.2-3 and BMDS Overhead Persistent Infra-Red Architecture (BOA) 6.1, in support of EPAA Phase 3 / Aegis BMD Engage-on-Remote functionality. Initial deployments will be to CENTCOM / EUCOM followed by NORTHCOM / PACOM providing enhanced tracking capabilities to the warfighter. MDA will also initiate integration of a sea-based mobile sensor in the Spiral 8.2-3 timeframe that will provide enhanced tracking for emerging threats. We will continue development of C2BMC Spiral 8.2-5, which provides increased system level discrimination data, BOA 7.0, to provide advance threat warning capability, threat characterization solutions and support command & control integration of the LRDR into the BMDS by 2021 to support a robust homeland defense capability. C2BMC will initiate Increment 7 development tasks for Robust Post Intercept Assessment supporting our regional defense focus. 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. C2BMC will update hardware/software to increase Cybersecurity through implementation of the DoD Cybersecurity Discipline Implementation Plan - Four Lines of Effort conducting over 63 cyber-focused tests and assessments involving multiple agencies over the FYDP to ensure the system is cyber-secure.

- **MDA Engineering (PE 0603890C, Budget Projects MD24 and MD31).** MDA is requesting $260.1 million in FY 2019 to perform the systems engineering required to design, build, test, assess, field and sustain the integrated BMDS. MDA Engineering defines BMDS architectures and functional requirements for integrated BMDS capabilities to defeat the evolving threats, analyzes architecture alternatives to address future threats, enables interoperability between U.S. forces and international partners, and drives future capability development from a system perspective to maximize the effectiveness of BMD technologies. MDA Engineering also performs pre- and post-mission analysis for BMD system tests, and assesses BMDS performance in order to deliver capabilities to the Warfighter. In FY 2019, MDA will conduct the engineering and technical assessment that underpins the EPAA Phase 3 Technical Capability Declaration (TCD). The TCD will provide confidence to the Warfighter that the Aegis Ashore site in Poland will operate as designed. MDA employs system and element-level models and simulations to verify BMDS performance and assess BMDS 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 to the Warfighter evolving, integrated, and layered BMDS performance and capabilities that have been thoroughly assessed and validated through testing and modeling and simulation. In this budget cycle, MDA is pursuing improvements to both system-level digital simulation and integrated system-level ground test simulations.

- **BMD Sensors (PE 0603884C).** MDA is requesting $220.9 million in FY 2019 to develop advanced discrimination algorithms for the AN/TPY-2 and SBX to counter evolving threats, and the implementation of object classification updates for COBRA DANE and UEWR. The discrimination improvement efforts will develop and field integrated Element capabilities to improve the ability of the BMDS to discriminate between lethal and non-lethal objects. In FY 2019, MDA supports the development of future radar capabilities through system engineering, software development, and testing support. MDA continues to support M&S efforts that include enhanced sensor models, integration of digital simulations into the BMDS M&S architecture, verification, validation, and accreditation of radar models, and interoperability between hardware and

simulation models to reduce test costs. MDA requests $81.0 million in FY 2019, for sensors testing activities (PE 0604879C). This request also provides planning, analysis, and execution of BMDS flight and ground tests identified in the IMTP and encompassing pre-test efforts, such as digital and Hardware-in-the-Loop (HWIL) pre-mission tests, and post-test efforts such as post-flight reconstruction.

AN/TPY-2 Radar

- **BMD Radars Program Operations and Maintenance.** O&M supports both homeland and regional defense missions. MDA is requesting $176.1 million in FY 2019 to sustain COBRA DANE, the Upgraded Early Warning Radars (UEWR), and the AN/TPY-2 radars. 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 a forward deployed THAAD batteries in Guam and South Korea.

- **Integrated Master Test Plan (IMTP).** MDA, in conjunction with IMTP stakeholders, 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. 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. Forty of the sixty-six flight tests in the BMDS Test Program are currently planned to achieve these criteria. For system-level ground testing, all tests culminate in operational testing with warfighters on console and independent operational assessments by the BMDS Operational Test Agency Team. This ensures that BMDS capabilities are credibly demonstrated and validated prior to delivery to the Warfighter. MDA works collaboratively with the Director, Operational Test & Evaluation; Deputy Assistant Secretary of Defense, Developmental Test and Evaluation; Commander, Joint Functional Component Command for Integrated Missile Defense; Service Operational Test Agencies and the Joint Interoperability Test Command to identify and incorporate all testing requirements into development of the IMTP, a comprehensive, highly integrated, complex, cost-effective series of flight tests, ground tests, wargames, and exercises.

BMDS Target

This budget continues MDA's longstanding support of U.S.-Israeli Cooperative BMD programs, to include the co-development of the David's Sling Weapon System, Upper Tier Interceptor, and Arrow Weapon System Improvements. MDA works with the Israeli Missile Defense Organization on these programs in accordance with jointly signed international agreements. MDA is requesting a total of $500 million in support of U.S.-Israeli programs.

VI. SUMMARY

MDA requests $9.9 billion in FY 2019 to strengthen and expand defenses for our nation, deployed forces, allies, and international partners against all ranges of increasingly capable missiles threats.

Warfighters from the 100th Missile Defense Brigade executed a Homeland Defense Test (FTG-15) on 30 May 2017; using the newest configuration Ground-Based Interceptor, launched from Vandenberg Air Force Base California; successfully intercepting an Inter-Continental Ballistic Missile range target launched out of the Reagan Test Center's Meck Island, Kwajalein Atoll, Marshall Islands.