Missile Defense Agency (MDA) Exhibit R-2 RDT&E Budget Item Justification	Date: February 2007
APPROPRIATION/BUDGET ACTIVITY: **RDT&E, DW/03 Advanced Technology Development (ATD)**	R-1 NOMENCLATURE: **0603175C Ballistic Missile Defense Technology**

COST ($ in Thousands)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Total PE Cost	147,270	193,307	118,569	109,540	116,014	121,008	127,917	131,291
0502 Advanced Technology Development	142,852	185,768	113,063	103,941	109,985	115,311	121,535	124,909
0602 Program-Wide Support	4,418	7,539	5,506	5,599	6,029	5,697	6,382	6,382

Note: In FY06, the Multiple Kill Vehicles program funding moved from Project 0502 (Engagement Systems area) to a new Program Element (0603894C) in Project 0515, Multiple Kill Vehicles.

In FY08, the NFIRE program funding has been moved to the Space Program Element (0603895C).

In FY08, the HAA program will be canceled. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

In FY08, the Micro Satellite program will be canceled. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

A. Mission Description and Budget Item Justification

A.1 System Element Description

As the United States develops and deploys increasing capabilities within the BMDS, our potential adversaries continue to develop more advanced missile technologies. The Advanced Technology Program Element develops tomorrow's technologies for potential integration into the BMDS to out-pace this evolving ballistic missile threat. The technology investment priorities balance the pursuit of the promising next generation technology with near-term, high-payoff, technology solutions that may enhance existing BMDS capabilities. The technology development activities include four focused areas that develop and mature promising concepts and technologies and a dedicated experiment focused on collecting data to support development of future boost phase intercept systems (Near Field Infrared Experiment (NFIRE)). The four focus areas are Sensors; Weapons; Innovation; and Advanced Command, Control, Battle Management, and Communications (C2BMC) Technology.

A.2 System Element Budget Justification and Contribution to the Ballistic Missile Defense System (BMDS)

This Program Element supports the development of next generation technologies across the entire BMDS as well as the mid-term needs associated with individual elements. The technology efforts selected may lead to: enhanced performance of a specific BMDS component/subsystem; may benefit a common component that can be used by multiple elements; or add a new capability to the BMDS. Technologies planned for transition

include: the Strategic Illuminator Laser (SILL) for ABL; Next Generation Transmit/Receive Integrated Microwave Module (TRIMM) for THAAD; Improved Chemical Oxygen Iodine Laser (COIL) technology for ABL weight reduction and power output needs; and Quantum Well Infrared Photodetector (QWIP) focal plane arrays (FPAs) for STSS and ABL. The transition of the Multiple Kill Vehicle (MKV) technology into a dedicated acquisition program is one example of a successful breakthrough technology development effort for a subsystem as well as a component that may be used by multiple elements. Additional examples of innovative technology development efforts leading to new capabilities for the BMDS include: Scalable Panels for Efficient Affordable Radar (SPEAR) for advanced sensors; Early Launch Detection and Tracking (ELDT) technologies for Boost Phase sensing; Air Launched Hit-to-Kill (ALHTK) for asymmetric threats and rapid deployment needs; and Coherent Distributed Aperture (CDA) technology for BMDS sensors.

A.3 Major System Element Goals

The three major goals for Advanced Technology are:

- Identify innovative concepts and technologies that can be applied across the BMDS to out pace the threat, improve system performance, and lower life cycle costs
- Maintain a balanced portfolio of high promising technologies with a risk level commensurate with the pay-off, and realize large returns on investment to complement the BMDS
- Develop key promising technologies and transition them into new development programs or as upgrades to improve the capability of the existing BMDS

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B. Program Change Summary	FY 2006	FY 2007	FY 2008	FY 2009
Previous President's Budget (FY 2007 PB)	149,305	206,676	183,414	214,062
Current President's Budget (FY 2008 PB)	147,270	193,307	118,569	109,540
Total Adjustments	-2,035	-13,369	-64,845	-104,522
Congressional Specific Program Adjustments	0	-12,551	0	0
Congressional Undistributed Adjustments	0	-818	0	0
Reprogrammings	707	0	0	0
SBIR/STTR Transfer	-2,742	0	0	0
Adjustments to Budget Years	0	0	-64,845	-104,522

FY06 decrease of $2.035 million includes SBIR/STTR transfer and MDA reprogrammings.

FY07 decrease includes congressional reduction to High Altitude Aircraft (-$22.5 million), a congressional undistributed reduction to the Technology Program Element (-$12.7 million), increases for congressional earmarks ($25.6 million), and a portion of the MDA congressional undistributed reduction.

FY08 decrease of $64.845 million and $104.522 million includes cancellation of the High Altitude Airship and Micro satellite programs; overhead reductions; and MDA realignments to higher priority programs.

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COST ($ in Thousands)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
0502 Advanced Technology Development	142,852	185,768	113,063	103,941	109,985	115,311	121,535	124,909
RDT&E Articles Qty	0	0	0	0	0	0	0	0

Note: In FY06, the Multiple Kill Vehicles program funding moved from Project 0502 (Engagement Systems area) to a new Program Element (0603894C) in Project 0515, Multiple Kill Vehicles.

NFIRE Funding: FY06 funding for NFIRE was directed by Congressional action to move from the BMDS Interceptors program element (PE 0603886C) to the BMD Technology program element (PE 0603175C). The FY07 funding was reviewed and deemed insufficient for the current schedule and requirements to complete the NFIRE satellite launch that would include not only the Track Sensor Payload, but an additional communications payload, the Laser Communications Terminal (LCT) from the German government. During development of the FY07 PB, it was determined that additional funding in FY07 to support the NFIRE program would be assigned to the STSS PE. In FY07, NFIRE funding is located in PE 0603175C ($10.8 million) and PE 0603893C ($25.2 million), for a total of $36 million to conduct the planned program. FY07 Planned Program activities and schedules will be addressed in PE 0603893C.

In FY08, funding for NFIRE will be moved from this PE (as well as PE 0603893C) to the Space Program Element 0603895C.

In FY08, the HAA program will be canceled. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

In FY08, the Micro Satellite program will be canceled. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

A. Mission Description and Budget Item Justification

As the United States develops and deploys increasing capabilities within the BMDS, our potential adversaries continue to develop more advanced missile technology. The Advanced Technology Program Element develops tomorrow's technologies for potential integration into the BMDS to out-pace this evolving ballistic missile threat. The technology investment priorities balance the pursuit of the promising next generation technology with near-term, high-payoff, technology solutions that may enhance existing BMDS capabilities. The technology development activities include four focused areas that develop and mature promising concepts and technologies and a dedicated experiment focused on collecting data to support development of future boost phase intercept systems (Near Field Infrared Experiment (NFIRE). The four focus areas are Sensors; Weapons; Innovation; and Advanced Command, Control, Battle Management, and Communications (C2BMC) Technology.

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The Sensors technology area focuses on developing new technologies to enable threat detection, threat identification, launch-to-destruction threat tracking, and discrimination in all phases of flight. Promising technologies in this area include active electro-optical (EO), passive electro-optical and infrared (EO/IR), and passive radio frequency (RF) sensors for detection and identification; radar systems technologies; concepts for Early Launch Detection and Tracking (ELDT); spectral sensing for kill assessment; micro satellites for distributed sensing; a High Altitude Airship (HAA) as a near-space platform for persistent surveillance and/or communications missions; and other BMDS applications.

- The EO/IR Active Sensors task is developing advanced laser radar (LADAR) technology. LADAR technology, coupled with passive sensors, allow improved system discrimination performance by providing access to currently unavailable target features. The Discriminating Sensor Technology (DST) development program within this EO/IR Active Sensors task will be completed in first quarter 2007.
- The EO/IR Passive Sensors task improves IR sensor technologies and components for near term BMDS needs and develops IR materials and focal plane arrays for future BMDS capabilities. These passive EO/IR technology initiatives benefit the BMDS by increasing the maximum range for detection of a threat, increasing the field of view of the infrared search and track function, improving discrimination, reducing the size and weight of sensor components, and accelerating the command and control process required to commence missile defense. The current effort improves the performance of Mercury Cadmium Telluride (HgCdTe) at long wave infrared (LWIR) for STSS in 2014; develops type II superlattice and HgCdTe on Si substrate capabilities at very long wavelength and multicolor for future transition to STSS and MKV in 2015; develops very large format and multicolor Quantum Well Infrared Photodetector arrays for future transition to ABL in the 2012-2014 timeframe. In order to facilitate the transition, the task also includes several laboratory, hardware-in-the-loop, and seeker level test activities to validate and increase the technology readiness level (TRL) of the sensors delivered.
- The Radar Systems Technology (RST) program integrates and tests next-generation transmitters, receivers, antennas, amplifiers, signal processors, and algorithms/software to demonstrate technologies to insert in BMDS radars in future blocks, as well as to enable and exploit new concepts in radar. RST focuses on technologies to improve traditional, high-power density radar systems such as the existing Sea-Based X-Band (SBX) Radar and the forward based AN/TPY-2 radar. RST also focuses on revolutionary technology associated with low-power density radar systems with associated benefits of high performance and lower cost, compared to existing systems. An important RST initiative is Coherent Distributed Apertures which can significantly increase radar sensitivity, overcome electronic counter-measures, and provide three dimensional spatial and velocity resolution critical for forward and mid-course sensing.
- The Early Launch Detection and Tracking (ELDT) effort is developing and demonstrating early detection, all-weather surveillance and fire control technologies for transition to boost defense segment systems. For a forward-based or theater-class missile defense system the time line is a critical component. This technology effort expects to increase battlespace by reducing the time required to detect a boosting missile compared to current baseline overhead and land/sea based assets. For ascent phase intercepts, ELDT improvements will enable targeting and interception of

theater-class threats. The technology programs under ELDT include two "see-through-clouds" passive boost detect sensor technologies, as well as a multi-static HF radar detect and track effort being pursued with Australia.

- Spectral Sensing for Kill Assessment (SSKA) is investigating phenomenology characteristic of hyper-velocity impacts and developing sensors that can be used for Kill Assessment (determining if the lethal object was hit and destroyed) and Warhead typing (determining the payload or warhead of the threat vehicle from the impact spectrum and debris). The sensors will provide timely information to the Battle Manager to support shoot-look-shoot engagements, consequence mitigation actions, and follow-on Command response decisions. Limited Kill Assessment capability is planned for 2010 with sensors capable of providing full global coverage of the ICBM threat space by 2014.
- The Micro Satellite task is investigating small satellite concepts, payloads, and applications for future Ballistic Missile Defense System employment. The micro satellite concept is to develop and evaluate lighter, lower cost satellites that allow for tailoring of payloads and coverage for specific missions including persistent surveillance and on-demand operations against a specific threat region. Additionally, the original experiments were expected to demonstrate detection and tracking, and communication concepts to enable future space-related BMD capabilities. At the conclusion of FY 07, this task will have demonstrated the ability of domestic industry to design and develop components needed to support future space sensing and target capabilities using micro satellites.
  - The Distributed Sensing Experiment (DSE) will develop components needed to demonstrate the utility of a network of three micro satellites to acquire and track targets in the boost and ballistic phases of flight and provide the three-dimensional tracking information to ground stations.
    - The Micro Satellites built using these components would be capable of constructing a 3-D spatial temporal track of a ballistic target and relay the target track data to ground station interfaces such as the C2BMC.
    - The Micro Satellites built using these components would perform target acquisition for boosting, below-the horizon (BTH), and mid-course above-the-horizon (ATH) targets.
  - The Target Risk Reduction Experiment will develop components for micro satellites to serve as cooperative targets for the ballistic missile defense system.
    - The low cost satellites are designed to threat representative configurations.
    - The satellite can be flown with threat representative orbits and spacecraft dynamics.
    - The satellites are designed to transmit truth data to the ground.

Current budgetary guidance to cancel the Microsat program at the end of FY07 will negate FY08 and subsequent effort. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

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- The High Altitude Airship (HAA) develops a stable, geostationary platform to support communications, sensor, or weapons requirements. The HAA prototype was intended to demonstrate the technical feasibility and military utility of an unmanned, un-tethered, solar powered airship that can fly for up to a month at 60,000 feet while carrying a 500 pound payload. The prototype is a developmental step toward building an operational High Altitude Airship. The HAA prototype also could function as a test bed for testing other MDA technologies. An operational HAA that can self-deploy from the continental United States to worldwide locations and operate autonomously for long-endurance operations (1 year or more) will be an autonomous, high-altitude, long-endurance platform that will enable for the first time, continuous over-the-horizon communications and wide-area surveillance, supporting theater operations without interruption or the cost / risk of a manned aircraft. A Technical Improvement Project to be executed simultaneously to mature critical technologies is a key risk reduction activity for a future operational airship. At the conclusion of FY 07, mature technologies will be available for the development of an HAA prototype per the current design.

Current budgetary guidance to cancel the High Altitude Airship program at the end of FY07 will negate FY08 and subsequent effort. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

The Weapons technology area focuses on developing technologies and new concepts which enable the successful destruction of any ballistic threat, in any phase of flight, via kinetic energy interceptors or directed energy systems. Focus areas include improved high power laser systems; improved laser components for target discrimination, tracking, and aimpoint selection; technologies that enable advanced kill vehicles to defeat countermeasures and maneuvering targets; and new concepts for integrating existing interceptors and electro-optical sensors onto fighter aircraft to address theater gaps and asymmetric homeland threats. Promising new laser technologies are developed within the Laser Technology Program (LTP) and promising technologies for hit-to-kill interceptors are being developed within the Interceptor Technologies Program (ITP).

The Laser Technology Program is developing next generation state-of-the art laser technologies. This program will develop higher power, lower weight and more reliable lasers; more sensitive detectors for laser radar (LADAR) target acquisition, discrimination, and precision aim point selection; and advanced optical beam stabilization and pointing technology. The promising technologies under development include:

- Strategic Illuminator Laser- A multi-kilowatt, brassboard illuminator system that significantly advances the state of the art in power, beam quality, reliability, and packaging for the Airborne Laser and other long-range laser platforms. The program validates the physical architecture of the laser head and the achievement of difficult weight and packaging goals for the power, structural, and cooling systems.

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- Small Laser Amplifier for Ladar - A powerful small laser transmitter (hundreds of watts) suitable for insertion on a missile defense platform with tight weight and volume constraints. After a successful competition between two companies developing competing/alternative prototypes, the final brassboard construction was awarded.
- Advanced Inertial Reference Unit - A device for highly accurate laser pointing and tracking. The increased accuracy provided by this technology will enhance performance of laser tracking, discrimination and engagement systems such as Airborne Laser. The task includes development of a breadboard prototype device used for telescope pointing and local-loop jitter suppression.
- Advanced Detectors - Improved detectors for LADARs, with increased sensitivity and bandwidth. Two contractors fabricated camera systems for 3-D target tracking and wave front sensing (adaptive optics) for delivery to government facilities and subsequent checkout. The increased sensitivity doubles the range at which a target can be detected and tracked providing a longer engagement time for the Airborne Laser.
- Angle-Angle Range Doppler Imager - Combine the capabilities angle-angle range and coherent Doppler LADAR to achieve both direct detection and coherent detection to enhance discrimination and aimpoint selection. MIT/LL began work on this project in January 2004 for application on kinetic kill vehicles (KKVs). This effort enables a LADAR system to provide highly accurate range and direction information as well as determining the shape and movement of the target.
- Advanced Chemical Oxygen-Iodine Laser (COIL) Technology - Development and experimental characterization of a high performance singlet delta oxygen generator based on a flat jet hydrogen peroxide injectors that improve chemical yield and device manufacturability. Improving COIL efficiency can enhance output power, increase the magazine of laser chemicals and extend the engagement range while reducing the production risks.
- Air (Oxygen) Laser - Develop and demonstrate a diode pumped liquid oxygen laser that reduces the weight and complexity of high energy laser weapons sources. Phase I under DARPA funding will develop and demonstrate a single KW device and design a scale-up laser; Phase II under joint MDA-DARPA funding will demonstrate the scale-up, tens-of-kW, device. The goal of this effort is to produce a high output power laser in a small, lightweight package for a future tactical directed energy weapon, the Airborne Laser Strategic Illuminator, or a discriminating LADAR.
- COIL Improvements - Four technology areas are being explored to improve efficiency while reducing weight and volume. These areas are: Deuterated Fuels; Advanced Generators; Supersonic Iodine Injectors; and Advanced Diagnostics. As these mature, they are anticipated to spawn future investments in line upgrades to the Airborne Laser.
- Ultra-Sensitive Detectors - Follow-on to Advanced Detectors further increasing sensitivity to the single photon level by reducing background noise. The combination of High bandwidth, high frame rate and low noise enables the sensor to resolve returns at lower signal levels permitting tracking at longer ranges more accurately for LADAR and KKV sensor applications. Two competing contracts were awarded for eventual down-select to one team.
- Advanced Track Illuminator Laser (ATILL) - A cryogenically cooled, high efficiency Yb:YAG laser capable of improving beam quality and output power, while reducing weight to support implementation on multiple platforms as a next generation illuminator.

- High Brightness / High Efficiency Lasers - FY07 new start to investigate two promising technologies: Diode Pumped Alkali Laser (DPAL), dielectric gas lasers pumped by diode laser arrays; and Tailored Aperture Ceramic Laser (TACL), ceramic materials with diode pumping on the edges. Projects offer alternative pathways to high average power with exceptional beam quality and efficiency while simultaneously reducing complexity and volumetric footprint, particularly important for reducing device size and power consumption and permitting long term storage.

The Interceptor Technologies Program (ITP) identifies, develops, and transitions advanced capabilities for future BMDS weapon systems. Infusion of ITP products will provide new capabilities for Boost, Midcourse, and Terminal Defense to counter new and evolving threats and countermeasures. These technologies provide miniaturized components to enable next generation small and lightweight kill vehicles and space products. They provide robust intercept capabilities in the absence of a priori target information, enhanced target detection and tracking by the kill vehicle, and improved lethality in the presence of endgame countermeasures. The ITP will deliver advanced components and subsystem technologies to enable next generation interceptors and discrimination approaches as well as upgrade and enhance existing kill vehicles to allow them to keep pace with the evolving threat. In addition, the ITP develops new system concepts that defeat evolving threats and countermeasures. During the past four years, funding for this development was primarily focused in the Multiple Kill Vehicles (MKV) program which was successfully transitioned to a new acquisition program within MDA in early 2QFY06. For the remainder of FY06, the ITP focused effort on identifying technologies needed to support the next generation of interceptors by conducting trade studies, soliciting inputs from industry, assessing technology shortfalls, and planning development projects. The ITP has been structured to address critical needs identified by Systems Engineering studies and STRATCOM's Prioritized Capabilities List, and risks identified by the MDA acquisition elements. The ITP will leverage the SBIR technology base and industry/FFRDC/university IRAD programs.

The ITP will conduct initial investments in promising technologies in FY 2007. Based on the success of that initial investment, the ITP will select three technology projects initiated in FY 2007 for continued development and transition in FY 2008+. Candidate technology investments include:

- Maneuvering Target Interceptor Technologies - Component, subsystem, and algorithm development.
  - Interceptor propulsion (lightweight solid and liquid divert and attitude control systems with high thrust).
  - Lightweight, high strength structures and materials with integral radiation hardening.
  - Advanced kill vehicle guidance, navigation, and control algorithms.
  - Lightweight avionics and communications (novel kill vehicle communications approaches and components, low latency in-flight target updates).

- Kill Vehicle Seekers - Concepts, hardware, software, and laboratory prototype development of small, lightweight components and multimode seekers capable of withstanding high stresses from fast accelerating boosters/divert systems for use on interceptors launched from silos, ships, or airborne platforms.
  - Advanced active and passive strap down seekers for target object mapping and target identification.
  - Distributed aperture target acquisition methodologies for small kill vehicles.
- Air-Based Weapon Technology - New concept and prototype hardware modification and/or development.
  - Air launched weapons concept development and preliminary designs, based on integrating existing PAC-3, THAAD or their components and modifying existing EO/IR sensors for employment on fighter aircraft.
- Advanced air-based weapons employment simulations and concept of operations development; utilizing advanced Operator-in-the-Loop simulations.
- Discrimination Augmentation - System concept development, trade studies, and component development.
  - Seeker/sensor technologies that offer improved ability to identify threats from among the non-lethal objects during intercept.
  - Novel Discrimination Concepts provides new and innovative methods to improve the Ballistic Missile Defense System (BMDS) discrimination against future threats.

The Innovation area seeks out promising new missile defense concepts and technology solutions and matures them to a level where they can be evaluated for transition directly to the BMDS or alternately to the Sensors, Weapons, or Hercules technology areas for continued development. The search for these technologies includes targeted technology outreach efforts and open solicitations that seek proposals for consideration from domestic and foreign industry, universities/colleges, researchers, and other agencies. The Innovation activity is organized into three distinct outreach efforts. The first area includes the Advanced Technology Broad Agency Announcement (BAA) and the Missile Defense, Science, Technology And Research (MSTAR) program, both supported by the Advanced Technology Innovation Cell (ATIC). The second area is comprised of statutory programs, and consists of the Technology Applications program and technical oversight of the Historically Black Colleges and Universities/ Minority Institutions (HBCU/MI), the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs. The third area is congressionally directed programs which are managed with a goal of maximizing utility for the BMDS.

- The Advanced Technology BAA invites proposals from foreign and domestic businesses, universities, researchers and agencies. This BAA funds domestic and international technologies which are the foundation of the future MDA technology portfolio . The BAA seeks new technologies and innovative concepts for components of the BMDS, and for technological improvements and/or cost reductions in the boost, midcourse, and terminal phases of missile defense. Specific research areas for each missile defense phase encompass Surveillance, Acquisition and Tracking, Discrimination, Communications, Engagement Planning, Threat Engagement, and Kill Assessment. New concepts are sought in the following

seven technology areas: Radar Systems, Lasers and Electro-Optical Systems, Integrated Active/Passive IR Sensor Systems, Computer Science, Signal and Data Processing, Physics, Chemistry, and Materials, Mechanical and Aerospace Engineering, and Battle Management/Command and Control. The Innovation activity established an Advanced Technology Innovation Cell (ATIC) to assess, evaluate and recommend investment for new and innovative technologies among proposals from all sources, both domestic and international. The ATIC uses a pool of recognized subject matter experts (SMEs) for the reviews and recommendations. This team of experts (government, industry, and academic) evaluates new ballistic missile defense concepts and technologies determining their technical feasibility, potential value added to the BMDS, initial capability, and maintains cognizance over leading edge concepts. The ATIC performs this function for all solicitations under the cognizance of the Innovation area (Advanced Technology BAA, MSTAR, SBIR/STTR, and HBCU/MI).

- The MSTAR program is an open BAA used to seek out breakthrough revolutionary technology from domestic, accredited universities. It leverages innovative research within academia in ten topic areas having potentially high payoff within the BMDS and provides an opportunity for our brightest young scientists and engineers to contribute to missile defense. MSTAR awards are three-year efforts with a maximum funding level of $600K ($200K/year).
- The Innovation activity conducts the congressionally mandated, Office of Secretary Defense directed Technology Applications (TA) program. This technology transfer program provides education, advice, and access to a business network and publicity for MDA-funded technologists at small and large businesses, universities, and federally funded laboratories. The TA program seeks to reduce the cost of technology development through commercial investment and accelerate maturation of technologies developed by MDA by introducing them into the high volume commercial marketplace.
- The Innovation activity manages and executes the congressionally mandated HBCU/MI program. The Innovation team conducts this program by issuing a BAA soliciting HBCU/MI proposals for research focused on contributing to key MDA technology needs. Contract funding is provided by MDA Small Business office, but Innovation funds the management activities. Innovation researches topics and selects BMDS relevant proposals from Historically Black Colleges and Universities/Minority Institutions (HBCU/MI). Innovation also provides technical and management oversight for the selected proposals.
- The Innovation activity provides technical direction for the congressionally mandated (15 U.S.C. 638(j)(3)) Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) program. Contract funding is provided by MDA Small Business office, but Innovation funds the technical oversight activities for topic selection and evaluation. The effort oversees topic development, evaluates and selects the best proposals from small businesses, and manages the resulting contracts. Advanced Technology SBIR managers conduct the MDA SBIR research, evaluation and debriefing process for all MDA Phase I & II proposals.
- The Innovation activity provides technical and management oversight for congressional interest technology programs.

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The Advanced Command, Control, Battle Management, and Communications (C2BMC) and Network Technology effort focuses on developing the next generation command and control and battle management concepts and the enabling technologies required to implement them among the BMDS. These activities will develop, integrate, and demonstrate advanced C2BMC concepts and enabling technologies for improving BMDS performance across all mission areas to include defense of friends and allies. Advanced BMDS integration concepts and techniques are demonstrated and evaluated in system-wide flight tests to facilitate the transition to the operational C2MBC. The key concepts under development include:

- Early BMDS subsystem integration, risk reduction, technology maturation, and confidence building. This activity uses simulation, Human-Machine Interface (HMI), mock-ups, early connectivity and prototype interfacing, to enable early information integration at the BMDS level for Command and Control, Battle Management, and Networking capabilities.
- Pathfinder command and control capabilities, including situational awareness, collaborative planning, post-intercept debris and consequence mitigation/management.
- Advanced sensor netting, including techniques to coordinate sensor resources for advanced tracking and discrimination capabilities.
- Advanced battle management and integrated fire control concepts, including techniques to coordinate weapon system engagements to achieve optimal shot doctrine and manage sensor resources against coordinated threat attacks.
- Advanced networking technology, to include migration to distributed architectures for providing distributed, fault tolerant, and gracefully degradable core C2MBC capabilities.
- Advanced concepts and risk reduction efforts associated with BMDS coalition and allied partner integration. Specific areas include situational awareness, post-intercept debris and consequence mitigation/management, and collaborative defense planning.

The Near Field Infrared Experiment (NFIRE) technology effort will collect high and low resolution images of a boosting rocket to improve our understanding of exhaust plume phenomenology and plume-to-rocket body discrimination. We will use this data to validate the models and simulations that are fundamental to developing the guidance and endgame homing algorithms for boost phase interceptors. A secondary objective of the experiment is to collect hyper-temporal short wave infrared and visible data for assessing early launch detection and tracking capability. The experiment will include three plume signature mission types: targets of opportunity, dedicated fly-bys, and ground observations. Targets of opportunity may include aircraft flights, space launches and missile tests at a viewing distance of 100 to 1000 kilometers. Dedicated fly-bys are high resolution observations of a dedicated target vehicle at a range of less than 10 kilometers. Ground observations may include bright burning events such as forest fires, volcanoes, and static tests of rocket engines. In addition to the plume data collections, NFIRE will carry a Laser Communication Terminal, to conduct communication experiments with the German Terra SAR-X satellite. These experiments will test low earth orbit satellite-to-ground and satellite-to-satellite capabilities of the terminal for potential incorporation into the Ballistic Missile Defense System. The laser communication experiments will be conducted on a non-interference basis with the other MDA missions.

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The NFIRE satellite will be operated from the Missile Defense Space Experimentation Center (MDSEC) by the MDA Space Applications Center of Excellence. Data products will be utilized by multiple programs to improve missile engagement performance.

NFIRE Goals:

- Launch the Near Field Infrared Experiment satellite
- Conduct multiple data collection missions against ground, air, space and ballistic missile targets
- Conduct low earth orbit satellite-to-satellite and satellite-to-ground laser communication experiments
- Use the data to validate the models and simulations that are fundamental to developing the navigation, guidance and control, and endgame homing algorithms, as well as laser communication proof of concept

B. Accomplishments/Planned Program

	FY 2006	FY 2007	FY 2008	FY 2009
Sensing Systems	64,306	88,678	52,556	37,210
RDT&E Articles (Quantity)	0	0	0	0

Dollars above include HAA in FY 06 and FY07.

FY06 Accomplishments:
Discriminating Sensor Technology:

- Complete full-power testing currently underway at the JPL Optical Communication Telescope Laboratory facility.

Passive EO/IR Technology:

- Delivered two quantum well infrared photodetector (QWIP) cameras to ABL and conducted a joint field test with ABL and Boeing on these cameras at the White Sands Missile Range. The data analysis is underway by Boeing and the results will help in determining the next step and direction of the QWIP technology development for ABL Block upgrades.
- Demonstrated the world's first type II superlattice infrared cameras at long wavelength. Improvement is still needed to make these sensors capable of meeting BMD system requirement.
- Demonstrated Mercury Cadmium Telluride (HgCdTe) on Si substrate technology at long wavelength. Improvement is still needed to make these sensors capable of meeting BMD system requirement.
- Demonstrated a breadboard 10º Kelvin cryocooler with efficiency improved from 10,000W/W to 3,000W/W.

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APPROPRIATION/BUDGET ACTIVITY: **RDT&E, DW/03 Advanced Technology Development (ATD)**	R-1 NOMENCLATURE: **0603175C Ballistic Missile Defense Technology**

Radar Systems Technology:

- Achieved key low power density knowledge point with delivery and test of "Spiral 0" digital subarray.
- Continued design and development of low power density RF panels with "Spiral 1" RF tile CDR and RF panel PDR. Technical and cost data continue to validate next generation radar concepts.
- Demonstrated, in real time, coherent distributed aperture scaleable sensitivity and the potential of providing robust forward-based sensing in the presence of countermeasures at the White Sands Missile Range against ballistic missiles and aircraft.
- Completed preliminary designs for key components of next generation transmit/ receive integrated microwave module (NGT).
- Delivered Multi-Chip Receiver-Exciter Module that exceeded size, weight and power consumptions goals, a key knowledge point on the path to fully digitized arrays.
- Continued successful low power density risk reduction with development and test of a silicon germanium monolithic microwave integrated circuit (MMIC) receive chain and an alternative radiator.

Early Launch Detection and Tracking Technology:

- Demonstrated HF radar real-time target track fusion against a boosting Terrier-Orion missile with multi-static passive receivers at White Sands Missile Range (WSMR) (Jun 06). This was a collaborative effort with Australia.
- Participated in cooperative R&D testing in Australia that demonstrated advanced Over The Horizon Radar (OTHR) concepts and algorithms using Australian operational assets (Feb 06).
- Conducted airborne tests of First Alert and Cueing (FAC) and Hyper-Temporal Infrared (HTI) "see-through-clouds" passive sensors against a static rocket booster through thick clouds (Feb 06).
- Conducted successful FAC/HTI ground tests through clouds from the top of Mt Washington, NH. (Aug 06).

Spectral Sensing for Kill Assessment:

- Began development of a high speed spectrometer instrument package for intercept flight tests.
- Continued modeling effort of hyper-velocity impact and subsequent fireball development and spectral output.
- Performed ground based experiments to verify modeling efforts and test potential sensor prototypes.

Micro Satellites:

- Micro Satellite DSE program:
  - Completed Distributed Sensing Experiment Critical Design Review.

- Completed system level documents and draft subsystem specifications.
- Baselined payload/bus ICD.
- Completed key trades.
- Identified major vendors.
- Defined satellite mechanical layouts.
- Identified launch vehicle and selected orbit.
- Defined ground segment approach.

- Micro Satellite Target System (MTS) program:
  - Completed MTS Critical Design Review.
  - Completed interface control and design documents.
  - Defined payload/bus system.
  - Completed all design trades.
  - Defined avionics subsystem.
  - Defined telecom subsystem.
  - Initiated long lead and preferred items procurements.
  - Selected major vendors.

High Altitude Airship:

- Developed and successfully tested the three critical technologies in power generation, energy storage, and hull mass reduction areas required for the HAA prototype.

FY07 Planned Program:

Passive EO/IR Technology:

- Continue to improve type II superlattice material quality and passivation. Deliver single-color, long-wavelength, focal plane array for lab testing and hardware in the loop testing. The goal is to demonstrate the technology in single color, then go to very large format, two-color array for MKV and very long wavelength for STSS.
- Continue to reduce the buffer layer dislocation defects of the HgCdTe on Si substrate. Deliver single color long wavelength focal plane array for lab testing. The goal is to be a competitive technology to be demonstrated in single color, then go to very large format two-color for MKV and long wavelength for STSS.
- Continue to develop 2kx2k two-color quantum well infrared photodetector arrays for ABL Block upgrades.

- Look into new concepts of infrared technologies, such as dilute III-V material for future potential infrared material to meet BMD needs.

Radar System Technology:

- Development of critical techniques to mitigate countermeasures to forward based sensing including coherently combining spatially-distributed apertures and advanced waveforms and related signal processing.
- Continue development of next-generation transmitters, receivers, antennae, signal processors, and software for improvements in BMDS radar detection, acquisition, tracking and discrimination capabilities.
- Continue development and technical analysis of advanced antenna technologies; deliver RF tiles for government testing, complete RF panel CDR and begin fabrication, and begin development of a complete low power density radar demonstration system.
- Complete design of next generation transmit/receive integrated microwave module based on previous and ongoing MDA, DARPA and NRL efforts in transmit/receive materials, efficiency, power and packaging technologies. Demonstrate NGT gallium nitride MMIC 1,000,000 hour mean time to failure, achieving key knowledge point.

Early Launch Detection and Tracking Technology:

- Conduct HF radar flight tests using operational Relocatable Over-the-Horizon Radar (ROTHR) against realistic ICBM-like targets of opportunity (Jun 07).
- Participate in cooperative R&D waveform development testing in Australia that will demonstrate advanced Over the Horizon radar clutter mitigation using Australian operational assets (Mar 07)
- Perform jitter mitigation effort for HTI sensor (Apr 07).
- Conduct flight and ground tests using FAC/HTI sensors (TBD).

Spectral Sensing for Kill Assessment:

- Complete development of high speed spectrometer instrument package for support of data collection during intercept flight tests.
- Continue with BMDS hyper/multi-spectral sensor prototype design, development, and testing.
- Perform ground based experiments to verify exploitable impact features derived from modeling and small scale tests.
- Utilize prototype sensors for airborne observation of an FTG intercept to gather data and test sensor concepts.

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Micro Satellites:

- Micro Satellite DSE program
  - Initiate Phase 3 Fabrication, Integration and Test of three Distributed Sensing Experiment micro satellites
  - FlatSat Integration and Test.
  - Micro Satellite A Fabrication , Integration and Test
  - Micro Satellite B Fabrication , Integration and Test
  - Micro Satellite C Fabrication , Integration and Test
  - Conduct the Pre-environmental Test Review
  - Spacecraft Bus assembly, integration and testing
  - Launch Readiness Review.
- Micro Satellite Target System (MTS) program
  - Finalize telecom subsystem design
  - Procure the flight components
  - Complete the power subsystem design
  - Final integration and functional test of the core bus

Current budgetary guidance to cancel the Microsat program at the end of FY07 will negate FY08 and subsequent effort. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

High Altitude Airship:

- Begin construction of the HAA prototype.
- Continue to develop the power generation, energy storage, and hull mass reduction technologies required for the operational HAA, through our Technology Improvement Project.

Current budgetary guidance to cancel the High Altitude Airship program at the end of FY07 will negate FY08 and subsequent effort. Therefore, FY07 planned activities will be modified to consolidate and finalize technical efforts in a manner which will enable efficient reactivation, if that is determined to be of value in the future.

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date: February 2007
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FY08 Planned Program:

Passive EO/IR Technology:

- Continue to improve type II superlattice material quality and passivation. Deliver single-color, long-wavelength, focal plane array for lab testing and hardware in the loop testing. The goal is to demonstrate the technology in single color, then go to very large format, two-color array for MKV and very long wavelength for STSS.
- Continue to reduce the buffer layer dislocation defects of the HgCdTe on Si substrate. Deliver single color long wavelength focal plane array for lab testing. The goal is to be a competitive technology to be demonstrated in single color, then go to very large format two-color for MKV and long wavelength for STSS.
- Continue to develop 2kx2k two-color quantum well infrared photodetector arrays for ABL Block upgrades.
- Look into new concepts of infrared technologies, such as dilute III-V material for future potential infrared material to meet BMD needs.

Radar System Technology:

- Initiate next generation radar system-level design and development.
- Continue to develop critical techniques to mitigate countermeasures to forward based sensing including coherently combining spatially-distributed apertures and advanced waveforms and related signal processing.
- Continue development of next-generation transmitters, receivers, antennae, signal processors, and software for improvements in BMDS radar detection, acquisition, tracking and discrimination capabilities.
- Continue development and technical analysis of advanced antenna technologies; deliver RF tiles for government testing, complete RF panel CDR and begin fabrication, and begin development of a complete low power density radar demonstration system.
- Complete design of next generation transmit/receive integrated microwave module based on previous and ongoing MDA, DARPA and NRL efforts in transmit/receive materials, efficiency, power and packaging technologies. Demonstrate NGT gallium nitride MMIC 1,000,000 hour mean time to failure, achieving key knowledge point.

Early Launch Detection and Tracking Technology:

- Continue development work, as warranted, with the operational Relocatable Over-the-Horizon Radar (ROTHR) against realistic ICBM-like targets of opportunity.
- Continue cooperative R&D waveform development testing with Australia, as warranted, to demonstrate advanced Over the Horizon radar clutter mitigation using Australian operational assets (Mar 07).
- Initiate platform integration design for flight test and evaluation of operational prototype HTI sensor.

- Continue flight and ground tests of developmental HTI sensor.

Spectral Sensing for Kill Assessment:
- Complete development of high speed spectrometer instrument package for support of data collection during intercept flight tests.
- Continue with BMDS hyper/multi-spectral sensor prototype design, development, and testing.
- Perform ground based experiments to verify exploitable impact features derived from modeling and small scale tests.
- Utilize prototype sensors for airborne observation of an FTG intercept to gather data and test sensor concepts.

FY09 Planned Program:
Passive EO/IR Technology:
- Continue to improve type II super lattice material quality and passivation. Deliver single-color, long-wavelength, focal plane array for lab testing and hardware in the loop testing. The goal is to demonstrate the technology in single color, then go to very large format, two-color array for MKV and very long wavelength for STSS.
- Continue to reduce the buffer layer dislocation defects of the HgCdTe on Si substrate. Deliver single color long wavelength focal plane array for lab testing. The goal is to be a competitive technology to be demonstrated in single color, then go to very large format two-color for MKV and long wavelength for STSS.
- Continue to develop 2kx2k two-color quantum well infrared photodetector arrays for ABL Block upgrades.
- Look into new concepts of infrared technologies, such as dilute III-V material for future potential infrared material to meet BMD needs.

Radar System Technology:
- Continue next generation radar system-level design and structure full-scale prototype demonstration.
- Continue development of critical techniques to mitigate countermeasures to forward based sensing including coherently combining spatially-distributed apertures and advanced waveforms and related signal processing.
- Continue development of next-generation transmitters, receivers, antennae, signal processors, and software for improvements in BMDS radar detection, acquisition, tracking and discrimination capabilities.
- Continue development and technical analysis of advanced antenna technologies; deliver RF tiles for government testing, complete RF panel CDR and begin fabrication, and begin development of a complete low power density radar demonstration system.

- Complete design of next generation transmit/receive integrated microwave module based on previous and ongoing MDA, DARPA and NRL efforts in transmit/receive materials, efficiency, power and packaging technologies. Demonstrate NGT gallium nitride MMIC 1,000,000 hour mean time to failure, achieving key knowledge point.

Early Launch Detection and Tracking Technology:

- As warranted, continue HF radar development flight tests using operational Relocatable Over-the-Horizon Radar (ROTHR) against realistic ICBM-like targets of opportunity.
- Participate in cooperative R&D waveform development testing with Australia, as warranted, to demonstrate advanced Over the Horizon radar clutter mitigation using Australian operational assets.
- Continue platform integration design for operational HTI prototype.
- Conduct flight and ground tests using operational prototype HTI sensor.

Spectral Sensing for Kill Assessment:

- Complete development of high speed spectrometer instrument package for support of data collection during intercept flight tests.
- Continue with BMDS hyper/multi-spectral sensor prototype design, development, and testing.
- Perform ground based experiments to verify exploitable impact features derived from modeling and small scale tests.
- Utilize prototype sensors for airborne observation of an FTG intercept to gather data and test sensor concepts.

	FY 2006	FY 2007	FY 2008	FY 2009
Weapons Technology	28,185	39,600	40,736	43,959
RDT&E Articles (Quantity)	0	0	0	0

Note: In FY06, the Multiple Kill Vehicles program funding moved from Project 0502 (Engagement Systems area) to a new Program Element (0603894C) in Project 0515, Multiple Kill Vehicles. Following resources were moved: FY06 - $82 million, FY07 - $220 million, FY08 - $273 million, FY09 - $306 million, FY10 - $308 million, FY11 - $113 million.

FY06 Accomplishments:

- Laser Technology Program
  - Strategic Illuminator Laser - Breadboard phase completed with demonstration of excellent beam quality at full power. Following a successful Critical Design Review in 1QFY06, fabrication of the brassboard version continued for delivery and testing in the first quarter of the following year.

- Small Laser Amplifier for Ladar (SLAL) - Conducted Critical Design Review and down selected to one contractor (LMCT) for Phase III, brassboard production and delivery. Non-selected amplifier (Northrop Grumman) incorporated into AARDI brassboard.
- Advanced Inertial Reference Unit - Following assembly and integration, exercised contract option in November 2005 to complete integration, conduct system performance testing and prepare for deployment by the end of the calendar year.
- Advanced Detectors - Completed Phase 3 testing at the Air Force Research Laboratory and submitted final report.
- Angle-Angle-Range Resolved Doppler Imager - Integrated an improved amplifier into the brassboard for Angle-Angle Doppler capability and packaged the unit for outdoor range testing to demonstrate system performance with full-scale targets.
- Advanced Chemical Oxygen - Iodine Laser (COIL) Technology - Project concluded.
- Air (Oxygen) Laser - Contractor unable to execute project; participation terminated.
- COIL Improvements - Deuterated Fuels: Tested various proportions of deuterated material; Injectors - finished fabricating full-scale Iodine nozzles for testing; Iodine Advanced Generators - completed testing alternative configurations and selected the best technique for scale-up; Advanced Diagnostics - concluded contract, integration complete. MicroCOIL generator successfully demonstrated at MIT.
- Ultra-Sensitive Detectors - After a competition between the contractors on the design of their detectors and multiplexers, down selected to one contractor (Raytheon Vision Systems) to start fabrication based on approved design.

- Interceptor Technologies Program
  - Initiated development of algorithms for optimal guidance of interceptors versus maneuvering threats.
  - Conducted technology surveys and assessments, including the release of a Request For Information to industry, for novel discrimination augmentation concepts.
  - Completed a comprehensive technology survey and development roadmap for kill vehicle lethality enhancement concepts.
  - Completed an assessment of PAC-3 and THAAD interceptors for air-launched compatibility and support requirements.
  - Conducted feasibility analyses, technology surveys, systems impact analyses, and program planning for interceptor technology projects for possible execution in FY07:
    - Advanced lightweight and high strength structures;
    - Advanced active/passive kill vehicle seekers'
    - Advanced distributed aperture target acquisition methodologies for small kill vehicles;
    - High frame rate focal plane arrays and readouts;
    - Silicon micro thrusters for small divert and attitude control systems.

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FY07 Planned Program:

- Laser Technology Program
  - Strategic Illuminator Laser - Finish brassboard fabrication, conduct verification testing, and deliver product.
  - Small Laser Amplifier for Ladar - Deliver completed device to Air Force for incorporation into Long Range Ladar.
  - Advanced Inertial Reference Unit - Deploy to Maui Space Surveillance System and integrate into Active Track Program.
  - Angle-Angle-Range Resolved Doppler Imager - Produce final report and documentation.
  - COIL Improvements - Deuterated Fuels: Select source of deuterated reactants and mature fuels work toward full-scale demonstration.
  - Ultra-Sensitive Detectors - Continue fabrication and integration of detector and multiplexer based on approved design.
  - Advanced Track Illuminator Laser (ATILL) - With data obtained from a Request for Information, will issue Broad Area Announcement resulting in at least two contracts for trade studies, risk reduction and breadboard design and fabrication. Will involve, and build on, prior work performed by MIT/LL.
  - High Brightness / High Efficiency Lasers - Using considerable expertise of Lawrence Livermore National Laboratory, build a 10 W demonstrator DPAL using pump diodes, a pump delivery system, vapor cell and cooling components from the design effort. TACL efforts will focus on ceramic material selection and laser model development followed by initial lasing experiments.
  - Convene a laser technology working group meeting to examine promising BMDS relevant laser technologies and select one to three technology base projects in FY 2007 for execution in FY 2008. Define knowledge/decision points to measure technical progress for each selected project.

- Interceptor Technologies Program
  - Continue optimal guidance algorithm development for interceptors versus maneuvering threats.
  - Initiate development of component technologies to counter maneuvering threats:
    - Lightweight divert and attitude control system (DACS) thrusters and pressurization components;
    - Lightweight, high strength materials characterization (coupon testing);
    - Miniaturized communications components.
  - Initiate development of the next generation kill vehicle seekers:
    - Advanced active/passive seeker breadboard telescope laboratory characterization;
    - Distributed aperture seeker algorithm development.
  - Continue concept development of air launched weapons concept and initiate preliminary design of an external weapons bay compatible with PAC-3 and THAAD interceptors, with an integral EO/IR sensor for tactical fighter aircraft.

- Initiate Operator-in-the-Loop simulations to identify optimal performance characteristics of air-launched weapons and sensors at the Virtual Warfare Center
- Continue advanced air-based weapons concept of operations development;
- Select teams and initiate concept development analyses, trade studies, and component development for novel discrimination augmentation concepts.

FY08 Planned Program:

- Laser Technology Program
  - Strategic Illuminator Laser - Complete testing and deliver to Airborne Laser or Air Force Research Laboratory.
  - COIL Improvements - Test deuterated fuels in full-scale demonstration and resume full-scale Injector fabrication, Generator performance verification, and development of four Iodine Nozzle technologies.
  - Ultra-Sensitive Detectors - Complete Detector system modeling, final design documentation, and delivery of prototype camera system for testing at government location.
  - Advanced Track Illuminator Laser (ATILL) - Complete fabrication of breadboard laser and verification testing leading to scale-up of design and production by single contractor.
  - High Brightness / High Efficiency Lasers - Finalized design and fabricate an 850 W demonstrator DPAL based on lessons learned from 10 W prototype with scaled-up thermal control system. Extensive TACL experiments will refine models and fabricate improved gain media for best beam quality possible.
  - Convene a laser technology working group meeting to examine promising BMDS relevant laser technologies and select one to three technology base projects in FY 2008 for execution in FY 2009. Define knowledge/decision points to measure technical progress for each selected project.

- Interceptor Technologies Program
  - Select three technology projects executed in FY 2007 for continued development in FY 2008. Candidate technology projects include:
    - Optimal guidance and kill vehicle control algorithms for maneuvering threats.
    - Lightweight divert and attitude control system (DACS) thrusters, pressurization, and thrust vectoring (component laboratory demonstrations).
    - Lightweight, high strength structures characterizations (component laboratory demonstrations).
    - Miniaturized communications components (component laboratory demonstrations).
    - Advanced active/passive seeker breadboard telescope laboratory characterization with active component.

- Distributed aperture seeker algorithm and hardware demonstrations.
- Initiate detailed design external weapons bay with integrated EO/IR sensor, capable of supporting a flight test with PAC-3 or THAAD derivative interceptors.
- Continue advanced air-based weapons employment simulations and concept of operations development.
- Initiate prototype development for novel discrimination augmentation concept.

FY09 Planned Program:

- Laser Technology Program
  - COIL Improvements - Continue full-scale Injector fabrication, Generator performance verification, and development of four Iodine Nozzle technologies.
  - Advanced Track Illuminator Laser (ATILL) - Complete fabrication of brassboard laser and verify performance before delivery to government.
  - High Brightness / High Efficiency Lasers - Characterize DPAL beam quality and efficiency and examine packaging options. Extensively test the TACL device fabricated from improved gain media and optimize power and beam quality.
  - Continue those efforts started in FY 2008 that demonstrate sufficient technical progress towards defined knowledge/decision points.
  - Convene a laser technology working group meeting to examine promising BMDS relevant laser technologies and select one to three technology base projects in FY 2009 for execution in FY 2010. Define knowledge/decision points to measure technical progress for each selected project.

- Interceptor Technologies Program
  - Continue development of the three technology projects selected in FY 2008. Candidate technology projects include:
    - Optimal guidance and kill vehicle control algorithm (Hardware-In-the-Loop testing).
    - Lightweight divert and attitude control system (DACS) thrusters, pressurization, and thrust vectoring hot fire tests (component laboratory demonstrations).
    - Lightweight, high strength prototype structures characterizations.
    - Miniaturized communications components(component laboratory demonstrations).
    - Advanced active/passive seeker breadboard demonstrations with active component.
    - Distributed aperture seeker algorithm and hardware demonstrations.
    - Concept development of air launched weapons concept and complete detailed design and prototype of a sensor and external weapons bay for tactical fighter aircraft.

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- Flight test of selected air-launched interceptors.
- Advanced air-based weapons employment simulations and concept of operations development.
- Prototype development for novel discrimination augmentation concept.

	FY 2006	FY 2007	FY 2008	FY 2009
Innovative Technology and Analysis	6,013	6,955	6,235	8,738
RDT&E Articles (Quantity)	0	0	0	0

FY06 Accomplishments:
Technology Outreach:

- Obtained Project Arrangement (PA) to work with Australia on the Over-The-Horizon-Radar (OTHR) and Early-Launch-Detection/Tracking (ELDT) programs.
- Advanced Technology was the first to accomplish an exchange of a UK scientist to work on-site at MDA on an MDA project. Obtained PA to work with the United Kingdom (UK) on the Hercules program in the UK for research on C2BMC.

MSTAR:

- Awarded six new MSTAR programs investing in missile defense technology ranging from cutting edge sensing technology (increasing FPA Directivity by an order of magnitude) to revolutionary war head kill assessment capabilities
- Johns Hopkins University/Applied Physics Lab's MSTAR award titled “Hypervelocity Impact Fragmentation For Intercept Optical Signatures”. JHU/APL will develop a high fidelity modeling and simulation capability (titled Hydrocode) to enable MDA to define the nature of debris clouds arising from hypervelocity impacts. This includes unparalleled capabilities to model and estimate fragment size distribution of both ductile and brittle structures and developing models for the partitioning of energy between kinetic energy, fracture energy, plastic/shock dissipation and thermal energy as a result of hypervelocity impact involving fragmentation. MDA's Kill Assessment Program is the end-user for this MSTAR research program.
- North Carolina State University's MSTAR award titled “Development of Highly-Sensitive Mercury Cadmium Telluride (HgCdTe) Detectors and Large Format FPAs for Space-based Imaging Applications in the 2 -14 micron”. Epitaxial layer overgrowth (ELO) for Silicon doped Cadmium Telluride (CdTe/Si) using MOVPE will reduce dislocations (impurities) in Cadmium Telluride (CdTe) buffer layer. This will improve the Detectivity of the FPA via reducing dislocation densities to less than 1000/square cm to enable BLIP performance at LWIR for satellite-based earth-observing FPAs. An order of magnitude increase in IR Sensor Detectivity is anticipated. The primary MDA user for this MSTAR research program is the MDA/DV EO/IR Sensor Program.

- University of Central Florida's MSTAR award titled "High-Impulse Rocket Propellants Using Nano-Particle Additives". UCF will partner with Edwards AFB to create special metallic nano-particle additives for the MKV's solid fuel propellant. This will enable much more efficient thrusting/impulse capabilities and attitude control.
- Pennsylvania State University's MSTAR award titled "Modeling and Simulation of high Altitude Target Phenomenology and Tracking" is collaborating with both Project Hercules and the MKV Program for future technology insertion.
- University of Delaware's MSTAR award titled "Multi-and Hyper-Spectral Millimeter Wave Imaging for Missile Defense" is examining innovative RF methods for high resolution radar sensor imagery which exceeds currents BMDS sensor capabilities. Several Advanced Technology sensor programs are targeted to insert this revolutionary imaging technology.
- University of Maryland's MSTAR award titled "Investigation on a Novel Coaxial Microinjector with Application to Liquid Micropropulsion System".

FY07 Planned Program:
Technology Outreach and Advanced Technology BAA:

- Continue to seek innovative and breakthrough technologies from domestic and international sources via the DV-BAA process.
- Continuation of Project Arrangement (PA) for a UK scientist to work on the Hercules program, on-site at MDA. Following this PA, continuation of this exchange effort will be realized through the establishment of an MDA working cell in the UK.
- Open discussions with Germany and Japan for development of the High Altitude Airship (HAA) program.
- Establish a Memorandum of Understanding (MOU) with France for BMDS relevant science and technology.
- Initiate discussions with Denmark industry to submit a proposal against MDA's existing BAA.
- Enhance DV's MDA Web Portal with Web based corporate knowledge capture and collaboration tools process.
- Continue to seek collaboration opportunities with MDA and other Government, Industry, and International efforts.

MSTAR:

- Award several MSTAR contracts in a variety of missile defense technology areas seeking to further acquire technology needed to counter evolving ballistic missile threats to the US and it allies. Research areas targeted under the scope of the MSTAR Program include Radar Systems; Lasers and Electro-Optical Systems; Integrated Active/Passive IR Sensor Systems; Computer Science, Signal and Data Processing; Mathematics, Probability, and Decision Theory; Physics, Chemistry, and Materials; Mechanical and Aerospace Engineering; Battle Management/Command and Control.
- Currently, the JHU/APL MSTAR Program (described above) is closest to insertion within the MDA Kill Assessment Program.

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FY08 - 09 Planned Program:

Technology Outreach and Advanced Technology BAA:

- Continue to seek innovative and breakthrough technologies from domestic and international sources via the Advance Technology-BAA process.
- Continue to pursue International program and expand Project Arrangements with other countries to attract participating scientist to work at MDA.
- Continue to seek collaboration opportunities with MDA and other Government, Industry, and International efforts.

MSTAR:

- Award several MSTAR contracts in a variety of missile defense technology areas seeking to further acquire technology needed to counter evolving ballistic missile threats to the US and it allies.

	FY 2006	FY 2007	FY 2008	FY 2009
Statutory and Mandated	1,920	2,185	1,589	1,611
RDT&E Articles (Quantity)	0	0	0	0

FY06 Accomplishments

Technology Applications Program:

- In FY06, the TA program worked directly with 24 different MDA-funded technologists as part of the Technology Applications Review process, which helps maturing MDA-funded technologies solidify their product and distribution plans. In addition, 29 company teams went through Business Focus Workshops for early stage (SBIR Phase I) technologies to help in building a business case to bring their technologies to market, be it military or commercial. The TA program was also active in its “outreach” program, featuring 31 MDA-funded technologies in its very well received MDA Tech Update quarterly newsletter. The capstone for the outreach year was publication of the report Defining Moments - Selected Highlights from 25 Years of Missile Defense Technology Development and Transfer. The TA program's dedicated Web site, www.mdatechnology.net, was also continually improved for functionality and content to benefit to the MDA technology program, which was demonstrated by continually increasing visit rates and follow-on queries about MDA-funded technologies.
- Established a teaming relationship between two MDA-funded companies, MMCC (metal matrix composites manufacturing) and Left Hand Design Corp. (high accuracy mirrors for sensors). MMCC now makes stable composite backplanes for Left Hand's fine steering mirrors.

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HBCU/MI:

- Continued to fund HBCU/MI programs to capitalize on successes from past year work. Complied with DFARS 226-7000 which implements HBCU and MI provisions of 10 U.S.C. 2323 and sets a DoD goal of 5% for each fiscal year to award contract and subcontract dollars to small disadvantaged business concerns and HBCUs and MIs.
- Florida International University's HBCU/MI award titled "Development of a Threat Assessment Module for Theater Missile Defense Using Belief Theory & Cognitive Engineering Approach" aims to develop a new threat level classification algorithm (TLCA) using Dempster-Shafer (D-S) Belief Theory to improve system capability of handling incomplete/ambiguous information. FIU will Design the information presentation & interaction interface between the operator and the underlying information-processing algorithm using cognitive engineering techniques and human-in-the-loop methodology to improve posture. Anticipated BMDS Operational payoff is to enable BMDS Operator (Commander) to more efficiently make operational and tactical real-time Warfighter decisions. MDA/Advance Technology's Project Hercules or MDA/C2BMC's Battle Manager is a potential end-user for this HBCU/MI research program.
- University of Hawaii's HBCU/MI award titled "Retrodirective Antennas and Micro-Thruster Propulsion System for Distributed Nanosatellite Sensor Networks" aims to develop two nanosatellite engineering models which each support:
  - A retrodirective antenna array for self-steering, secure crosslink communications
  - A micro-thruster propulsion system suitable for nanosatellites, to provide orbital corrections
  - An affordable nanosatellite bus system, including low-mass structural housing, thermal management, communications, command and data handling, stabilization, and power subsystems. Anticipated BMDS Operational payoff will be to develop proof-of-concept cluster of two nanosatellites to demonstrate key enabling technologies for missile defense; with dual-use civilian applications in crisis management and disaster mitigation. MDA's Multiple Kill Vehicle Program is a potential end-user for this HBCU/MI research program.

SBIR/STTR:

- Successful examples from this year of DV-sponsored Phase II projects that have received outside funding to transition their technology into the BMDS and DoD.
  - MP Technologies: "LWIR Focal Plane Array Based on Type-II InAs/GaSb Superlattices" received $500,000 from MDA/DVS which will allow for the transfer of the technology for testing in the THAAD seeker.
  - Numerical: "Radar Centroid Processing and EO/IR System Model Development for BMD Benchmark" received $200,000 in matching funds from MDA/BC for improvements to the BMDS battle management and command and control system.
  - MicroSat Systems: "Responsive Micro satellite Target System Design Implementation". The AFRL is matching $250 from the AF DSX funding to explore the potential for current and emerging spacecraft radios to be used with existing hardware encryption, and thereby coming

interoperable within the Air Force Spacecraft Communication Network (AFSCN). It will give the BMDS and other DoD capabilities to perform extremely low-cost tactical space flight with major impact on several mission areas.

FY07 - 09 Planned Program:
Technology Applications Program:

- The Technology Applications program will conduct Technology Applications Reviews and Business Focus Workshops. Continue to accelerate technology maturation techniques such as commercialization assistance by expert reviews and advice, out reach publications and web site, consultation and training of technology developers, and application of standard metrics to validate technology maturation claims.

HBCU/MI:

- Continue to fund HBCU/MI to support BMDS technology needs as they arise. Comply with DFARS 226-7000 which implements HBCU and MI provisions of 10 U.S.C. 2323 and sets a DoD goal of 5% for each fiscal year to award contract and subcontract dollars to small disadvantaged business concerns and HBCUs and MIs.
- Transition successful HBCU/MI programs to the BMDS or Sensors, Weapons, and Hercules technology areas.

SBIR/STTR:

- Continue technical oversight of the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program.

	FY 2006	FY 2007	FY 2008	FY 2009
Congressional Action	29,850	25,600	0	0
RDT&E Articles (Quantity)	0	0	0	0

FY06 Accomplishments:
Provided programmatic oversight and technical influence for the following congressional directed technology programs.

- Center for Optical Logic Devices
- Massively Parallel Optical Interconnects for Micro Satellite Applications
- Advanced RF Technology Development
- Multiple Target Tracking Optical Sensor Array Technology (MOST)
- Porous Silicon
- SiC Thick Film Mirror Coatings

- Advanced Processing Architecture
- Aluminum Nitride Substrates for Wide Bandgap Devices
- High Density Power Supplies using Silicon Carbide
- Day and Night Vision Sensor
- NetCentric Airborne Defense Element (NCADE)

FY07 Planned Program:
Provide programmatic oversight and technical influence for the following congressional directed technology programs.

- Advanced Processing Architecture
- Massively Parallel Optical Interconnects
- Center for Optical Logic Devices (COLD)
- Advanced RF Technology Development
- Multiple-Target-Tracking Sensor-Array Technology (MOST)
- Photoconductor on Active Pixel Sensor (POAP)
- SIC Thick Film Mirror Coatings
- Conformal Embedded Rectennas for Areal Platforms

	FY 2006	FY 2007	FY 2008	FY 2009
Advanced Communications Technology	0	11,997	11,947	12,423
RDT&E Articles (Quantity)	0	0	0	0

FY07 Planned Program:

- Commence/continue activities to enable the integration of advanced C2BMC capabilities into BMDS subsystems:
  - Define and demonstrate the Kinetic Energy Interceptor (KEI) to C2MBC messages associated with enabling C2BMC connectivity, rules of engagement (ROE), machine acknowledgements, sharing of KEI generated boost-phase tracking information, and interceptor seeker imagery.
  - Define and demonstrate the Surveillance and Tracking Space System (STSS) to C2BMC interface. This includes defining and demonstrating tactical data links (TADIL-J) interfaces in a lab environment and planning for future interfaces. Examine multi-level security issues for overhead non-imaging infrared (ONIR) to C2MBC interfaces.

  - Demonstrate and evaluate advanced C2BMC capabilities in five live-flight test events using the C2MBC X-Lab. Assess each capability's performance, maturity level, and readiness for transition into the BMDS.
  - Design a transportable C2MBC mockup to enable war fighter to define crew positions and develop concept of operations (CONOPS) in the areas of boost phase tracking and classification, sensor resource management, weapons resource management, post-intercept debris information flow, and communication with allies.
- Develop and demonstrate next generation command and control capabilities:
  - Demonstrate sensor registration and health and status monitoring capabilities to eliminate sensor bias, achieve covariance consistency, and synchronize the timing of sensors across the BMDS.
  - Conduct pilot efforts to create a service oriented architecture (SOA) compliant version of the BMDS command and control (C2) capabilities to enable integration with the global command and control system-joint (GCCS-J) and net-enabled command capability (NECC) systems.
  - Develop consequence mitigation/management capabilities; post-intercept debris fallout prediction and warning capabilities; and lethality modeling improvements to enable large raid size debris predictions in real time.
- Develop and demonstrate next generation sensor netting and sensor resource management techniques.
  - Conduct sensor netting experiments associated with BMDS registration, bias mitigation techniques, sensor tracking (local), network tracking, discrimination, sensor resource tasking, system level target object map (TOM), and communications/bandwidth constraints.
  - Assess distributed track processing techniques for integrated air and missile defense (IAMD) sensor netting concepts, including the use of the Tactical Component Network (TCN).
  - Demonstrate and increase maturity of sensor interface definitions using a research and development version of the C2MBC network interface processors (CNIP).
- Develop and demonstrate advanced battle management (BM) and integrated fire control capabilities.
  - Demonstrate and assess global integrated fire control functionality in the C2BMC X-Lab.
  - Conduct a pathfinder effort to develop an integrated capability for initial system level hit assessment, kill assessment, and weapons typing.
  - Demonstrate initial distributed battle management constructs, including advanced battlefield learning techniques, sensor/shooter asset management, and operations/planning options such as reallocation of assets.
- Demonstrate and transition advanced networking technologies.
  - Assess initial distributed track processing capabilities for IAMD integration, including the use of TCN to enable effective C2 and BM/fire control capabilities under conditions of limited communications bandwidth.
  - Demonstrate and start transitioning flexible theater C2BMC services, including distributed correlation / discrimination and flexible satellite communications.
- Develop tools and techniques to facilitate technology maturation and transition to operations.

- Develop the analytic and experimentation infrastructure to enable concept simulation. Develop the collaborative environments to enable demonstration of C2BMC capabilities during live flight events using the C2BMC X-Lab.

FY08 Planned Program:

- Commence/continue activities to enable the integration of advanced C2BMC capabilities into new BMDS subsystems:
  - Define and demonstrate the Airborne Laser (ABL) to C2MBC messages associated enabling C2BMC connectivity, rules of engagement (ROE), machine acknowledgements, sharing of ABL boost-phase tracking information, ABL hit assessment, ABL kill assessment, and ABL post-intercept debris fallout predictions.
  - Integrate the C2BMC X-Lab and Missile Defense Space Experimentation Center (MDSEC) at a level higher than SECRET to enable demonstration of advanced C2BMC capabilities.
  - Demonstrate and evaluate advanced C2BMC capabilities in five live-flight test events using the C2MBC X-Lab.
  - Build the transportable C2MBC mockup and conduct war fighter concept of operations (CONOPS) development in the areas of boost phase tracking and classification, sensor resource management, weapons resource management, post-intercept debris information flow, and communication with allies.
- Develop and demonstrate next generation command and control capabilities.
  - Develop, demonstrate, and transition a sensor registration and health and status monitoring capability for fixed site sensors.
  - Develop and demonstrate technology to assess sensor registration, bias, covariance consistency, and system level time synchronization for broader set of BMDS and allied sensors, to include mobile sensors.
  - Transition NECC pilot project to the operational C2BMC system.
  - Conduct transition demonstrations for providing C2BMC capabilities via information technology (IT) infrastructure associated with deployed or planned deployments with GCCS-J and NECC, North Atlantic Treaty Organization (NATO) Air Command and Control System (ACCS), and other appropriate systems.
  - Demonstrate the initial post-intercept consequence mitigation capability in an operational environment as an overlay to current situational awareness displays for both United States and allied systems. Update BMDS planning tools with next generation software codes to conduct real-time high fidelity assessments. Integrate high-altitude weather system information to increase confidence in post-intercept debris pattern predictions.
- Develop and demonstrate next generation sensor netting and sensor resource management techniques.
  - Conduct sensor netting experiments associated with BMDS registration, sensor tracking (local), network tracking, discrimination, sensor resource tasking, system-level TOM, and communications/bandwidth constraints.

- Conduct assessments of expanded distributed track processing capabilities for the BMDS, to include measurement and track-level sensor information. Assess both tracking and discrimination constructs for adapting TCN to achieve BMDS and IAMD system tracking and discrimination needs.

- Develop and demonstrate advanced battle management and integrated fire control capabilities.
  - Integrate information of high altitude weather, CONOPS, shot doctrine, and debris mitigation associated with theater boost phase intercept into the pathfinder capability for system level hit assessment, kill assessment, and weapons typing.
  - Integrate the CONOPS information for advanced and emerging BMDS capabilities (such as multiple kill vehicles) into distributed battle management constructs.
  - Conduct architecture assessments of BM functions federated between C2BMC/GIFC and various allied/coalition partners.
- Demonstrate and transition advanced networking technologies.
  - Continue assessment of distributed track processing capabilities for IAMD integration, including the use of TCN to enable effective C2 and BM/fire control capabilities under conditions of limited communications bandwidth.
  - Demonstrate and transition advanced information assurance concepts into the BMDS testbed.
  - Transition flexible theater C2BMC services, including distributed correlation / discrimination and flexible satellite communications.
- Develop tools and techniques to facilitate technology maturation and transition to operations.
  - Continue development of the analytic and experimentation infrastructure to enable concept simulation. Develop the collaborative environments enable demonstration of C2BMC capabilities during live flight events using the C2BMC prototype.

FY09 Planned Program:

- Commence/continue activities to enable the integration of advanced C2BMC capabilities into BMDS subsystems.
  - Demonstrate and evaluate advanced C2BMC capabilities in five live-flight test events using the C2BMC X-Lab.
  - Align war fighter concept of operations (CONOPS) with appropriate engagement sequence group (ESG) in the areas of boost phase tracking and classification, sensor resource management, weapons resource management, post-intercept debris information flow, and communication with allies.
- Develop and demonstrate next generation command and control capabilities.
  - Continue to Develop, demonstrate, and transition a sensor registration and health and status monitoring capability for fixed site sensors.
- Develop and demonstrate next generation sensor netting and sensor resource management techniques.
  - Conduct sensor netting experiments associated with BMDS registration, sensor tracking (local), network tracking, discrimination, sensor resource tasking, system-level TOM, and communications/bandwidth constraints.

- Conduct assessments of expanded distributed track processing capabilities for the BMDS, to include measurement and track-level sensor information. Assess both tracking and discrimination constructs for adapting TCN to achieve BMDS and IAMD system tracking and discrimination needs.

- Develop and demonstrate advanced battle management (BM) and integrated fire control capabilities.
  - Conduct architecture assessments of BM functions federated between C2BMC/GIFC and various allied/coalition partners.
  - Integrate the CONOPS information and engagement sequence group (ESG) priorities for advanced and emerging BMDS capabilities (such as multiple kill vehicles) into distributed battle management constructs.
- Demonstrate and transition advanced networking technologies.
  - Continue assessment of distributed track processing capabilities for IAMD integration, including the use of TCN to enable effective C2 and BM/fire control capabilities under conditions of limited communications bandwidth.

	FY 2006	FY 2007	FY 2008	FY 2009
NFIRE	12,578	10,753	0	0
RDT&E Articles (Quantity)	0	0	0	0

FY06 Accomplishments:
- Completed spacecraft bus assembly, integration, and test to prepare for payload integration
- Completed and delivered the Track Sensor Payload (TSP) for payload integration
- Completed Space Vehicle integration and acceptance testing to ensure the spacecraft and its payloads are functioning
- Completed simulator testing between Space Vehicle and Laser Communication Terminal (LCT)
- Started Space Vehicle environmental testing to ensure the spacecraft and its payloads can survive launch and space environments

FY07 Planned Program:
- Receive Laser Communications Terminal (LCT) payload for payload integration
- Complete and certify Ground Segment Mission Operations Center to ensure the system is ready to support mission operations
- Conduct Mission Training to ensure the mission operators are prepared to execute
- Conduct Mission Rehearsals to test the interactions between the ground system, space system, and personnel prior to a mission
- Complete delivery and acceptance of Launch Vehicle to support launch of the spacecraft
- Launch the NFIRE Satellite to insert the spacecraft into orbit

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date: February 2007
APPROPRIATION/BUDGET ACTIVITY: **RDT&E, DW/03 Advanced Technology Development (ATD)**	R-1 NOMENCLATURE: **0603175C Ballistic Missile Defense Technology**

- Conduct Initial On-Orbit Operations to ensure the functionality and performance of the TSP prior to executing a mission
- Accept delivery of two Multi-stage Boost Targets
- Conduct Target of Opportunity Missions to collect low resolution plume data and validate the tracking performance of the TSP
- Conduct Near Field Boosting Target Fly-by mission to collect high resolution plume data
- Conduct Hyper-Temporal Experiment to assess early launch detect and tracking capability
- Conduct laser communications experiments to assess the viability of the technology for use by the BMDS and STSS Block 2012 (O)

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date: February 2007
APPROPRIATION/BUDGET ACTIVITY: RDT&E, DW/03 Advanced Technology Development (ATD)	R-1 NOMENCLATURE: 0603175C Ballistic Missile Defense Technology

C. Other Program Funding Summary

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total Cost
PE 0603881C Ballistic Missile Defense Terminal Defense Segment	1,120,879	1,092,076	962,585	1,004,282	924,101	851,213	678,694	501,147	7,134,977
PE 0603882C Ballistic Missile Defense Midcourse Defense Segment	2,391,246	3,043,058	2,520,064	2,359,665	2,179,602	1,699,963	1,153,082	1,183,003	16,529,683
PE 0603883C Ballistic Missile Defense Boost Defense Segment	455,572	628,958	548,759	432,432	448,375	678,913	829,683	1,026,239	5,048,931
PE 0603884C Ballistic Missile Defense Sensors	284,297	514,129	778,163	984,963	939,417	791,701	723,843	603,585	5,620,098
PE 0603886C Ballistic Missile Defense System Interceptors	200,446	356,004	227,499	393,317	522,388	730,236	836,029	570,206	3,836,125
PE 0603888C Ballistic Missile Defense Test and Targets	610,619	601,782	586,150	628,364	662,984	681,511	696,037	705,210	5,172,657
PE 0603889C Ballistic Missile Defense Products	387,402	0	0	0	0	0	0	0	387,402
PE 0603890C Ballistic Missile Defense System Core	409,993	429,420	482,016	511,147	558,746	579,571	579,316	588,481	4,138,690
PE 0603891C Special Programs - MDA	271,021	353,031	323,250	305,409	369,073	526,966	789,017	792,271	3,730,038
PE 0603892C Ballistic Missile Defense Aegis	893,040	1,122,669	1,059,103	1,129,425	1,221,650	1,067,587	1,054,753	1,089,078	8,637,305
PE 0603893C Space Tracking & Surveillance System	220,048	322,220	331,525	347,811	412,623	501,197	778,067	981,424	3,894,915
PE 0603894C Multiple Kill Vehicle	48,370	144,362	271,151	352,741	461,179	618,263	673,477	842,905	3,412,448
PE 0603895C BMD System Space Program	0	0	27,666	35,093	46,849	56,183	133,617	157,117	456,525
PE 0603896C BMD C2BMC	0	246,852	258,913	294,627	300,847	282,615	267,275	269,420	1,920,549
PE 0603897C BMD Hercules	0	49,674	53,658	54,264	54,405	55,142	53,355	54,198	374,696
PE 0603898C BMD Joint Warfighter Support	0	54,935	48,787	50,428	54,086	56,603	58,890	60,206	383,935
PE 0603904C BMD Joint National Integration Center (JNIC)	0	110,629	104,012	106,985	111,542	111,947	113,592	115,287	773,994
PE 0603905C BMD Concurrent Test and Operations	0	23,159	0	0	0	0	0	0	23,159
PE 0603906C Regarding Trench	0	0	2,000	3,000	5,000	5,000	9,000	9,000	33,000
PE 0605502C Small Business Innovative Research - MDA	133,105	0	0	0	0	0	0	0	133,105
PE 0901585C Pentagon Reservation	14,874	15,527	6,058	6,376	4,490	4,725	4,801	4,877	61,728
PE 0901598C Management Headquarters - MDA	98,609	87,059	85,906	86,453	70,355	69,855	69,855	69,855	637,947

D. Acquisition Strategy

BMD Technology does not have any major performers that qualify for this category based on the Financial Management Regulations.

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date: February 2007
APPROPRIATION/BUDGET ACTIVITY: **RDT&E, DW/03 Advanced Technology Development (ATD)**	R-1 NOMENCLATURE: **0603175C Ballistic Missile Defense Technology**

COST ($ in Thousands)	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
0602 Program-Wide Support	4,418	7,539	5,506	5,599	6,029	5,697	6,382	6,382
RDT&E Articles Qty	0	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification

Program-Wide Support provides funding for common non-headquarters support functions across the entire program such as strategic planning, program integration, business management, cost estimating, contracting, and financial management, to include preparation of financial statements, reimbursement of financial services provided by DFAS, internal review and audit, earned-value management, and program assessment. Includes costs for both government civilians performing these functions, as well as outside services and support contractors that augment government staff in these areas. Many of these costs reside within the Missile Defense Agency Executing Agents in the Services: Army Space and Missile Defense Command, Army PEO Space and Missile Defense, Office of Naval Research, and various Air Force laboratory and acquisition activities, although some functions and costs within this program element are performed by MDA employees assigned within the National Capital Region (NCR). Other costs included herein provide facility capabilities for MDA Executing Agent locations, such as physical and technical security, legal services, travel and training, office and equipment leases, utilities and communications, supplies and maintenance, and similar operating expenses. Also includes funding for charges on canceled appropriations in accordance with Public Law 101-510, legal settlements, and foreign currency fluctuation on a limited number of foreign contracts.

B. Accomplishments/Planned Program

	FY 2006	FY 2007	FY 2008	FY 2009
Civilian Salaries and Support	4,418	7,539	5,506	5,599
RDT&E Articles (Quantity)	0	0	0	0

See Section A: Mission Description and Budget Item Justification

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date: February 2007
APPROPRIATION/BUDGET ACTIVITY: **RDT&E, DW/03 Advanced Technology Development (ATD)**	R-1 NOMENCLATURE: **0603175C Ballistic Missile Defense Technology**

C. Other Program Funding Summary

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