FY 2007 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2006
Exhibit R-2

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603114N
PROGRAM ELEMENT TITLE: POWER PROJECTION ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total PE	129,578	127,049	76,806	40,926	64,151	75,000	74,830
2911 POWER PROJECTION ADVANCED TECHNOLOGY	80,738	81,299	76,806	40,926	64,151	75,000	74,830
9999 CONGRESSIONAL PLUS-UPS	48,840	45,750	0	0	0	0	0

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program develops and demonstrates advanced technologies, including Directed Energy, for naval weapon systems, and Electric Warship. This Program Element (PE) includes elements of the following Future Naval Capabilities (FNCs); Time Critical Strike (TCS), Autonomous Operations (AO), and Knowledge Superiority Assurance (KSA). Within the Naval Transformation Roadmap, this investment will achieve one of four key transformational capabilities required by Sea Strike as well as technically enable elements of both Sea Shield and Force Net.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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B. PROGRAM CHANGE SUMMARY:

	FY 2005	FY 2006	FY 2007
FY 2006 President's Budget Submission	135,758	82,538	84,043
Congressional Action	0	45,750	0
Congressional Undistributed Reductions/Rescissions	-110	-1,239	0
Execution Adjustments	-3,163	0	0
FY 2005 SBIR	-2,918	0	0
Program Adjustments	11	0	-3,170
Program Realignment	0	0	-4,225
Rate Adjustments	0	0	158
FY 2007 President's Budget Submission	129,578	127,049	76,806

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

C. OTHER PROGRAM FUNDING SUMMARY:
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

E. PERFORMANCE METRICS:
The metrics used for 0603114N programs are Technology Transition Agreements (TTA). TTAs are agreements between the Office of Naval Research and an acquisition program office to transition the 6.3 technology into an acquisition program.

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COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
2911 POWER PROJECTION ADVANCED TECHNOLOGY	80,738	81,299	76,806	40,926	64,151	75,000	74,830

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Project includes elements of the following Future Naval Capabilities (FNCs): Time Critical Strike (TCS); Autonomous Operations (AO).

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2005	FY 2006	FY 2007
PRECISION STRIKE TECHNOLOGY	36,866	51,263	47,247

This project focuses on the development of high speed (Mach 3 to Mach 4+) propulsion technologies supporting the development of strike weapons which significantly decrease the launch to engagement timeline. Investments under this activity were previously reported under the Time Critical Strike Future Naval Capability (FNC). This new activity breakout provides improved clarification of the overall investment scope.

Increase in FY 2006 and FY 2007 is due to a program adjustment for HyFly and NAI RATTLRS.

FY 2005 Accomplishments:

- National Aerospace Initiative Revolutionary Approach to Time-critical Long Range Strike (NAI RATTLRS): Initiated inlet/engine/nozzle design, integration and component testing. Initiated fabrication of long lead flow path hardware and ground testing of airframe and inlet configurations. Initiated design & risk reduction activities which lead to preliminary design.
- HyFly: Continued HyFly project efforts by conducting unpowered flights to demonstrate aircraft separation and booster powered flight. Completed freejet ground demonstration of engine performance.

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FY 2006 Plans:

- NAI RATTLRS: Complete a preliminary design review of the proposed concept. Complete system critical design review. Fabricate safe separation flight test vehicles and flight test hardware. Accelerate technical development of individual components. Begin engine component fabrication assembly and testing, fabrication assembly and system check-out of the airframe and components, and fabrication of safe separation flight test vehicles and flight test hardware.
- HyFly: Complete two fully powered HyFly flights to demonstrate flight worthiness.

FY 2007 Plans:

- NAI RATTLRS: Complete final component demonstration and validation along with a critical design review. Conduct system checkouts and fabrication of flight demonstration vehicles. Perform a safe separation flight test.
- HyFly: Complete three fully powered HyFly flights to demonstrate Hypersonic and long rangeflight performance.
- Electromagnetic Gun (EM) Gun: Initiates procurement under this PE the first set of new capacitor banks to support the 32MJ muzzle energy demonstration. Additional sets will be purchased in FY08 and FY09 to provide a total of 100MJ of energy to the system. Conduct testing of initial barrel design components from the three vendors currently under contract to design and build the tactical barrel. Conduct system level testing of the energy storage and power delivery system through the rails of the railgun to ensure initial design will support the full scale power and current requirements in FY09 and FY10. Support testing of initial projectile concepts from two vendors currently under contract for projectile development.

	FY 2005	FY 2006	FY 2007
STRIKE AND LITTORAL COMBAT TECHNOLOGIES	28,168	8,735	21,051

The focus of this effort is on those technologies that will support the Naval Precision Strike Operations and provide the Navy of the future the ability to quickly locate, target, and strike critical targets. This activity includes support to the following Future Naval Capability (FNC) Enabling Capabilities (ECs): Advanced Naval Fires Technology, Hostile Fire Detection and Response, Dynamic Target Engagement & Enhanced Sensor Capabilities, and Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets.

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Decrease in funding from FY 2005 to FY 2006 is due to completion of initiatives. The funding profile from FY 2006 to FY 2007 reflects the reorganization of Future Naval Capabilities Program investments into Enabling Capabilities (ECs). As a result of this reorganization, the funding for each EC has been aligned to a Budget Activity 2 and Budget Activity 3 PE as appropriate. This Activity reflects the alignment of investments for the following ECs: Advanced Naval Fires Technology Spiral 1, Hostile Fire Detection and Response Spiral 1, Dynamic Target Engagement & Enhanced Sensor Capabilities, and Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets.

FY 2005 Accomplishments:

- Advanced Gun Barrel & Targeting Technology (AGTT): Continued prior year efforts and began large scale gun material development and prototyping.
- Cruise Missile Real Time Retargeting (CMRTR): Completed program by performing full system test of V.3 sensor, completing V.4 sensor for low cost terminal seeker, integrated V.2, V.3 sensors with V.4, and performed V.4 subsystem tests.
- Precision Strike Navigator (PSN): Completed development of low cost precision Fiber Optic Gyro (FOG) Inertial Measurement Unit (IMU), and delivered updated high accuracy unit ready for evaluation.
- High-Speed Anti Radiation Missile (HSARM): Completed development, subsystem, and system level flight test demonstration of an advanced dual mode anti-radiation missile seeker for a ramjet-powered missile airframe. Classified effort will develop classified seeker technology for time critical targeting.
- Low-Cost Guided Imaging Rocket: Completed effort to develop a low-cost rocket system that uses an imaging seeker which can be used against a wide variety of targets.
- Ground Moving Target Indicator (GMTI) Capability: Began initial planning for a low-cost, single board radar system suitable for use on a long endurance Unmanned Air Vehicle (UAV).

FY 2006 Plans:

- AGTT: Take completed analytical modeling and scaled prototypes of advanced liner coatings and aluminum composite metal matrix material designs and complete fabrication of a full scale composite barrel test section.
- HSARM: Complete classified effort to develop seeker technology for time critical targeting.
- GMTI Capability: Continue effort to provide a low-cost, single board radar system suitable for use on a long endurance UAV.
- Ultra Endurance UAV: Initiate effort to provide affordable, high endurance platform/propulsion with

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Commercial Off the Shelf (COTS) and modified COTS components for persistent Intelligence, Surveillance and Reconnaissance (ISR), targeting, Bomb Damage Assessment/Bomb Damage Indication (BDA/BDI), and weapon delivery.

FY 2007 Plans:

- Advanced Naval Fires Technology (ANF): Initiate effort to reduce time delay from target acquisition to engagement through information sharing interfaces; accurate mobile, lightweight fire control systems and improved forward digital target acquisition and hand off. Specific tasks include: adaptive expeditionary maneuver warfare system, advanced gun barrel technology, advanced weapons material technology, indirect weapon aiming/pointing system size/weight reduction, Marine Air/Ground Task Force (MAGTF)/Joint fires information exchange connectivity and interoperability, Vertical Assault force lightweight computational interface capability, and universal fire control software for indirect weapon systems.
- Hostile Fire Detection and Response (HFDR): Develop technologies for hostile fire detection and active response capabilities to increase individual Marine and tactical level unit survivability and mobility. Specific efforts include: advanced ammo packaging, Electronic Warfare (EW) Integrated System for Small Platforms (EWISSP) and GUNSLINGER hostile fire detection and counter fire system.
- Dynamic Target Engagement & Enhanced Sensor Capabilities: Develop the capability to improve the processing of dynamic targets from 100 to 400 per day. Develop UAVs with increased endurance and support for more autonomous operations. Specific tasks include development of: decision support algorithms for dynamic target engagement, remote sensor fusion hardware for ground sensors, an ultra endurance UAV, and a GMTI radar system for use on UAVs.
- Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets: Provide products to discriminate targets from non-combatants and provide terminal guidance to engage targets that are operating in close proximity to noncombatants. The effort will develop advanced sensors, communications, and planning systems. Specific tasks include: the development of a Low-Cost Terminal Imaging Seeker (LCTIS).

	FY 2005	FY 2006	FY 2007
AUTONOMOUS OPERATIONS (AO)	15,704	21,301	8,508

The Autonomous Operations (AO) Future Naval Capability (FNC) activity aims to enhance the mission capability and operational utility of Naval forces by developing technologies that will dramatically increase the autonomy, performance, and affordability of Naval organic Unmanned Vehicle systems. By defining and focusing risk reduction overarching Intelligent Autonomy (IA) Science and Technology principles, transitional products

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will be developed in four areas: Unmanned Air Vehicles (UAV) Technology, which includes IA reasoning, technologies to enhance “see and avoid” capabilities, object identification, vehicle awareness, and vehicle and mission management; Unmanned Undersea Vehicles (UUV), which will demonstrate the technical feasibility for a UUV system to effectively search, detect, track and trail undersea threats while maintaining a robust communications link to enable appropriate command, control and transmission of collected data; Unmanned Ground Vehicles (UGV), which focus on the increasing utility of UGV systems in urban and littoral terrain to Marine Corps units; and UAV Propulsion, which will develop innovative propulsion and power technologies unique to Naval UAVs operating from surface combatants. This activity also contains a task from the Knowledge Superiority Assurance FNC.

Increase in funding from FY 2005 to FY 2006 is due to new initiatives. The funding profile from FY 2006 to FY 2007 reflects the reorganization of Future Naval Capabilities (FNC) Program investments into Enabling Capabilities (ECs). As a result of this reorganization, the funding for each EC has been aligned to a Budget Activity 2 and Budget Activity 3 PE as appropriate. This Activity reflects the alignment of investments for the following ECs: Marine and UxV Tactical Intelligence, Surveillance and Reconnaissance (ISR).

FY 2005 Accomplishments:

- IA Task: Continued in-water and simulation testing and demonstrating of dynamic replanning and autonomous vehicle control technologies. Conducted in-water demonstration of maritime situation awareness technology and simulation testing of dynamic replanning capability in a simulated warfare environment integrated with a Naval control station.
- UAV Technology: Continued work developing and performing simulation testing of sensors and sensor software and the development of multi-modal interface control. Developed and conducted testing of self-awareness sensor software and sub-system self-awareness sensors. Developed and tested several prototype Sonochute Launched UAVs (SL-UAV). Began integration of Landing Period Designator in the Bell Helicopter Eagle Eye ship landing simulator.
- UUV: Continued work developing and demonstrating undersea operations for Maritime Reconnaissance (MR) technologies, including transition of ISR Mast and advanced autonomy for 21-in UUV and autonomous docking station for small UUVs; continued development and testing of Undersea Search and Survey (USS) and Communications/Navigation Aids technologies.
- UAV Propulsion: Conducted ground test of the XTE-67/A1 UAV demonstrator engine with Naval-unique technologies and integrate with the enhanced next-generation commercial core and a Mach 3.5 capable expendable turbine engine for missile applications. This meets Integrated High Performance Turbine Engine Technology

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(IHPTET) phase III Joint Expendable Turbine Engine Concept goals and is a foundation for the Versatile Affordable Advanced Turbine Engine program.

FY 2006 Plans:

- IA Task: Complete testing and demonstration of dynamic replanning technologies including high-fidelity simulation of multiple classes of Naval unmanned vehicles in a simulated warfare environment, hardware, and in-water demonstrations. Continue testing and demonstration of multi-vehicle cooperation technologies.
- UAV Technology: Continue testing and demonstration of multi-modal interface control. Complete performing simulation testing of sensors and sensor software. Demonstrate the Sonochute Launched UAV from P-3 and continue system development. Integrate the Landing Period Designator into Eagle Eye and Firescout ship recovery systems and conduct demonstrations.
- UUV: Transition USS and Communication Navigation Aid products to Program Management Office-Explosive Ordnance Disposal and Office of Naval Intelligence (ONI-34); standup Submarine Track and Trail (STT) efforts in the areas of advanced undersea sensors, communications, and autonomy. TThe STT-B effort transfers to PE 0603747N in FY 2007 due to EC realignments.
- UAV Propulsion: Continue ground test of the XTE-67/A1 UAV demonstrator engine with naval-unique technologies and integrate with an enhanced next-generation commercial core and a Mach 3.5 capable expendable turbine engine for missile applications.
- Reconfigurable Surveillance UAV's (RSU): This effort will develop surveillance UAV's that can be reconfigured to support different packages in order to better provide protection to the warfighters. This activity will transition to PE 0602131M in FY 2007 due to the EC alignments.

FY 2007 Plans:

- IA Task: Complete testing and demonstration of multi-vehicle cooperation technologies including high-fidelity simulation of multiple heterogeneous Naval unmanned vehicles in a simulated warfare environment, hardware, and in-water demonstrations.
- UAV Technology: Complete testing and demonstration of multi-modal interface control.
- UAV Propulsion: Integrate power generation, distribution, prognostic and engine diagnostic and thermal management technologies on the WLE-67/A1 demonstrator engine and ground test. The propulsion system and associated technologies developed and demonstrated are applicable towards Joint-Unmanned Combat Air System (J-UCAS), and Broad Area Maritime Surveillance (BAMS) UAV.

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C. OTHER PROGRAM FUNDING SUMMARY:
Navy RELATED RDT&E:
PE 0601153N Defense Research Sciences
PE 0602114N Power Projection Applied Research
PE 0602131M Marine Corps Landing Force Technology
PE 0602236N Warfighter Sustainment Applied Research
PE 0603123N Force Protection Advanced Technology
PE 0603782N Mine and Expeditionary Warfare Advanced Technology
PE 0603236N Warfighter Sustainment Advanced Technology
PE 0603790N NATO Research and Development
PE 0305204N Tactical Unmanned Aerial Vehicles (JMIP)
PE 0603502N Surface and Shallow Water Mine Countermeasures
PE 0603654N Joint Service Explosive Ordnance Development

NON-NAVY RELATED RDT&E: These PEs adhere to Defense S&T Reliance agreements with oversight provided by the Joint Director of Laboratories.
PE 0603285E Advanced Aerospace Systems
PE 0603709D8Z Joint Robotics Program
PE 0604709D8Z Joint Robotics Program
PE 0602203F Aerospace Propulsion
PE 0603216F Aerospace Propulsion and Power Technology
PE 0603205F Flight Vehicle Technology

D. ACQUISITION STRATEGY:
Not applicable.

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CONGRESSIONAL PLUS-UPS:

	FY 2005	FY 2006
ADVANCED ELECTRIC DRIVES	1,453	0

This effort supported advanced electric drives.

	FY 2005	FY 2006
ADVANCED LIFTING BODY RESEARCH PROGRAM	4,824	0

This effort worked on issues arising from commercialization efforts coming from technology transfer.

	FY 2005	FY 2006
ADVANCED PANORAMIC SENSOR SYSTEMS FOR UAVs	0	1,250

This effort supports advanced panoramic sensor systems for UAVs reseach.

	FY 2005	FY 2006
ADVANCED TECHNOLOGIES FOR HIGH VELOCITY PARTICLE CONSOLIDATION	0	1,000

This effort supports advanced technologies for high velocity particle consolidation research.

	FY 2005	FY 2006
ADVANCED TECHNOLOGIES FOR PRINTED WIRING ASSEMBLY FABRICATION (PWB-HVPC)	3,278	0

This effort developed technologies and techniques to reverse engineer and repair multilayer printed circuit boards in Navy systems. Technologies included applying discrete sequence spread spectrum technologies for high resolution imaging of multilayer boards and laser assisted through hole and line metallization on boards.

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	FY 2005	FY 2006
ARTICULATED STABLE OCEAN PLATFORM	966	1,000

FY 2005 - This effort developed a numeric tool for general articulated offshore platforms using simulation models previously developed.

FY 2006 - This effort supports articulated stable ocean platform research.

	FY 2005	FY 2006
BOW LIFTING BODY SHIP RESEARCH	0	6,000

This effort supports bow lifting body ship research.

	FY 2005	FY 2006
CENTER FOR COASTLINE SECURITY TECHNOLOGY	2,413	0

This effort developed and delivered visible and infrared sensors for harbor and coastal 24 hour all weather surveillance. Sensors were integrated on underwater, surface, and airborne unmanned vehicles as well as at the Naval Surface Warfare Center Carderock’s South Florida Test Facility along with attendant signal processing.

	FY 2005	FY 2006
COUNTERMINE LIDAR UAV-BASED SYSTEM (CLUBS)	0	1,000

This effort supports the Countermine LIDAR UAV-Based System (CLUBS)

	FY 2005	FY 2006
DP-2 VECTORED THRUST AIRCRAFT PROGRAM	7,256	3,900

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FY 2005 - The test aircraft experienced a nozzle box failure in Nov 2004 which delayed testing. This effort repaired the affected systems and made additional vehicle improvements to increase hover performance and reliability: lightweight fuselage and wing, robust nozzle box and cascade mechanism. Testing resumed Jun 2005 to complete sustained controlled hover, in and out of ground effects.

FY 2006 - This effort supports the DP-2 Vectored Thrust Aircraft Program.

	FY 2005	FY 2006
EXCALIBUR UNMANNED COMBAT AERIAL VEHICLE	0	1,000

This effort supports the Excalibur unmanned combat aerial vehicle research.

	FY 2005	FY 2006
FREE ELECTRON LASER	2,121	0

This effort developed a capability to support the operation of a 5 MeV high current injector in the free electron laser facility. The task included processing and characterization of super conducting radio frequency cavities which were assembled in a cryounit for a systems test.

	FY 2005	FY 2006
HIGH OPERATING TEMPERATURE MIDWAVE INFRARED SENSORS	1,640	0

This effort developed and evaluated high performance medium wavelength infrared sensors of pixel size 320x240 with 640x480 goal for Navy, Marine Corps, and Army needs.

	FY 2005	FY 2006
HIGH-SPEED ANTI-RADIATION DEMONSTRATION (HSAD) - AIRFRAME/PROPULSION SECTION	4,822	5,000

FY 2005 - This effort matured key areas in the propulsion elements of the HSAD advanced anti-radiation guided missile. The effort better characterized the subsystem performance with additional testing, ramjet fuel development, insensitive munitions development, propulsion system optimization studies and propulsion

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requirements development through operational/mission analysis.

FY 2006 - This effort supports HSAD-Airfram/Propulsion Section research.

	FY 2005	FY 2006
INFORMATION SHARING FOR ISR TARGETING AND ENGAGEMENT OF MOBILE TARGETS	0	1,500

This effort supports information sharing for ISR targeting and engagement of mobile targets research.

	FY 2005	FY 2006
INTERNAL ROTOR URBAN FLIGHT VEHICLE	0	500

This effort supports internal rotor urban flight vehicle research.

	FY 2005	FY 2006
LADAR	2,026	1,000

FY 2005 - This effort developed autonomous target recognition techniques, using ladar data that can be employed in an anti-ship role.

FY 2006 - This effort supports LADAR research.

	FY 2005	FY 2006
LONG WAVELENGTH ARRAY	0	3,500

This effort supports long wavelength array research.

	FY 2005	FY 2006
LOW COST TERMINAL IMAGING SEEKER	4,341	2,000

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FY 2005 - This effort conducted additional modeling and simulation to improve characterization of the performance of the system and data collection and develop algorithms to improve the system performance in signal processing.

FY 2006 - This effort supports low cost terminal imaging seeker research.

	FY 2005	FY 2006
LOW-POWER MEGA-PERFORMANCE UAV PROCESSING ENGINES	1,928	0

This effort developed and delivered a Sequential Instruction Multiple Data (SIMD) integrated processing chip capable of 96 giga-loating point operations per second (GFLOPS) along with macro code software modules to process synthetic aperture radar onboard a small tactical unmanned aerial vehicle.

	FY 2005	FY 2006
LOW-POWER POLYMER BASED INFRARED TECHNOLOGY	0	1,500

This effort supports low-power polymer based infrared technology research.

	FY 2005	FY 2006
MULTI-FUNCTIONAL, HIGH-PERFORMANCE DUAL BAND IMAGING	1,640	0

This effort researched and developed sensor issues associated with multi-band infrared and radio frequency sensors for detection and track of asymmetric maritime threats.

	FY 2005	FY 2006
QUIET HIGH SPEED PROPULSION	3,473	4,800

FY 2005 - This effort developed an advanced hub-driven podded propulsor design for surface ship and submarine applications. The system has the attributes of reduced low-speed acoustic and electromagnetic signatures, is power dense, and provides high-speed platform performance.

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FY 2006 - This effort supports quiet high speed propulsion research.

	FY 2005	FY 2006
SHORT PULSE LASER DEVELOPMENT FOR MICROMACHINING APPLICATIONS	1,640	1,900

FY 2005 - This effort developed and delivered femtosecond lasers for micromachining of silicon and other materials.

FY 2006 - This effort supports short pulse laser development for micromachining applications research.

	FY 2005	FY 2006
SMART INSTRUMENT DEVELOPMENT FOR THE MAGDALENA RIDGE OBSERVATORY	0	3,500

This effort supports smart instrument development for the magdalena ridge observatory.

	FY 2005	FY 2006
SPACE SURVEILLANCE TECHNOLOGY	3,375	0

This effort supported space surveillance technology.

	FY 2005	FY 2006
STRUCTURALLY INTEGRATED LOW OBSERVABLE COATING SYSTEM	1,644	4,200

FY 2005 - This effort demonstrated light-weight, durable paint-replacement film development and manufacturing. The goal of this task was to reduce the cost, weight, and maintenance associated with paint replacement films for military aircraft.

FY 2006 - This effort supports structurally integrated low observable coating system research.

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	FY 2005	FY 2006
TERAHERTZ DETECTION SYSTEM FOR IEDS/LANDMINES	0	1,200

This effort supports terahertz detection system for IEDS/Landmines research.