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<b>Missile Defense Agency (MDA) Exhibit R-2 RDT&amp;E Budget Item Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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COST (\$ in Thousands)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total PE Cost	226,765	231,145	136,241	184,877	197,229	205,191	212,435	218,763
0502 Advanced Technology Development	203,551	226,795	131,783	177,338	184,744	193,263	201,706	209,363
0503 Laser/LADAR Technology	20,328	0	0	0	0	0	0	0
0602 Program-Wide Support	2,886	4,350	4,458	7,539	12,485	11,928	10,729	9,400

*Note:*  
 In FY 2004, the Laser Technology Project, 0503, was moved into the 0502 Project, Advanced Technology Development.  
 In FY 2006, the Multiple Kill Vehicle funding is moved to Project 0515 in the BMD Midcourse Defense Program Element 0603882C.

**A. Mission Description and Budget Item Justification**

The mission of the Missile Defense Agency (MDA) is to develop an integrated layered Ballistic Missile Defense System (BMDS) to defend the United States, its deployed forces, friends and allies from ballistic missiles of all ranges and in all phases of flight. In late 2004 the United States fielded a limited capability to defeat a ballistic missile threat. Continuing through the Future Years Defense Plan (FYDP), the breadth and depth of this initial capability will be expanded by adding and networking forward-deployed sensors, interceptors at sea and on land, and layers of increasingly capable weapons and sensors. Today's MDA activities are focused on five objectives: 1) complete development, initial fielding, and verification of Block 2004; 2) provide BMDS sustainment and Warfighter (Combatant Commanders) support; 3) develop a totally integrated capability for Block 2006 and beyond based on a strong core research and development program and improving the BMDS incrementally over time to meet future challenges; 4) execute an increasingly complex test program; and 5) establish a robust international foundation for missile defense.

MDA identifies BMDS capabilities, architectures and element contributions to counter the threat and organizes them by Engagement Sequence Groups (ESGs). These ESGs describe a combination of weapons, sensors and Command and Control, Battle Management, and Communications (C2BMC) capabilities that must work together to detect, track and intercept an enemy missile; the complete kill chain from the time the threat missile is first detected through the intercept of the target. Through ESGs, the MDA Systems Engineer identifies the necessary interfaces required to deliver a usable configuration of the BMDS. ESGs are also useful in helping the operator plan and train for operation of that capability, and they provide a means to track and test future improvements to the system.

The BMD Technology Program Element (PE) funds the development of new system concepts and key components to support two-year block upgrades and capability improvements. The PE consists of four primary areas: Sensing Systems, Engagement Systems, High Altitude Airship Advanced Concept Technology Demonstration, and Innovative Technology and Analysis. The Sensing Systems area focuses efforts on Discriminating Sensor Technology, Electro-optical Infrared Passive Technology, Radar Systems Technology, Early Launch Detection and Tracking, and Microsatellites. The Engagement Systems technology area focuses efforts on Multiple Kill Vehicles and Laser Technology. The High Altitude Airship Advanced Concept Technology Demonstration program is working towards a prototype platform that will eventually lead to the deployment of a fully operational High Altitude Airship. The Innovative Technology and Analysis program efforts include the Advanced Systems Innovation Cell and the Missile Defense Science, Technology, and Research program. All of the efforts in the BMD Technology PE are supported by a strong team of government personnel and support contractors.

Program-Wide Support provides funding for common support functions across the entire program such as strategic planning, program integration, 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 support contractors providing government staff augmentation in these areas. Applies to costs at the MDA HQ as well as its 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. Other costs include physical and technical security, legal services, travel and training, office and equipment leases, utilities and communications, supplies and maintenance, and

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---	------------------------------

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similar operating expenses at the various MDA Executing Agent locations, which at the MDA HQ are generally funded from the Management Headquarters Program Element (0901598C). 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>B. Program Change Summary</b>	FY 2004	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2005 PB)	225,268	204,320	199,468	246,291
Current President's Budget (FY 2006 PB)	226,765	231,145	136,241	184,877
Total Adjustments	1,497	26,825	-63,227	-61,414
Congressional Specific Program Adjustments	0	23,950	0	0
Congressional Undistributed Adjustments	0	2,875	0	0
Reprogrammings	1,628	0	0	0
SBIR/STTR Transfer	-131	0	0	0
Adjustments to Budget Years	0	0	-63,227	-61,414

The FY 2004 Ballistic Missile Defense Technology Program Element budget request in the FY 2005 budget compared to the FY 2006 budget showed an increase of \$1,497,000. This resulted from a transfer of \$131,000 to the Small Business Innovative Research Program; and a reprogramming of \$1,628,000 based on Agency priorities.

The FY 2005 Ballistic Missile Defense Technology Program Element budget request in the FY 2005 budget compared to the FY 2006 budget showed an increase of \$26,825,000. This increase reflects Congressional Specific Program Adjustments of \$23,950,000 and Congressional Undistributed Adjustments of \$2,875,000.

In FY 2006 and FY 2007:

- MKV effort transitioned to Project 0515 in the BMD Midcourse Defense PE (0603882C) in FY 2006.
- Advanced Concept Technology Demonstration (ACTD) prototype demonstration efforts slowed on the High Altitude Airship.
- Discriminating Sensor Technology project terminates after AMOR testing.
- Reduced Laser Technology efforts.
- Reduced SETA support and government salary funding for technology programs.

**UNCLASSIFIED**

<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
--	------------------------------

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COST (\$ in Thousands)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
0502 Advanced Technology Development	203,551	226,795	131,783	177,338	184,744	193,263	201,706	209,363
RDT&E Articles Qty	0	0	0	0	0	0	0	0

*Note: In FY 2006, the Multiple Kill Vehicles program funding will move from Project 0502 (Engagement Systems area) to the BMD Midcourse Program Element, 0603882C in Project 0515, Multiple Kill Vehicles.*

**A. Mission Description and Budget Item Justification**

The Advanced Technology Development program develops technology to counter missiles in all phases of flight by investing in technologies according to engineering discipline: Sensing Systems, Engagement Systems, High Altitude Airships, and Innovative Technology and Analysis.

The Sensing Systems Technology area focuses on active electro-optical (EO) sensors, passive electro-optical and infrared sensors (EO/IR), radar systems technologies, concepts for Early Launch Detection and Tracking (ELDT), and micro satellites.

- The EO/IR Active Sensors task, under the Discriminating Sensor Technology (DST) program, is developing advanced laser radar (LADAR) technology for insertion in future kinetic kill vehicle and surveillance systems. LADAR technology, coupled with passive sensors, can provide improved system discrimination performance by providing target features currently unavailable.
- EO/IR Passive Sensors task develops basic technologies in components and materials focused on enhancing the capabilities of the BMDS. Examples include:
  - Multi-color focal plane arrays
  - Silicon substrates for Mercury-Cadmium-Telluride (HgCdTe) infrared sensors
  - Very long wave infrared (VLWIR) sensors
- The Radar Systems Technology program integrates and tests next-generation transmitters, receivers, antennas, signal processors, and software to demonstrate technologies to insert in BMDS radars in future blocks, as well as enable new concepts in radar.
- The ELDT task develops, integrates, and tests electro-optical and radio-frequency concepts for detecting and tracking missile launches through clouds. These technologies will help enlarge the battlespace by adding time for decision makers and battle management.
- The Micro Satellite task is investigating small satellite concepts, payloads, and applications for future BMDS technology demonstrations.

The Engagement Systems Technology area consists of: Advanced Discrimination Initiative (ADI), Multiple Kill Vehicles (MKVs) and the Laser Technology Program (LTP).

- The MKV program develops multiple, lightweight, sophisticated, and lethal interceptors on a single-carrier vehicle that is compatible with existing launch systems.
- The ADI was a cross-Agency effort to modify BMD System weapons and sensors to defeat adversary countermeasures and increase overall system effectiveness in the midcourse phase.
- The Laser Technology program consists of the following:
  - Strategic Illuminator Laser- A multi-kilowatt brassboard illuminator system that will significantly advance the state-of-the-art in high-power laser illuminator brightness, reliability, and packaging. Contracts were awarded in April 2003 on the basis of a Broad Agency Announcement (BAA) to three responsive contractors for a four month concept development phase (Phase I). Following a Conceptual Design Review, Phase II for brassboard design was exercised in September 2003 providing continued funding to Northrop Grumman for 18 months of effort.
  - 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. Contracts were awarded in May 2003 on the basis of a BAA to two responsive contractors, Northrop Grumman and Coherent Technologies Inc., for a 12 month concept development phase (Phase I).

**UNCLASSIFIED**

<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
--	------------------------------

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- Advanced Inertial Reference Unit - A device for highly accurate laser pointing and tracking. Contract was awarded in April 2003 on the basis of a BAA to Applied Technology Associates for a 12 month concept development and gyro survey phase (Phase I).
- Advanced Detectors - Improved detectors for laser radars, with increased sensitivity and bandwidth. Contract was awarded in May 2003 on the basis of a BAA to four responsive contractors (Raytheon, SAIC, Sensors Unlimited, and VOXTEL) for a 6 month concept development phase (Basic contract) of a wave front sensor/tracker and a ranging camera.
- Angle-Angle Range Doppler Imager - Combine the capabilities angle-angle range and coherent Doppler radars to achieve both direct detection and coherent detection to enhance discrimination and aimpoint selection on stressing target objects such as tumbling reentry vehicles and decoys. MIT/LL began work on this project in January 2004.
- Advanced Chemical Oxygen-Iodine Laser (COIL) Technology - A new concept for a high performance singlet delta oxygen generator has been developed based on a high surface area flat jet of hydrogen peroxide that increases the specific surface area for chemical reactions. Contract awarded to Directed Energy Solutions in May 2004.

The Airship program is MDA's participation in the High Altitude Airship (HAA) Advanced Concept Technology Demonstration (ACTD) and supports the development of uninhabited, long-endurance platform to carry a wide range of BMD assets.

The Innovative Technology and Analysis area consists of the Advanced Systems Innovation Cell (ASIC), Innovative Science and Technology (IS&T) and technical analysis.

The SBIR Team oversees the MDA SBIR Evaluation and Debriefing process for all MDA Phase I and Phase II proposals. The Team also monitors Advanced Systems (AS) Phase I and Phase II SBIR Contracts.

**B. Accomplishments/Planned Program**

	FY 2004	FY 2005	FY 2006	FY 2007
Sensing Systems Technology	51,352	73,349	66,774	78,685
RDT&E Articles (Quantity)	0	0	0	0

**FY 2004 Accomplishments:**

- Upgraded range-resolved Doppler imaging LADAR breadboard to full power and commenced integration of other discriminating seeker capabilities (TRL 3-4).
- Completed development of several focal plane arrays for both space surveillance and seeker applications, including simultaneous two-color arrays. Transitioned final development of a radiation hardened long-wave infrared focal plane array to the Space Tracking and Surveillance System and the Manufacturing and Producibility deputate. Completed development of two different infrared cameras based on Quantum Well Infrared Photodetector (QWIP) technology for Airborne Laser search and track improvements.
- Continued development of a 10-Kelvin cryocooler using pulse tube technology for space surveillance application. This technology would enable space surveillance systems to extend into the very long wave infrared, increasing capability against colder targets and extending the useful range (TRL 2).
- Continued development of next-generation transmitters, receivers, antennas, signal processors, and software for improvements in BMDS radars. Continued design and technical analysis of advanced antenna technologies; performed distributed aperture coherence tests; delivered high voltage S-Band power amplifier chips based on GaAs technology and transitioned further development and packaging of this technology to the Navy.
- Completed initial studies of possible micro satellite uses for BMDS. Completed conceptual design of experiments in missile defense functionalities such as sensing, precision guidance and propulsion, and communications.
- Continued investigation into electro-optical and radio-frequency methods for Early Launch Detection and Tracking. Participated in several flight tests, gathering data for proof-of-principle.

UNCLASSIFIED

Missile Defense Agency (MDA) Exhibit R-2A RDT&E Project Justification	Date February 2005
---	-----------------------

APPROPRIATION/BUDGET ACTIVITY RDT&E, DW/03 Advanced Technology Development (ATD)	R-1 NOMENCLATURE 0603175C Ballistic Missile Defense Technology
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FY 2005 Planned Accomplishments:

- Test upgraded range-resolved Doppler imaging LADAR breadboard at full power. Integrate LADAR with passive sensors and beam pointing system; test fully functional active/passive discriminating sensor with breadboard-level fidelity (TRL 4). Commence design of a flyable brassboard discriminating sensor based on this technology.
- Characterize infrared cameras based on Quantum Well Infrared Photodetector (QWIP) technology for Airborne Laser search and track improvements. Pursue development of next generation infrared sensors based on Type II Superlattice and PbSnTe materials for very long wavelength operation. Continue investigations into growing HgCdTe on Silicon substrates, allowing for larger format arrays and diversity in the industrial base for HgCdTe substrate materials.
- Complete development of a 10-Kelvin cryocooler using pulse tube technology for space surveillance applications. Commence laboratory characterization and testing of this technology (TRL 3-4).
- Continue development of next-generation transmitters, receivers, antennas, signal processors, and software for improvements in BMDS radars. Continue design and technical analysis of advanced antenna technologies; further demonstrate distributed aperture coherence; complete development of high voltage X-Band power amplifier chips based on GaAs technology. Commence development of transmit/receive modules based on packaging of wide-bandgap materials in conjunction with DARPA.
- Commence initial design of micro satellite experiments in missile defense functionalities such as sensing, precision guidance and propulsion, and communications. Mature designs to preliminary design review (PDR) level for possible flight experiments with Space Test Program.
- Continue investigation into electro-optical and radio-frequency methods for Early Launch Detection and Tracking (ELDT). Participate in all available flight tests as well as dedicated static tests in order to continue gathering data for proof-of-principle. Commence initial system engineering and design for prototypical ELDT sensors.
- Start initial conceptual studies into the use of spectral sensing techniques for real-time BMDS assessment of hit-to-kill effectiveness. Commence gathering of phenomenology data.

FY 2006 Planned Program:

- Pursue improvements in Quantum Well Infrared Photodetector (QWIP) technology for possible space surveillance applications. Continue development of next generation infrared sensors based on Type II Superlattice and PbSnTe materials for very long wavelength operation. Continue investigations into growing HgCdTe on Silicon substrates, allowing for larger format arrays and diversity in the industrial base for HgCdTe substrate materials.
- Continue laboratory characterization and testing of 10-Kelvin cryocooler technology (TRL 4).
- Continue development of next-generation transmitters, receivers, antennas, signal processors, and software for improvements in BMDS radars. Continue design and technical analysis of advanced antenna technologies; deliver low-power-density antenna arrays. Continue development of transmit/receive modules based on packaging of wide-bandgap materials in conjunction with DARPA.
- Complete designs and commence fabrication of micro satellites for experiments in missile defense functionalities such as sensing, precision guidance and propulsion, and communications for flight experiments with DoD/USAF Space Test Program to demonstrate capabilities for future BMDS.
- Continue investigation into electro-optical and radio-frequency methods for Early Launch Detection and Tracking (ELDT). Participate in all available flight tests as well as dedicated static tests in order to continue gathering phenomenology data. Complete design and commence fabrication of prototypical ELDT sensors.
- Start design of spectral sensing systems for real-time BMDS assessment of hit-to-kill effectiveness. Continue gathering of phenomenology data for proof-of-principle.

FY 2007 Planned Program:

- Pursue improvements in Quantum Well Infrared Photodetector (QWIP) technology for possible space surveillance applications. Continue development of next generation infrared sensors based on Type II Superlattice and PbSnTe materials for very long wavelength operation. Continue investigations into growing HgCdTe on Silicon substrates, allowing for larger format arrays and diversity in the industrial base for HgCdTe substrate materials. Test delivered arrays in environments relevant to their application.
- Continue laboratory endurance testing of 10-Kelvin cryocooler technology (TRL 4).

**UNCLASSIFIED**

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--	------------------------------

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- Continue development of next-generation transmitters, receivers, antennas, signal processors, and software for improvements in BMDS radars. Continue design and technical analysis of advanced antenna technologies; test and characterize low power density arrays in a radar testbed. Continue development of transmit/receive modules based on packaging of wide-bandgap materials in conjunction with DARPA.
- Complete designs and commence fabrication of micro satellites for experiments in missile defense functionalities such as sensing, precision guidance and propulsion, and communications for flight experiments with DoD/USAF Space Test Program to demonstrate capabilities for future BMDS.
- Complete fabrication of prototypical Early Launch Detection and Tracking (ELDT) sensors in both electro-optical and radar. Utilize prototypes in all available flight tests. Complete design and commence fabrication of prototypical ELDT sensors.
- Complete design of spectral sensing systems for real-time BMDS assessment of hit-to-kill effectiveness. Continue gathering of phenomenology data.

	FY 2004	FY 2005	FY 2006	FY 2007
Engagement Systems Technology	54,862	76,560	39,433	46,116
RDT&E Articles (Quantity)	0	0	0	0

Note: In FY 2006, the Multiple Kill Vehicles program funding will move from project 0502 (Engagement Systems area) to the BMD Midcourse Program Element, 0603882C in project 0515, Multiple Kill Vehicles.

FY 2004 Accomplishments:

- Selected one contractor team to begin Multiple Kill Vehicle (MKV) system development.
- Conducted MKV kill vehicle seeker, divert propulsion, and avionics component breadboard demonstrations.
- Conducted second MKV system design review to ensure kill vehicle and carrier vehicle compatibility.
- Performed advanced studies and engineering tests to improve ADI and related concepts, and developed other advanced counter-countermeasure capabilities.
- Completed an Engineering Change Proposal for insertion of Advanced Discrimination into the Ground Based Midcourse Defense System.
- Performed Ground Testing of Advanced Discrimination.

FY 2005 Planned Accomplishments:

- Conduct critical design review for the MKV hover test vehicle.
- Purchase long lead items for MKV kill vehicle hover test in FY 2006.
- Conduct MKV kill vehicle seeker, divert propulsion, and avionics brassboard demonstrations.
- Conduct MKV weapon control algorithm and software development.
- Continue execution of Strategic Illuminator, Compact Laser Radar Amplifier, Advanced Inertial Reference Unit, Advanced Detectors, and Angle-Angle-Range Doppler Imaging LADAR through prototype demonstration to termination.
- Select one to three technology base projects in FY 2005 for execution in FY 2006.
- Conduct a Concept Design Review for ADI, Block 2008/2010 capability in BMDS.
- Complete disposition of Capistrano Test Site equipment from the former Spaced Based Laser program in FY 2005.

UNCLASSIFIED

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<ul style="list-style-type: none"><li>• Strategic Illuminator Laser- Following first light using a single gain medium and first light at full power (1QFY05), a Preliminary Design Review will be conducted (2QFY05) and the breadboard demonstration will be completed in July 2005.</li><li>• Small Laser Amplifier for Ladar - Following a Program Review in 1QFY05, both contractors enter Phase IIb, breadboard fabrication. Anticipate completion of breadboards and testing at half power by the end of FY2005.</li><li>• Advanced Inertial Reference Unit - Following breadboard completion and a successful Critical Design Review in 1QFY05, Option 2 was exercised with program plan formulation and fabrication of the prototype device to follow.</li><li>• Advanced Detectors - Phase 2 commences with detector batch production and camera integration (detector and read-out). Additional modeling &amp; simulation of the system will be conducted.</li><li>• Angle-Angle-Range Resolved Doppler Imager (AARDI) - Complete waveform generator and range-Doppler resolution demonstration. Integrate amplifier into breadboard for Angle-Angle Doppler capability and demonstrate system operation.</li><li>• Advanced Chemical Oxygen-Iodine Laser (COIL) Technology - Complete testing of nozzle at current rate and scale up facility for increased flow, conduct hot flow test and produce test report to conclude the project.</li><li>• Oxygen Laser - Develop and demonstrate a diode pumped liquid oxygen laser that reduces the complexity and bulk of high energy production compared to COILs by using the liquid oxygen for both lasing medium and heat dissipation. Contract to be awarded to Directed Energy Solutions in early FY05.</li><li>• Ultra-Sensitive Detectors - Initiate program, conduct design optimization and risk reduction.</li></ul> <p>FY 2006 Planned Program:</p> <ul style="list-style-type: none"><li>• Strategic Illuminator Laser - Fabricate brassboard tactical prototype and initiate high power brassboard lasing tests</li><li>• Small Laser Amplifier for Ladar - Complete program, deliver completed amplifiers to government/Federally Funded Research and Development Center (FFRDC) candidates including Advanced Systems Discriminating Seeker Technology program and MIT/Lincoln Laboratory for evaluation.</li><li>• Advanced Inertial Reference Unit - Complete program, deliver completed assembly to government/contractor facilities for evaluation as an ABL enhancement</li><li>• Advanced Detectors - Complete program; deliver completed cameras to government field site for evaluation.</li><li>• Ultra-Sensitive Detectors - Continue Program, complete design phase and begin fabrication and demonstration.</li><li>• Oxygen Laser - Initiate Phase II on the basis of results of Phase I, which will support evaluation of the potentially high combat payoff of the system</li><li>• AARDI ladar - Complete program. Test integrated AARDI breadboard at MIT/Lincoln Laboratory</li><li>• Advanced COIL Technology - Continue experiments with high-energy fuels and novel injection approaches at the Air Force Research Laboratory</li><li>• Continue the Laser Technology Program by selecting a new project for initiation in FY06 after competitive review of available investment opportunities by MDA-led government team, or upgrade existing project into a major project with higher annual value.</li></ul> <p>FY 2007 Planned Program:</p> <ul style="list-style-type: none"><li>• Strategic Illuminator Laser - Complete program. Deliver to government field facility for independent test and evaluation</li><li>• Oxygen Laser - Continue Phase II to develop subscale tactical laser system (if Phase II adopted).</li><li>• Ultra-Sensitive Detectors - Complete program, deliver units to government field site (probable: Air Force Research Laboratory) for evaluation</li><li>• Advanced COIL Technology - Complete experiments with high-energy fuels and evaluate for insertion onto ABL aircraft.</li><li>• Continue Laser Technology Program by selecting a new project in FY06 and Initiate FY07 based on available funds and technological opportunity.</li></ul>		

**UNCLASSIFIED**

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	FY 2004	FY 2005	FY 2006	FY 2007
High Altitude Airship	50,534	24,332	16,844	41,186
RDT&E Articles (Quantity)	0	0	0	0
<p>FY 2004 Accomplishments:</p> <p>Executing Agent for High Altitude Airship ACTD (goal TRL 4-7). The objective of this ACTD is to demonstrate the engineering feasibility and potential military utility of an unmanned, untethered, gas filled, solar powered airship that can fly at 65,000 feet. The prototype airship developed under this effort should be capable of continuous flight for up to a month while carrying a multi-mission payload.</p> <p>FY 2005 Planned Accomplishments:</p> <p>The prototype airship design and risk reduction phase culminated with a Critical Design Review in early October 2004. The next phase of the program, the airship prototype development, build, and demonstration phase, will begin in November 2004 and will continue through the remainder of FY 2005.</p> <p>FY 2006 Planned Program:</p> <p>The airship prototype development, build, and demonstration phase continues through FY 2006 with subsystem integration and ground level testing.</p> <p>FY 2007 Planned Program:</p> <p>The airship prototype development, build, and demonstration phase will continue through 2007 when flight tests should demonstrate remote C2 link connectivity, sensor and communications package utilization, and flight/payload integration capability.</p>				
	FY 2004	FY 2005	FY 2006	FY 2007
Innovative Technology and Analysis	4,235	9,296	7,732	10,351
RDT&E Articles (Quantity)	0	0	0	0
<p>FY 2004 Accomplishments:</p> <ul style="list-style-type: none"> <li>The Advanced Systems Innovation Cell (ASIC) is the focal point for review of all internally and externally generated new ideas submitted to MDA. This team of experts (government, industry and academic) evaluates new ballistic missile defense concepts and technologies determining their technical feasibility, initial capability, and maintains cognizance over leading edge concepts. The team seeks new and innovative concepts via a Federal Business Opportunities Broad Agency Announcement (BAA) for integrated systems and for technical improvements in boost, midcourse, and terminal phases of missile defense.</li> </ul>				

**UNCLASSIFIED**

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**FY 2005 Planned Accomplishments:**

- Continue to execute ASIC planned program. Fund additional innovative ideas.
- Missile Defense Science, Technology and Research (MSTAR): MSTAR is MDA's University Research Program. It seeks to incorporate innovative research at the University level into ballistic missile defense, as well as to provide training for future missile defense scientists and engineers. MSTAR seeks new and innovative concepts via a Federal Business Opportunities Broad Agency Announcement (BAA) for research and for technical improvements in boost, midcourse, and terminal phases of missile defense.
- Release the MSTAR BAA to solicit proposals from academic institution and plan to review, select, and award in 6-9 months.

**FY 2006 Planned Program:**

- Continue to execute ASIC planned program. Fund additional innovative ideas.
- Missile Defense Science, Technology and Research (MSTAR): MSTAR is MDA'S University Research Program. It seeks to incorporate innovative research at the University level into ballistic missile defense, as well as to provide training for future missile defense scientists and engineers. MSTAR seeks new and innovative concepts via a Federal Business Opportunities Broad Agency Announcement (BAA) for research and for technical improvements in boost, midcourse, and terminal phases of missile defense.
- Release the MSTAR BAA to solicit proposals from academic institution and plan to review, select, and award in 6-9 months.

**FY 2007 Planned Program:**

- Continue to execute ASIC planned program. Fund additional innovative ideas.
- Missile Defense Science, Technology and Research (MSTAR): MSTAR is MDA'S University Research Program. It seeks to incorporate innovative research at the University level into ballistic missile defense, as well as to provide training for future missile defense scientists and engineers. MSTAR seeks new and innovative concepts via a Federal Business Opportunities Broad Agency Announcement (BAA) for research and for technical improvements in boost, midcourse, and terminal phases of missile defense.
- Release the MSTAR BAA to solicit proposals from academic institution and plan to review, select, and award in 6-9 months.

	FY 2004	FY 2005	FY 2006	FY 2007
Statutory and Mandated	3,503	3,715	1,000	1,000
RDT&E Articles (Quantity)	0	0	0	0

Note: The SBIR/STTR, Historically Black Colleges and Universities/Minority Institutions (HBCU/MI) and Technology Applications projects are all covered within the BMD Technology PE Statutory and Mandated program.

**FY 2004 Accomplishments:**

- Continued to fund HBCU/MI.
- Continued providing technology maturation techniques, such as commercialization reviews and outreach, which helped leverage outside resources and provided a strong foundation essential for scaling up MDA-funded technology to address system capabilities.
- Continued program support for the administration of the SBIR/STTR Program.
- Established investment strategy and formulation of SBIR/STTR Technology Roadmaps

**UNCLASSIFIED**

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--	------------------------------

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FY 2005 Planned Accomplishments:

- Continue to fund HBCU/MI.
- Continue providing technology maturation techniques, such as commercialization reviews and outreach, which help leverage outside resources and provide a strong foundation essential for scaling up MDA-funded technology to address system capabilities.
- Continue program support for the administration of the SBIR/STTR Program.

FY 2006 Planned Program:

- Continue to fund HBCU/MI.
- Continue providing technology maturation techniques, such as commercialization reviews and outreach, which help leverage outside resources and provide a strong foundation essential for scaling up MDA-funded technology to address system capabilities.

FY 2007 Planned Program:

- Continue to fund HBCU/MI.
- Continue providing technology maturation techniques, such as commercialization reviews and outreach, which help leverage outside resources and provide a strong foundation essential for scaling up MDA-funded technology to address system capabilities.

	FY 2004	FY 2005	FY 2006	FY 2007
Congressional Action	39,065	39,543	0	0
RDT&E Articles (Quantity)	0	0	0	0

FY 2004 Accomplishments:

- Provided Congressionally-mandated funding for:
  - Massively Parallel Optical Interconnects for Microsatellites
  - Silicon Carbide Wide Bandgap Research - Wide Bandgap Optoelectronics
  - AEOS MWIR Adaptive Optics
  - Advanced RF Technology Development
  - SiC Mirrors - Porous Silicon
  - Tulane Center for Missile Defense
  - Extended FootPrint Program
  - Advanced Metalized Gelled Propellants
  - Chemical Vapor Deposition of Organic Materials
  - Center for Optical Devices
  - Improved Materials for Optical Memories

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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- Multiple Target Tracking Optical Sensor Array Technology
- Kinetic Energy Anti-Satellite Technology

**FY 2005 Planned Accomplishments:**

- Provide Congressionally-mandated funding for:
  - Advanced Processing Architecture
  - Next-Again-Generation Radiation Hard CMOS
  - Ultra-Thin Integrated Electronics Miniaturization Trusted Foundry
  - Massively Parallel Optical Interconnects for Microsatellites
  - Center for Optical Logic Devices
  - Silicon Carbide Wide Bandgap Research
  - Multiple Target Tracking Optical Sensor Array Technology (MOST)
  - Advanced RF Technology Development
  - SiC Thick Film Mirror Coatings
  - Porous Silicon
  - Tulane Missile Defense
  - Improved Materials for Optical Memories
  - Army Counterspace Technology Testbed

**C. Other Program Funding Summary**

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total Cost
PE 0603879C Advanced Concepts, Evaluations and Systems	132,701	159,878	0	0	0	0	0	0	292,579
PE 0603881C Ballistic Missile Defense Terminal Defense Segment	860,794	928,388	1,143,610	1,034,676	879,674	617,319	731,282	485,512	6,681,255
PE 0603882C Ballistic Missile Defense Midcourse Defense Segment	3,731,708	4,521,019	3,266,196	3,945,991	3,650,848	3,315,513	3,183,622	2,545,882	28,160,779
PE 0603883C Ballistic Missile Defense Boost Defense Segment	475,911	476,179	483,863	648,728	620,793	690,807	811,430	1,183,182	5,390,893
PE 0603884C Ballistic Missile Defense Sensors	417,814	577,297	529,829	995,711	1,214,008	1,186,134	1,069,208	1,018,614	7,008,615
PE 0603886C Ballistic Missile Defense System Interceptors	114,669	279,815	229,658	444,900	677,243	1,137,337	1,468,827	1,717,507	6,069,956
PE 0603888C Ballistic Missile Defense Test and Targets	616,773	720,818	622,357	684,170	608,282	643,119	661,362	670,092	5,226,973
PE 0603889C Ballistic Missile Defense Products	309,949	383,830	455,152	509,982	509,161	516,599	516,017	515,729	3,716,419

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total Cost
PE 0603890C Ballistic Missile Defense System Core	449,747	399,829	447,006	538,442	532,412	530,934	520,679	531,832	3,950,881
PE 0603891C Special Programs - MDA	0	0	349,522	482,903	826,173	1,097,252	1,015,198	1,244,072	5,015,120
PE 0605502C Small Business Innovative Research - MDA	146,030	0	0	0	0	0	0	0	146,030
PE 0901585C Pentagon Reservation	16,251	13,761	17,386	15,586	6,058	6,376	4,490	4,725	84,633
PE 0901598C Management Headquarters - MDA	92,100	113,777	99,327	95,443	98,984	98,728	81,492	81,760	761,611
Air Force – Other Procurement	0	0	2,400	1,453	11,279	386	17,710	25,709	58,937
Air Force – Operations and Maintenance	0	17,600	7,964	11,712	33,830	33,080	34,119	35,398	173,703
Air Force – Military Personnel	0	0	3,628	7,640	8,332	8,535	8,826	9,129	46,090
Army – Operations and Maintenance	37,600	49,597	66,974	68,246	69,809	71,472	73,325	75,230	512,253
Army National Guard – Operations and Maintenance	0	0	155	151	150	154	164	167	941
Army National Guard – Military Personnel	21,000	21,000	17,648	24,432	24,952	25,591	25,591	25,591	185,805
Navy – Operations and Maintenance	0	11,300	12,900	24,100	24,400	24,600	23,300	23,700	144,300
PAC-3/MEADS – RDT&E	433,728	344,978	304,973	336,959	465,395	521,791	522,418	502,961	3,433,203
PAC-3/MEADS – Missile Procurement	841,964	574,972	581,924	578,579	660,584	616,020	509,032	738,679	5,101,754

**D. Acquisition Strategy**

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

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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COST (\$ in Thousands)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
0503 Laser/LADAR Technology	20,328	0	0	0	0	0	0	0
RDT&E Articles Qty	0	0	0	0	0	0	0	0

*Note: In FY 2005, the Laser Technology Project, 0503, moved into the Advanced Technology Development Project, 0502.*

**A. Mission Description and Budget Item Justification**

The Laser Technology program focuses on developing lasers and related component technology for low power applications including tracking, weapon guidance, and imaging, while investing in high-energy laser technologies that could lead to future ABL improvements. The emphasis on low-power systems is driven by their considerable potential to improve and support MDA's hit-to-kill weapons. Having selected concepts and awarded contracts for four focused technology projects in FY 2003, the Agency will continue these through FY 2004, and initiate new projects in FY 2005. The projects will be drawn from proposals solicited from the laser and electro-optics industry and supported by BMDs element evolutionary block upgrades. Selected programs include:

- Strategic Illuminator for rugged long-range tracking and wavefront sensing device to support Airborne Laser upgrades and strategic surveillance applications.
- Compact laser radar (LADAR) amplifier for kill vehicles to enhance target discrimination at extended range.
- Advanced inertial reference unit for precision pointing knowledge for acquisition, tracking, and pointing applications.
- Advanced low-noise, fast detectors for tracking, ranging, imaging, and laser wavefront sensing.

**B. Accomplishments/Planned Program**

	FY 2004	FY 2005	FY 2006	FY 2007
Laser Technology	20,328	0	0	0
RDT&E Articles (Quantity)	0	0	0	0

*Note: In FY 2005, Laser Technology moved into the Advanced Technology Development Project 0502.*

**FY 2004 Accomplishments:**

- Strategic Illuminator - The contractor designed a densely packaged, rugged, high radiance, solid-state laser. Tasks included breadboarding the electronics, developing a light weight power supply and designing a blowdown chiller that all fit together in a compact volume.
- Compact Laser Radar Amplifier - Following Preliminary and Critical Design Reviews (in 1QFY04 and 3QFY04, respectively), Phase II for breadboard fabrication was exercised providing funding for one contractor to continue with this 12 month effort.
- Advanced Inertial Reference Unit - Following Preliminary and Critical Design Reviews (in 1QFY04 and 4QFY04, respectively), Phase II for breadboard fabrication of a prototype device was exercised providing funds to one contractor to continue this 12 month effort.
- Advanced Detectors - Following Critical Design Review in November 2003, Option I was exercised providing continued funding to two contractors for 12 month efforts to produce a wave front sensor/tracker and a ranging camera.
- Angle-Angle-Range Resolved Doppler Imager - Designed and experimented on a revolutionary photon-counting laser radar capable of both direct detect and Doppler measurements.

Project: 0503 Laser/LADAR Technology

MDA Exhibit R-2A (PE 0603175C)

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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- Advanced Chemical Oxygen-Iodine Laser (COIL) Technology - Conducted experiments to increase specific power (watts/kg) of COIL devices for future Airborne Laser blocks.
- Up to three technology base projects were selected for selection in FY 2004 for execution in FY 2005. In addition to these projects, in FY 2004, approximately \$7.4 million was used to cover costs associated with Capistrano Test Site deactivation.

**C. Other Program Funding Summary**

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total Cost
PE 0603879C Advanced Concepts, Evaluations and Systems	132,701	159,878	0	0	0	0	0	0	292,579
PE 0603881C Ballistic Missile Defense Terminal Defense Segment	860,794	928,388	1,143,610	1,034,676	879,674	617,319	731,282	485,512	6,681,255
PE 0603882C Ballistic Missile Defense Midcourse Defense Segment	3,731,708	4,521,019	3,266,196	3,945,991	3,650,848	3,315,513	3,183,622	2,545,882	28,160,779
PE 0603883C Ballistic Missile Defense Boost Defense Segment	475,911	476,179	483,863	648,728	620,793	690,807	811,430	1,183,182	5,390,893
PE 0603884C Ballistic Missile Defense Sensors	417,814	577,297	529,829	995,711	1,214,008	1,186,134	1,069,208	1,018,614	7,008,615
PE 0603886C Ballistic Missile Defense System Interceptors	114,669	279,815	229,658	444,900	677,243	1,137,337	1,468,827	1,717,507	6,069,956
PE 0603888C Ballistic Missile Defense Test and Targets	616,773	720,818	622,357	684,170	608,282	643,119	661,362	670,092	5,226,973
PE 0603889C Ballistic Missile Defense Products	309,949	383,830	455,152	509,982	509,161	516,599	516,017	515,729	3,716,419
PE 0603890C Ballistic Missile Defense System Core	449,747	399,829	447,006	538,442	532,412	530,934	520,679	531,832	3,950,881
PE 0603891C Special Programs - MDA	0	0	349,522	482,903	826,173	1,097,252	1,015,198	1,244,072	5,015,120
PE 0605502C Small Business Innovative Research - MDA	146,030	0	0	0	0	0	0	0	146,030
PE 0901585C Pentagon Reservation	16,251	13,761	17,386	15,586	6,058	6,376	4,490	4,725	84,633
PE 0901598C Management Headquarters - MDA	92,100	113,777	99,327	95,443	98,984	98,728	81,492	81,760	761,611
Air Force – Other Procurement	0	0	2,400	1,453	11,279	386	17,710	25,709	58,937
Air Force – Operations and Maintenance	0	17,600	7,964	11,712	33,830	33,080	34,119	35,398	173,703
Air Force – Military Personnel	0	0	3,628	7,640	8,332	8,535	8,826	9,129	46,090
Army – Operations and Maintenance	37,600	49,597	66,974	68,246	69,809	71,472	73,325	75,230	512,253
Army National Guard – Operations and Maintenance	0	0	155	151	150	154	164	167	941
Army National Guard – Military Personnel	21,000	21,000	17,648	24,432	24,952	25,591	25,591	25,591	185,805
Navy – Operations and Maintenance	0	11,300	12,900	24,100	24,400	24,600	23,300	23,700	144,300
PAC-3/MEADS – RDT&E	433,728	344,978	304,973	336,959	465,395	521,791	522,418	502,961	3,433,203
PAC-3/MEADS – Missile Procurement	841,964	574,972	581,924	578,579	660,584	616,020	509,032	738,679	5,101,754

Project: 0503 Laser/LADAR Technology

MDA Exhibit R-2A (PE 0603175C)

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>		Date <b>February 2005</b>
<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>	
<b><u>D. Acquisition Strategy</u></b>  BMD Technology does not have any major performers that qualify for this category based on the Financial Management Regulations.		

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<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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COST (\$ in Thousands)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
0602 Program-Wide Support	2,886	4,350	4,458	7,539	12,485	11,928	10,729	9,400
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 support functions across the entire program such as strategic planning, program integration, 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 support contractors providing government staff augmentation in these areas. Applies to costs at the MDA HQ as well as its 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. Other costs include physical and technical security, legal services, travel and training, office and equipment leases, utilities and communications, supplies and maintenance, and similar operating expenses at the various MDA Executing Agent locations, which at the MDA HQ are generally funded from the Management Headquarters Program Element (0901598C). 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 2004	FY 2005	FY 2006	FY 2007
Civilian Salaries and Support	2,886	4,350	4,458	7,539
RDT&E Articles (Quantity)	0	0	0	0

See Section A: Mission Description and Budget Item Justification

**UNCLASSIFIED**

<b>Missile Defense Agency (MDA) Exhibit R-2A RDT&amp;E Project Justification</b>	Date <b>February 2005</b>
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<b>APPROPRIATION/BUDGET ACTIVITY</b> <b>RDT&amp;E, DW/03 Advanced Technology Development (ATD)</b>	<b>R-1 NOMENCLATURE</b> <b>0603175C Ballistic Missile Defense Technology</b>
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<b>C. Other Program Funding Summary</b>									
	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total Cost
PE 0603879C Advanced Concepts, Evaluations and Systems	132,701	159,878	0	0	0	0	0	0	292,579
PE 0603881C Ballistic Missile Defense Terminal Defense Segment	860,794	928,388	1,143,610	1,034,676	879,674	617,319	731,282	485,512	6,681,255
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PE 0605502C Small Business Innovative Research - MDA	146,030	0	0	0	0	0	0	0	146,030
PE 0901585C Pentagon Reservation	16,251	13,761	17,386	15,586	6,058	6,376	4,490	4,725	84,633
PE 0901598C Management Headquarters - MDA	92,100	113,777	99,327	95,443	98,984	98,728	81,492	81,760	761,611
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Air Force – Operations and Maintenance	0	17,600	7,964	11,712	33,830	33,080	34,119	35,398	173,703
Air Force – Military Personnel	0	0	3,628	7,640	8,332	8,535	8,826	9,129	46,090
Army – Operations and Maintenance	37,600	49,597	66,974	68,246	69,809	71,472	73,325	75,230	512,253
Army National Guard – Operations and Maintenance	0	0	155	151	150	154	164	167	941
Army National Guard – Military Personnel	21,000	21,000	17,648	24,432	24,952	25,591	25,591	25,591	185,805
Navy – Operations and Maintenance	0	11,300	12,900	24,100	24,400	24,600	23,300	23,700	144,300
PAC-3/MEADS – RDT&E	433,728	344,978	304,973	336,959	465,395	521,791	522,418	502,961	3,433,203
PAC-3/MEADS – Missile Procurement	841,964	574,972	581,924	578,579	660,584	616,020	509,032	738,679	5,101,754