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

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: POWER PROJECTION APPLIED RESEARCH

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
POWER PROJECTION APPLIED RESEARCH	153,897	135,454	84,914	67,205	71,966	71,780	72,005

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE emphasizes near to mid-term transition opportunities by developing and demonstrating technologies supporting the Future Naval Capability (FNC)/Program Enabling Capabilities (ECs) for Marine and Unmanned Vehicle Tactical Intelligence, Surveillance and Reconnaissance (ISR), Advanced Naval Fires Technology, Hostile Fire Detection and Response, and Dynamic Target Engagement & Enhanced Sensor Capabilities. Within the Naval Transformation Roadmap, this investment will achieve two of four key transformational capabilities required by Sea Strike as well as technically enable the Littoral Sea Control key transformational capability within Sea Shield.

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	135,163	94,148	73,926
Congressional Action	0	42,750	0
Congressional Undistributed Reductions/Rescissions	-107	-1,444	0
Execution Adjustments	8,608	0	0
Federal Technology Transfer	-35	0	0
FY 2005 SBIR	-2,494	0	0
Program Realignment	0	0	10,936
Rate Adjustments	0	0	52
Realignment of EM Railgun from PE 0603123N	12,762	0	0
FY 2007 President's Budget Submission	153,897	135,454	84,914

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:
This PE is focused on 6.2 applied research. As such it develops early components technologies that if successful can be integrated into weapon systems that meet warfighter requirements. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environment). The metrics used

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to evaluate 6.2 programs are necessarily less precise than those used in 6.3 programs.

The metrics for this PE can be divided into two categories: technological and organizational/functional. Technological metrics address the success of the work performed. The primary technological metrics used in this PE involve laboratory experiments/tests demonstrating proof of the concept for the technology. This demonstration is frequently a hand-assembled functioning breadboard of the concept. The organizational/functional metrics applied to this PE include: transition of the technology to advanced development in a 6.3 PE and applicability of the technology to documented warfighter problems or requirements. Successful implementation of these categories would result in the application of a pass/fail metric and further evaluation for possible transition to a 6.3 development/demonstration program.

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PROGRAM ELEMENT: 0602114N PROGRAM ELEMENT TITLE: POWER PROJECTION APPLIED RESEARCH
PROJECT TITLE: POWER PROJECTION APPLIED RESEARCH

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
POWER PROJECTION APPLIED RESEARCH	115,714	87,704	84,914	67,205	71,966	71,780	72,005

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses the technology issues involving the Navy's capability to project naval power on the broad seas and in the littoral regions.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2005	FY 2006	FY 2007
STRATEGIC SUSTAINMENT	28,199	22,942	13,580

The Strategic Sustainment activity develops technologies which will sustain and improve Navy's strategic system capabilities in the areas of Radiation Hardened System Design (RAD HARD), Solid Rocket Motor Ignition (SRM) Response, and drag reduction devices. This activity contains the Technology for the Sustainment of Strategic Systems (TSSS) and the Strategic Systems Infrastructure (SSI) effort.

Decreases in FY 2006 and FY 2007 are due primarily to completion of TSSS Phase 1 effort. The FY 2007 $10M reduction is due to the completion of the TSSS portion of the program and the reduction in the last year of the SSI portion of the program.

FY 2005 Accomplishments:

- TSSS: Completed RAD HARD System Design Tool task. The SRM ignition response effort completed code validation and verification with flight test data. The Drag Reduction Devices task completed the development of an aero elasticity tool for performance prediction of missiles with drag reduction devices. Successfully completed New Technology Gyro, Micro-Thermal Control (MTC), Silicon Oscillating Accelerometer (SOA) and transitioned all three to SSP Fiber Optic Gyro Navigation (FOGN). Initiated development of Atom Interferometer

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Gravity Gradient (AIGG) for real time measurement of vertical deflection (VD) and gravity anomalies for use in non-gravity mapped areas.
- SSI: Continued Missile propulsion effort with subscale static motor testing. Post Boost Control System (PBCS) developed thermal/mechanical valve and flow impingement models. Ordnance Initiation technology effort conducted design reviews and purchased and tested prototype sub-assemblies for evaluation. Missile electronics continued the model development. Navigation Sonar initiated trade studies and design of new technology sensors.

FY 2006 Plans:

- TSSS: Underwater launch task will conduct exit testing of the Underwater Launch Technology Sustainment System (ULTSS). Testing will be performed to demonstrate the utility of the ULTSS in guiding and advising engineers unfamiliar with Underwater Launch (UWL) technology in the creation of a conceptual design. Release of final version of ULTSS. Complete fabrication and test prototype Atom Interferometer Gravity Gradient (AIGG) sensor using the exit criteria. If successful, transfer to SSP program. The TSSS Phase I effort is completed.
- SSI: Missile tasks in Propulsion will continue efforts by conducting non-eroding throat tests, chamber bottle tests, insulator tests, component compatibility tests and propellant hazard assessment. The program will conduct an innovative testing of new rocket motor case/nozzle design. Continue Advanced PBCS Valve efforts by conducting materials compatibility tests, an Integrated Valve Assembly demo, subscale propellant mixes and a manifold concept demo. Ordnance Initiation Technologies program will integrate various sub-assemblies and perform laboratory testing on various prototype designs. Continue Missile Electronics efforts by conducting small coupon aging studies, conduct radiation hardening tests & assessments, complete board aging model development, and continue development of board level and missile level modeling techniques. Sonar effort will complete detailed design and begin fabrication of the prototype new technology hardware.

FY 2007 Plans:

- SSI: Continue Missile propulsion efforts by conducting larger scale non-eroding throat tests, chamber bottle tests, insulator tests, component compatibility tests and propellant hazard assessment. Continue Advanced PBCS Valve Technology and Materials program efforts by conducting materials compatibility tests, Integrated Valve Assembly demo, subscale propellant mixes and a manifold concept demo. Goal is heavy wall testing simulating a very limited full scale Post Boost control system test. Ordnance Initiation Technologies program will refine the design and perform tests on the prototype demonstrating and documenting new ordnance

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initiation technology that meets the requirements. The Missile Electronics Technologies program completes code development with final Validation and Verification of the models with experimental radiation hard data and aging data. Navigation sonar will complete Laboratory and tank testing of the new technology transducer and hydrophones. Prototype hardware will be integrated aboard USNS WATERS to provide a Navigation Sonar System (NSS) test bed and evaluated at-sea in an operational environment.

	FY 2005	FY 2006	FY 2007
HIGH SPEED PROPULSION AND ADVANCED WEAPON TECHNOLOGIES	34,166	16,841	14,266

The work in this activity supports technologies that support high speed weapons delivery and advanced weapons development. High speed weapons (Mach 3 to Mach 6+) will provide the Navy the capability to attack time critical targets by delivering a weapon over long distances in very short periods of time.

The decrease in FY 2006 reflects conclusion of HyFly 6.2 work, reduced 6.2 effort in National Aerospace Initiative High Supersonic Turbine Vehicle (NAI HSTV), and transfer of Non-Lethal Weapons to PE 0602651M.

The decrease from FY 2006 to 2007 is a result of the reduced 6.2 funding for the High Speed Turbine program which is transitioning to a predominantly 6.3 flight demonstration program.

FY 2005 Accomplishments:

- HyFly: Completed HyFly related applied research. Completed development of high temperature ceramic matrix materials meeting projected Mach 6 thermal environment. Program fully transitions in FY 2006 to a series of flight demonstrations in PE 0603114N.
- Integrated High Payoff Rocket Propulsion Technology (IHPRPT): Completed Phase II air-to-air development of heavy weight motor. Demonstrated survivable nozzle and composite case for air-to-air rocket motor. Initiated development of new energetic materials for Phase III advanced composite rocket motor. Continued development of surface launch component technologies.
- Asymmetric Threat Defense: Continued development of detection and continuous target tracking algorithms. Demonstrated warhead effects on aluminum hull boats.
- National Aerospace Initiative High Supersonic Turbine Vehicle (NAI HSTV): Continued development and validation of flow path and turbine engine components and continue component rig testing. Began design of airframe components and assessment of thermal management techniques.
- Non-Lethal Weapons: This program has been transferred to PE 0602651M.

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FY 2006 Plans:

- IHPRPT: Complete and demonstrate Phase II performance goals using an air-to-air flight weight motor. Continue formulation and scale up of new propellants that will meet Phase III goals. Continue development of surface launch component technologies.
- Asymmetric Threat Defense: Demonstrate dual mode warhead effectiveness in both above and below water detonations. Demonstrate Electro-Optic (EO) guidance processing algorithm performance to detect small boats in clutter environment and to maintain track of closely spaced boats.
- NAI HSTV: Continue development of component/subsystem technologies in propulsion, inlet, nozzle, airframe, and thermal management for high supersonic turbine powered weapon systems. Select technologies for validation and conduct ground testing/validation.

FY 2007 Plans:

- IHPRPT: Initiate demonstration of air-to-air system that uses new energetic ingredient compositions to meet Phase III IHPRPT performance goals. Continue development of surface launch component technologies.
- NAI HSTV: Continue development of component/sub-system technologies for high supersonic turbine powered weapon systems. Conduct validation, ground testing and demonstrations.
- Asymmetric Threat Defense: Complete EO guidance processing and dual mode warhead efforts. Initiate identification of reactive material target interaction phenomenology, and development of lethality model. Initiate adaptive warhead technology development for air dominance and strike weapons, low cost miniaturization of guidance and control and propulsion control technologies. Continue development of propulsion and high temperature materials technologies to enable high speed weapons.

	FY 2005	FY 2006	FY 2007
UNMANNED VEHICLES	8,695	6,335	0

The focus of this activity is on those technologies that relate to the development of Unmanned Vehicles (UVs) that will support Naval forces and expeditionary operations. Specific technology areas include the development of Intelligent Autonomy (IA) technologies to increase autonomy, performance, and affordability in Unmanned Underwater Vehicles (UUVs), Unmanned Air Vehicles (UAVs), Unmanned Ground Vehicles (UGVs), UAV control systems, UAV radar systems, and UAV propulsion and power systems. Naval Research Laboratory (NRL)

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investment/performance is included in this effort through FY 2006.

FY 2007 reflects the transition of Autonomous Operations (AO) efforts to PEs 0602747N and 0603114N.

FY 2005 Accomplishments:

-IA: Continued development of dynamic replanning and autonomous control technologies (this effort transitioned to PE 0603114N in FY 2006). Conducted simulation of dynamic replanning and multi-vehicle technology for littoral Intelligence Surveillance and Reconnaissance (ISR). Completed simulation demonstration of multi-vehicle distributed cooperative control jointly with Air Force for Intelligence Surveillance and Reconnaissance (ISR) and strike missions. Completed joint DARPA UAV/UGV reconnaissance demonstration.
- UUV: Continued development and transition of UUV-deployed ISR Electro-Magnetic/Electro-Optic (EM/EO) sensors and software, multi-vehicle Undersea Search and Surveillance (USS) and communication link development; continued Magnesium Semi-Fuel Cell energy source development and demonstration. Completed preparation of transition data package for the Integrated Motor Propulsor (IMP).
- UAV control: Continued development of command, control and displays for multiple UAVs, and single frequency multi-point UAV communications. Continued shipboard UAV landing aid research.
- UAV propulsion: Continued development of XTE-67/A1 advanced turbine gas generator core effort.
- Autonomous Mobile Platform (AMP): Integrated energy replenishment and storage with a mobile platform and demonstrated replenishment and relocation operation.
- Integrated energy replenishment and storage mechanism in small autonomous vehicles and demonstrated replenishment and relocation. (NRL)
- Continued development of small autonomous mobile vehicles that can replenish their energy supply. Achieved controlled sustained flight of a flapping-wing, flying/crawling expendable countermeasure (CM) micro vehicle and successfully tested sailing and flight modes of an expendable airplane/sailboat, mobile, Electronic Warfare (EW) sensor platform. (NRL)
- Completed development of high performance EO/IR sensors for UAV's. (NRL)
- Initiated development of a lightweight, 4.5hp, recuperated, turbo-shaft engine with an integral 3 kW generator for UAV propulsion and portable power generation. (NRL)

FY 2006 Plans:

- IA: Complete development of multi-vehicle cooperation technologies. Complete medium-fidelity simulation of

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multi-vehicle cooperation technologies. Transition efforts to PE 0603114N in FY 2007.
- UUV: Complete Undersea Search and Surveillance (USS) and Communications Navigation Aid (CNA) efforts through transition to PMS-Explosive Ordnance Disposal (EOD) and ONI-34; Complete Submarine Track and Trail (STT) efforts in advanced undersea sensors, communications, and autonomy. The STT UUV Technology efforts transition to PE 0602747N in FY 2007 due to EC realignments.
- UAV control: Continue development of airborne and shipboard battle manager platforms for UAVs and the airborne control station for control of multiple UAVs. Initiate investigation on integration of the Landing Period Designator (LPD) algorithms and system into air wake tracking system for autonomous shipboard recovery of UAVs. This effort will transition to PE 0603114N in FY 2007.
- UAV propulsion: Continue development of XTE-67/A1 demonstrator engine and demonstration of Integrated High Performance Turbine Engine technology (IHPTET) Joint Technology Demonstrator Engine (JTED) components. Transition to PE 0603114N in FY 2007.
- Continue development of small autonomous mobile vehicles. FY 2007 effort reflected in Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies activity. (NRL)
- Continue development of lightweight UAV engine. FY 2007 effort reflected in Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies activity. (NRL)
- Initiate design and development of a disposable micro air vehicle (MAV) which will enable the airborne delivery and precision placement of miniature EW sensors and payloads. FY 2007 effort reflected in Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies activity. (NRL)
- Autonomous Systems: Initiate development of near optimal trajectory planners to enhance the capabilities of UAVs and other distributed autonomous systems. FY 2007 effort reflected in Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies activity. (NRL)

FY 2007 Plans:

- Efforts no longer funded in this Activity.

	FY 2005	FY 2006	FY 2007
NAVIGATION, ELECTRO OPTIC/INFRARED (EO/IR), AND SENSOR TECHNOLOGIES	13,073	6,869	13,844

This activity describes Navy Science and Technology (S&T) investments in the areas of Electro Optic/Infrared devices, Global Positioning Station (GPS) and Fiber Optic Gyro (FOG) Navigation systems, and advanced sensors. The network centric and navigation technology effort is focused on improving the navigation accuracy of Naval

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forces through improvements in FOGs, distributed timekeeping systems, and GPS improvements. This effort also includes NRL investment/performance in the technology areas of Electronics, Electronic Warfare, and Communications.

Changes in the funding profile between FY 2005 and FY 2007 are due to natural progression of program initiations and completions.

FY 2005 Accomplishments:

- Navigation Technologies: Continued Precision Time and Time Interface transfer demonstration, Deeply Coupled Global Positioning System/Inertial Navigation System (GPS/INS) with nonlinear filter algorithm development, Distributed Time Standards Technology, Rb Double Bubble Maser Atomic Clock, and static testing of Tightly Coupled GPS/INS/Loran projects. Initiated the following project: Fiber Optic Ring Gyroscope Development.
- Electro-Optic/Infrared (EO/IR) technologies: Continued Multispectral Infrared Focal Plane Array (IRFPA) assembly and testing, and fabrication of photonic Millimeter Wave (MMW) threat detection prototype receivers. Continued development of high-performance, low-cost EO/IR airborne surveillance sensors for unmanned aerial vehicles, and ultra-high performance EO/IR Imagers. Continued development of auto-target identification techniques for Laser Range-gated imagers.
- Electronics: Continued spectral emittance based target discrimination work, long wave IR (LWIR) “W”-structured type-II superlattice (WSL) development, GaSb substrate study, and high power laser Hollow Core (HC)-Photonic Band Gap (PBG) effort. Initiated study Yb doped ceramic YAG and Y2O3 for optical cooling efficiency, investigated high power 1030 nm lasers as a pump source. (NRL)
- Electronic Warfare: Completed Infrared Counter Measures (IRCM) effort by implementing preprocessing and track algorithms into imaging seeker surrogates. (NRL)
- Communications: Continued IR obscurant technology development defining high aspect ratio particle characterizations and synthesized rod-shaped nanoparticles. Provided demonstrations of covert laser communications using Multi-Quantum Well (MQW) retroreflectors to several operational units. Increased bandwidth of MQW retroreflector laser communications system with Cat's eye Backplane. (NRL)

FY 2006 Plans:

- Navigation Technologies: Continue Distributed Time Standards algorithm development, Rb Clock design and experiments, and Link 16 Time Transfer development and testing. Continue Tightly Coupled GPS/INS/LORAN effort and Fiber Optic Ring Gyroscope development. Complete Algorithm development for Distributed Time Scaling and

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the Deeply Integrated GPS/INS width Nonlinear Filter project. Initiate the Magnetic Passive Reset for Inertial Navigation System (INS) and the development of Advanced GPS/INS (GIN) Systems for Strike Weapons.
- EO/IR: Continue development of low cost piezoelectric motion and jitter compensation for high resolution visible and infrared sensors. Millimeter Wave (MMW) and TeraHertz (THz) Imaging effort will complete development of MMW imagers and continue development of THz imaging through fog, clouds, clothing, and some walls. Continue Nano Sensors development of ultra low noise uncooled nanotechnology infrared sensors and nanoatomic sensor nonvolatile memories. Electronic Zoom effort will continue development of electronic liquid crystal based directional field of view and zoom imagers. Continue multi-sensor (visible, infrared, millimeter wavelength, terahertz and laser imagers) fusion for objection recognition.
- Electronics: Continue high power HC-PBG development and Yb doped ceramic YAG high power laser efforts. Complete target discrimination effort by conducting a real time demonstration of spectral emmitance based target/material target discrimination using Long Wave (LW) Quantum Well Infrared Photodetector (QWIP) sensor. Complete study of WSLs for multiband IR photodiodes by demonstrating high performance dual-band Long Wave (LW) & Very Long Wave Infrared (VLIR) photodiode operation. Complete study of pre-growth molecular hydrogen cleaning of GaSb substrates. (NRL)
- Electronic Warfare: Continue IR obscurant technology development fabricating and evaluating fieldable IR obscurants and particle dissemination methods. (NRL)
- Communications: Continue covert high bandwidth communications effort. Complete development of MQW retroreflector with Cat's Eye Backplane. Transition compact, light-weight MQW communications to operational forces. Initiate the development of small hyperspectral sensors and associated signal processing algorithms in a compact format that will fit in small UAVs and be capable of detecting small targets. (NRL)

FY 2007 Plans:

- Navigation Technologies: Continue Rb Clock development and testing, Fiber Optic Ring Gyroscope development, Magnetic Passive reset for INS, and Advanced GPS/INS systems for strike weapons. Initiate self-locked Intra-Cavity Alkali Vapor Laser (ICAL) opto-atomic clock project and Repeat spoofer detection and location project. Complete Network Centric Navigation (Link-16 Time Transfer), Distributed Time Standards, and Tightly Coupled GPS/INS/Loran efforts.
- EO/IR: Complete development of low cost piezoelectric motion and jitter compensation for high resolution visible and infrared sensors. Continue Millimeter Wave (MMW) and TeraHertz (THz) Imaging project. Complete development of ultra low noise uncooled nanotechnology infrared sensors and continue development nanoatomic sensor nonvolatile memories. Complete development of electronic liquid crystal based directional field of view and zoom imagers. Complete multi-sensor (visible, infrared, millimeter wavelength, terahertz and laser

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imagers) fusion for objection recognition effort.
- Electronics: Complete demonstration of high laser power through IR transmitting HC-PBG fiber. Complete performance optimization and scaling law development for the Radiation Balanced Laser. (NRL)
- Electronic Warfare: Complete development of IR obscuration technologies for surface vessel protection to achieve order of magnitude improvement over current obscurants and develop dissemination system prototype. (NRL)
- Communications: Continue development of free space laser communications systems with the development of a hybrid infrared system with dramatically lower power requirements at the sensor/transmitter. Continue small hyperspectral sensor development. (NRL)
- Complete long-term demonstration of multiple sensor-equipped vehicles, covering autonomous sensing operation and multiple replenishment/relocation cycles under autonomous or semi-autonomous control. (NRL)
- Complete development of small autonomous mobile expendable EW vehicles that can replenish their energy supply. Select multi-mode locomotion method and energy harvesting technique and construct and demonstrate vehicles. (NRL)
- Continue development of MAV. (NRL)
- Automous Systems: Continue development of near optimal trajectory planners to enhance the capabilities of UAVs and other distributed autonmous systems. (NRL)

	FY 2005	FY 2006	FY 2007
DIRECTED ENERGY AND EM GUNS (FORMERLY ELECTRIC WEAPONS)	27,864	33,087	30,759

The goal of this activity is to develop Directed Energy (DE) and Electric Propulsion power weapons for Navy applications. One major component of the DE program is the Free Electron Laser (FEL) which if successful could be applicable for shipboard applications as a defense weapon against advanced cruise missiles and asymmetric threats. The other major component is the Electro Magnetic (EM) gun program that is focused on developing the technology to launch a long range projectile from Navy ships. This activity also includes NRL investment/performance in these research areas.

Increase in FY 2005 is due to the addition of $13M for EM Gun and an additional $3M invested in the Directed Energy effort. Increase in FY 2006 and decrease in FY 2007 is due to funding profile of EM Gun program.

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FY 2005 Accomplishments:

- DE: Continued with fabrication of high current, high brightness injectors including superconducting Radio Frequency (RF) cavity base design. Conducted experiments with alternative FEL amplifier configurations to compare performance to current oscillator configuration and to determine the best scale up path to a megawatt FEL. Initiated Solid State Laser (SSL) fiber phasing technology development. Initiated development of High Power Microwave (HPM) source technology. Initiated support to Joint Office of the Secretary of Defense (OSD) High Power SSL program.
- EM Gun: Initiated design of prototype, 1/2 scale 32 MegaJoule (MJ) EM gun system. Conducted risk reduction efforts relating to arcing and rail wear/gouging.
- Investigated tribologic aspects of sliding metal-to-metal high current contacts in the rails of EM railguns. (NRL)

FY 2006 Plans:

- DE: Continue 1 micron filamentation, halo limitation, and short Rayleigh range studies. Continue lethality testing and optical propagation studies. Current injector task will complete assembly and test the Advanced Energy Systems (AES) Cryounit. Continue testing of RF gun High Voltage Power Supply (HVPS) components which are required for the 100 kW high current injector. Install HVPS gun and commission HVPS. Begin gun performance tests and 750 MHz cryounit integration. FEL development effort will continue 750 MHz cryomodule design, complete facility upgrade for 100 kW FEL development, and begin cryomodule construction.
- EM gun: Develop inital technology for Full Scale Proof of Concept Demonstrator for testing of integrated launch package (ILP) in 2009. Conduct investigation of improved rail gun rail wear techniques. Conduct testing of capacitor based pulse forming network system to 32 megajoules (of 200 required) of stored power with prototypical rail gun system increasing in power level and projectile speed, while examining rail/bore life issues expected to be seen at larger scale.
- Continue to pursue superior designs of insulators to handle the thermal and mechanical shocks generated by the launch in EM railguns. (NRL)
- Initiate development of novel electric weapon architectures and designs that enhance performance and maintainability. (NRL)

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FY 2007 Plans:

- DE: Complete gun performance tests. Complete 750 MHz Cryounit integration and low power characterization. FEL development task will complete cryomodule design. Continue cryomodule construction. Continue FEL development and investigation into the application of FEL technology to other areas including advanced materials, optics, bioscience, medical, manufacturing, weaponization, and solid state physics.
- EM Gun: Complete preliminary designs of 32MJ muzzle energy electromagnetic demonstration launchers and begin detailed design with industry partners in preparation for fabrication (FY08/09) and demonstration (FY10). Continue bore life risk reduction tests by scaling laboratory launcher muzzle energy from 8 to 16MJ to ensure bore life characteristics of the rails and insulators apply at the higher energies. Finalize projectile conceptual designs from two industry vendors and begin projectile preliminary design. Initiate conceptual design of rotating machine pulsed power. Continue Integrated Product Team (IPT) collaborations between industry, Navy and the Army Electromagnetic Launch program to ensure consistent, non-duplicative technology maturity activities.
- Continue investigation of surface treatments such as advanced coatings or "MAX-phase" materials to harden the rails in electromagnetic railguns. (NRL)
- Continue development of designs for viable novel electric weapon architectures that enhance performance and maintainability. (NRL)

	FY 2005	FY 2006	FY 2007
STRIKE AND LITTORAL COMBAT TECHNOLOGIES	3,717	1,630	12,465

The focus of this effort is on those technologies that will support Naval Precision Strike Operations and provide the Navy of the future the ability to quickly locate, target, and strike critical targets ashore. NRL investment/performance in this effort is included. Efforts in this PE transitioned from these PEs 0602131M, 0602235N, 0602236N, 0603114N, 0603236N and 0603640M.

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: Advanced Naval Fires Technology Spiral 1, Hostile Fire Detection and Response Spiral 1, Marine and UxV Tactical ISR, and Dynamic Target Engagement & Enhanced Sensor Capabilities.

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FY 2005 Accomplishments:

- Advanced Gun Barrel (AGB) & Seeker Technology: Continued development including gun fire testing of 45mm inserts used in coating technologies. Conducted mechanical and thermal analysis and tested composite material samples for the composite barrel design. Effort transitions to PE 0603114N in FY06.
- Initiated development and demonstration of image-while-scan (IWS) technologies needed to perform imaging and identification of targets of radars operating in non-spotlight mode. (NRL)
- Continued development of new queing receiver brassboard for high probability of intercept wide instantaneous bandwidth receiver. (NRL)
- Continued development of and construction of retrievable airborne W-Band decoys and conducted W-band Radar Cross Section (RCS) experiment with NRL passive decoy and WARLOC radar. (NRL)
- Initiated development of improved processing algorithms based on Joint Time Frequency Analysis (JTFA) for integration into existing Synthetic Aperture Radar (SAR) image formation processors to enhance the resolution and target characterization of SAR data. (NRL)

FY 2006 Plans:

- Hand Held Precision Targeting: Initiate/complete development of the rangefinder module including integration of an inertial measurement unit (IMU) and magnetometer. This will allow the forward observer to use a laser range finder for target designation in a magnetically hostile environment.
- Continue SAR algorithm development, IWS technology development, and wide bandwidth amplifier development. (NRL)
- Complete queing receiver brassboard for a high probability of intercept wide instantaneous bandwidth receiver and conduct a small-scale signal collection in a maritime environment field test. (NRL)
- Continue W-band decoy development. (NRL)
- Continue JFTA improved processing algorithm development. (NRL)
- Initiate development of software for a genetic algorithm selection process for use with identified analytic performance metrics for the optimization of communications jamming techniques. (NRL)

FY 2007 Plans:

- Marine and UxV Tactical ISR (MUTI): Initiate effort to develop improved radar that will provide real-time tactical targeting and improved sensor processing to provide improved access to available ISR products.

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Specific tasks include: signal intelligence visualization, automated pattern recognition, dynamic replanning/autonomous vehicle control, fully integrated advanced demonstrator engine, multi-vehicle cooperation/targeting and networking communications software. (formerly funded in PE's 0602131M and 0603114N)
- Dynamic Target Engagement & Enhanced Sensor Capability (DTEESC): Initiate effort to develop the capability to improve the processing of dynamic targets from 100 to 400 targets per day. It will also improve UAV performance in the areas of increased endurance and support for more autonomous operations. Specific tasks include the development of: decision support algorithms for dynamic target engagement, remote sensor fusion hardware for ground sensors, an ultra endurance UAV, and a Ground Moving Target Indicator (GMTI) sensor for use on UAVs. (formerly funded in PE's 0602235N, 0603640M, and 0603114N)
- Hostile Fire Detection and Response Spiral 1 (HFDR): Initiate effort to develop technologies for hostile fire detection and active response capabilities that will 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 the GUNSLINGER hostile fire detection and counter fire system. (formerly funded in PE's 0602131M, 0602236N, and 0602235N)
- Advanced Naval Fires Technology Spiral 1 (ANFT): Initiate effort to reduce the time delay from target acquisition to engagement through improved information sharing interfaces, accurate mobile and 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, improved fire control systems, advanced fires coordination technology, and advanced target acquisition. (formerly funded in PE's 0602236N and 0603236N)
- Complete W-band decoy development with a demonstration of active ECM techniques. (NRL)
- Complete the development of improved processing algorithms based on the JFTA by incorporating algorithmic tools into existing SAR system for testing. (NRL)
- Continue IWS technology development. (NRL)
- Continue genetic algorithm selection process for communication jamming.(NRL)

CONGRESSIONAL PLUS-UPS:

	FY 2005	FY 2006
ADVANCED HIGH-ENERGY THERMOBARIC WARHEAD DEVELOPMENT	963	0

This effort demonstrated an advanced high-energy thermobaric explosive composition that will provide enhanced internal blast pressures and moderate thermal effects in confined environments for the M72 LAW (Light Anti-tank Weapon) ASM. Primary efforts included fuze development and booster testing.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602114N PROGRAM ELEMENT TITLE: POWER PROJECTION APPLIED RESEARCH
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	FY 2005	FY 2006
ADVANCED HYBRID STORED ENERGY DEVICES FOR AFFORDABLE AIR WEAPONRY	1,446	0

Effort supported Advanced Hybrid Stored Energy Devices for Affordable Air Weaponry.

	FY 2005	FY 2006
ADVANCED REACTIVE MATERIAL ENHANCED NANOCOMPOSITE WARHEADS (ARMENW)	2,506	0

This effort supported the manufacturing technology development and production scale up of high density nano material composites used in the construction of advanced warheads for air and surface weapons.

	FY 2005	FY 2006
ADVANCED SMART OPTICAL SENSOR PAYLOAD TECHNOLOGY FOR SURVEILLANCE	963	0

Effort developed Advanced Smart Optical Sensor Payload Technology for Surveillance.

	FY 2005	FY 2006
AIRCRAFT CARRIER SURVEILLANCE SYSTEM	2,700	3,500

FY 2005 - Effort developed Aircraft Carrier Surveillance System.

FY 2006 - This effort supports the Aircraft Carrier Surveillance System.

	FY 2005	FY 2006
AUTONOMOUS UNDERWATER VEHICLE DOCKING AND RECHARGING STATION	0	2,100

This effort supports autonomous underwater vehicle docking and recharging station research.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602114N PROGRAM ELEMENT TITLE: POWER PROJECTION APPLIED RESEARCH
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	FY 2005	FY 2006
COMBUSTION LIGHT GAS GUN	4,051	4,250

FY 2005 - This effort developed the technologies for a hyper-velocity weapon based on high-energy electric plasma ignition heating of injected light gas. Designed a 155mm CLGG system capable of demonstrating full scale, single shot performance. Demonstrated operational characteristics using cryogenic propellants.

FY 2006 - This effort supports combustion light gas gun research.

	FY 2005	FY 2006
DEVELOPMENT PROCESSES FOR FULL SCALE PRODUCTION OF SILICON CARBIDE WAFERS	0	1,700

This effort supports development processes for full scale production of silicon carbide wafers research.

	FY 2005	FY 2006
DEVICE INTEGRATION OF WIDE BAND GAP SEMICONDUCTORS AND MULTIFUNCTIONAL OXIDES	1,640	1,500

FY 2005 - This effort commissioned a deposition system for oxide component deposition and quantified growth parameter variables. Grew test structures for initial calibration and feedback for optimization of deposition parameters.

FY 2006 - This effort supports device integration of wide band gap semiconductors and multifunctional oxides research.

	FY 2005	FY 2006
DOD AGILE MANUFACTURING CENTER FOR CASTINGS TECHNOLOGY (AMCAST)	0	2,100

This effort supports the DOD Agile Manufacturing Center for Castings Technology (AMCAST).

BUDGET ACTIVITY: 02
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	FY 2005	FY 2006
ELECTROMAGNETIC (EM) RAIL GUN TEST MUNITION	1,060	0

This effort developed Electromagnetic (EM) Rail Gun Test Munition.

	FY 2005	FY 2006
ELECTRONIC MOTION ACTUATION SYSTEMS	0	2,200

This effort supports electronic motion actuation systems.

	FY 2005	FY 2006
FIRELIDAR	1,640	0

This effort developed an eyesafe laser imaging system complementary to IR imagers. Effort developed innovative technologies to overcome the deficiencies of an infrared sensors used by firefighters. These sensors currently bloom and become useless in brightness of a hot fire. Approach used laser illumination and spectral filters to see through fire and smoke. Imagery will also be relayed via a wireless LAN to the command center.

	FY 2005	FY 2006
FREE ELECTRON LASER	0	3,500

This effort supports technologies to support the development of a high average power Free Electron Laser system that is applicable to shipboard self defense.

	FY 2005	FY 2006
HIGH ENERGY DENSITY CAPACITORS FOR MILITARY APPLICATIONS	0	1,500

This effort supports high energy density capacitors for military applications research.

BUDGET ACTIVITY: 02
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	FY 2005	FY 2006
HIGH PERFORMANCE FREQUENCY MODULATED FIBER OPTIC LINK	0	1,200

This effort supports high performance frequency modulated fiber optic link research.

	FY 2005	FY 2006
HIGH POWER FEL DEVELOPMENT FOR NAVY APPLICATIONS	0	1,500

This effort supports high power FEL development for Navy applications research.

	FY 2005	FY 2006
HYPERSONIC WEAPONS ENABLING CAPABILITY	963	0

This effort extended the capabilities of the Integrated Hypersonic Aeromechanical Tool (IHAT) and developed a virtual weapon simulation that will support the extended analysis of high speed weapons.

	FY 2005	FY 2006
INTEGRATED BIOLOGICAL WARFARE TECHNOLOGY PLATFORM	3,375	0

This effort applied the integrated Biological and Chemical Warfare Defense (IBCWD) decision analysis technology software to survey vessels approaching aircraft carriers on the high seas. Transformed the IBCWD software framework into a system that provides situation awareness, real-time response planning, and integrated collaborative center for decision maker interaction.

	FY 2005	FY 2006
INTEGRATED PERSONNEL PROTECTION SYSTEM	1,156	0

Effort developed an Integrated Personnel Protection System consisting of a miniaturized wearable computing device, integrated sensors and a display system. System will be capable of providing alert reports and situational information to the command stations.

BUDGET ACTIVITY: 02
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	FY 2005	FY 2006
KILL ASSIST ADVERSE-WEATHER TARGETING SYSTEM (KAATS)	1,640	0

This developed technologies to support a system that will provide precision targeting and weapon delivery in adverse weather for time critical missions. Integrated sensor platform UAV. Demonstrated sensor on a UAV with relative targeting against a fixed target.

	FY 2005	FY 2006
MARINE MAMMAL RESEARCH PROGRAM	0	1,000

This effort supports the Marine Mammal Research Program.

	FY 2005	FY 2006
MDETEC	0	1,000

This effort supports MDETEC research.

	FY 2005	FY 2006
MILLIMETER/TERAHERTZ IMAGING ARRAYS	2,026	3,600

FY 2005 - This effort developed technology to realize simultaneous infrared (IR) and millimeter wave (MMW) imaging capabilities through a common aperture and to fuse IR and MMW imagery for all-weather and high resolution imaging.

FY 2006 - This effort supports millimeter/terahertz imaging arrays research.

	FY 2005	FY 2006
MOBILE ON-SCENE SENSOR AIRCRAFT C4I CENTER	963	0

This effort developed the technology for a mobile forward C4I deployed center that can receive imagery from an airborne sensor and executing command and control over that sensor.

BUDGET ACTIVITY: 02
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	FY 2005	FY 2006
MULTI-SENSOR HYPERSPECTRAL SYSTEM FOR DAY/NIGHT RECONNAISSANCE	0	2,600

This effort supports multi-sensor hyperspectral system for day/night reconnaissance research.

	FY 2005	FY 2006
NAVY SECURITY AUTOMATION AND FUTURE ELECTRO-ROBOTS	0	1,000

This effort supports Navy security automation and future electro-robots research.

	FY 2005	FY 2006
OBLIQUE ANGLE HYPERSPECTRAL IMAGE FUSION	0	1,650

This effort supports oblique angle hyperspectral image fusion research.

	FY 2005	FY 2006
RETROREFLECTING OPTICAL COMMUNICATIONS FOR SPECIAL OPERATIONS	1,928	1,000

FY 2005 - This effort increased retro reflector data rate to 10-50 Megabits per second. This effort developed a micro electronic mechanical system (MEMS) optical mirror, steered laser interrogator on a small tactical UAV and interrogate a 50 Mbps retro-reflector on an unattended ground sensor.

FY 2006 - This effort supports retroreflecting optical communications for special operations research.

	FY 2005	FY 2006
SILVER FOX UNMANNED AERIAL VEHICLE (UAV)	2,413	1,750

FY 2005 - This effort integrated the latest sensor and data link technologies into the Silver Fox UAV. The work expanded the operational use of Silver Fox into the maritime environment.

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FY 2006 - This effort supports the Silverfox UAV.

	FY 2005	FY 2006
SPECTRAL BEAM COMBINING FIBER LASERS	0	1,000

This effort supports spectral beam combining fiber lasers research.

	FY 2005	FY 2006
THERMAL MANAGEMENT SYSTEMS FOR HIGH DENSITY ELECTRONICS	5,787	5,600

FY 2005 - This effort evaluated and demonstrated advanced cooling techniques for military processing systems. The work used the advanced cooling techniques that were developed and refined the techniques to work within the space, weight, and durability requirements of mobile electronics.

FY 2006 - This effort supports thermal management systems for high density electronics research.

	FY 2005	FY 2006
ULTRA HD PROJECTION DISPLAY	0	1,500

This effort supports ultra HD projection display research.

	FY 2005	FY 2006
UNATTENDED IMAGING SENSOR NETWORK (UISN)	963	0

The Unattended Imaging Sensor Network (UISN) developed a low probability of intercept (LPOI) unattended imagery node network used by Special Operations Forces (SOF) for surveillance and force protection missions.

	FY 2005	FY 2006
WORK FLOW ENGINE FOR OFF-LINE IMAGERY	0	1,000

This effort supports work flow engine for off-line imagery research.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602114N PROGRAM ELEMENT TITLE: POWER PROJECTION APPLIED RESEARCH
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C. OTHER PROGRAM FUNDING SUMMARY:
NAVY RELATED RDT&E:
PE 0601152N (In-House Laboratory Independent Research)
PE 0601153N (Defense Research Sciences)
PE 0602123N (Force Protection Applied Research)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0602235N (Common Picture Applied Research)
PE 0603114N (Power Projection Advanced Technology)
PE 0603640M (USMC Advanced Technology Demonstration)
PE 0603790N (NATO Research and Development)

NON-NAVY RELATED RDT&E:
PE 0602303A (Missile Technology)
PE 0602618A (Ballistics Technology)
PE 0602624A (Weapons and Munitions Technology)
PE 0603004A (Weapons and Munitions Advanced Technology)
PE 0602702E (Tactical Technology)
PE 0603739E (Advanced Electronics Technologies)
PE 0603763E (Marine Technology)
PE 0602203F (Aerospace Propulsion)
PE 0602601F (Space Technology)
PE 0602602F (Conventional Munitions)
PE 0603216F (Aerospace Propulsion and Power Technology)

D. ACQUISITION STRATEGY:
Not applicable.