FY 2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2008
Exhibit R-2

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

COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
POWER PROJECTION APPLIED RESEARCH	112,088	106,667	79,913	79,343	110,523	154,034	173,054

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Jan 2007). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE supports both advanced technology research and near to mid-term transition opportunities. The advanced research focus is primarily on High Energy Lasers (HEL), Electromagnetic railgun development, advanced rocket propulsion, electro-optic/infrared (EO/IR) sensor technologies. The mid-term effort is focused on 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, Weapons of Mass Destruction (WMD), 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.

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

B. PROGRAM CHANGE SUMMARY:

	FY 2007	FY 2008	FY 2009
FY 2008/FY 2009 President's Budget Submission	114,071	83,419	82,781
Congressional Action	0	24,600	0
Congressional Undistributed Reductions/Rescissions	0	-713	0
Execution Adjustments	126	0	0
Federal Technology Transfer	-20	0	0
Program Adjustments	0	0	-2,486
Rate Adjustments	0	0	-382
SBIR Assessment	-2,089	-639	0
FY 2009 President's Budget Submission	112,088	106,667	79,913

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 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 environments). The metrics used to evaluate 6.2 programs are necessarily less precise than those used in 6.3 programs.

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

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.

FY 2009 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2008
Exhibit R-2a

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

COST: (Dollars in Thousands)

Project Number & Title	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate
POWER PROJECTION APPLIED RESEARCH	112,088	106,667	79,913	79,343	110,523	154,034	173,054

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 2007	FY 2008	FY 2009
WMD DETECTION	0	6,694	8,094

The Chief of Naval Operations (CNO) in the Navy Strategic Plan (NSP) has directed that the Navy be able to combat Weapons of Mass Destruction (WMD) at sea and ashore. This activity addresses the development of key technologies for standoff detection of WMD's and component nuclear materials on ships at sea. The program will develop and demonstrate technology for actively detecting fissile material and other weapons of mass destruction.

FY 2008 reflects the initiation of the WMD Detection Program. FY 2009 increase represents the ramping up of the program as continuing technological efforts evolve.

FY 2008 Plans:

- Initiate investigations into the use of Free Electron Laser (FEL) accelerator technologies for the detection of WMD's and nuclear components & materials. Conduct experiments to determine the ability of the FEL to perform remote detection of nuclear material on surfaces, and chemical biological agents in aerosol clouds.
- Initiate investigation into the feasibility of using particle beams (neutrons, gamma rays, muons, and others) to perform standoff detection of fissile material. Develop neutron and gamma ray detection technology to support the active interrogation of special nuclear materials.

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

- Initiate development of hand-held and portable radiation detector technology to support maritime interdiction operations.
- Initiate modeling and simulation efforts to determine the ability to use neutron activation analysis to locate smuggled nuclear weapons and material through underwater detection.

FY 2009 Plans:

- Initiate planning for a maritime demonstration of standoff detection of fissile materials. This effort will involve formation of a team comprised of DoD, interagency, and international partners to support the demonstration.
- Continue investigations into using FEL accelerator and optical beams for WMD and chembio agent detection.
- Continue investigation of using particle beams for standoff detection of special nuclear materials.
- Continue neutron and gamma ray detection technology development.
- Continue investigation of hand held and portable detector technology for maritime interdiction.
- Continue underwater detection technology development of smuggled nuclear weapons and materials.

	FY 2007	FY 2008	FY 2009
STRATEGIC SUSTAINMENT	13,380	6,661	0

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.

The reduction from FY 2007 through FY 2009 is due to the completion of Technology for the Sustainment of Strategic System (TSSS) in FY 2007 and Strategic System Infrastructure (SSI) in FY 2008.

FY 2007 Accomplishments:

- TSSS: Completed phase II.
- SSI: Continued Missile propulsion efforts by conducting larger scale non-eroding throat tests, chamber bottle tests, insulator tests, component compatibility tests and propellant hazard assessment. Continued Advanced Post Boost Control System (PBCS) Valve Technology and Materials program efforts. Goal is heavy wall testing simulating a very limited full scale Post Boost control system test. Continued Ordnance Initiation Technologies program. Completed the Missile Electronics Technologies program code development with final

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

Validation and Verification of the models with experimental radiation hard data and aging data. Completed Navigation sonar task with Laboratory and tank testing of the new technology transducer and hydrophones. Prototype hardware integrated aboard USNS WATERS to provide a Navigation Sonar System (NSS) test bed and evaluated at-sea in an operational environment.

FY 2008 Plans:

- SSI: Complete Missile propulsion efforts by conducting final testing. Complete 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. Complete Ordnance Initiation Technologies program by demonstrating and documenting new ordnance initiation technology that meets the requirements. Program completed.

	FY 2007	FY 2008	FY 2009
HIGH SPEED PROPULSION AND ADVANCED WEAPON TECHNOLOGIES	13,905	7,890	7,741

The high speed weapons work in this activity is focused on demonstrating propulsion and vehicle technologies for Mach3+ to Mach8 capable weapons. The solid rocket motor Integrated High Performance Rocket Propulsion Technology (IHPRPT) technology development activities will provide improved rocket based weapon performance. The rocket technologies apply to both air dominance and strike weapons and will provide both improved range and speed.

This work includes technologies associated with high acceleration capable projectile structures, high temperature and high strength materials to enable projectiles to survive high speed launch environment, improved thermal prediction methodologies and test techniques, wide dynamic pressure adaptable projectile controls and non-explosively launched lethal mechanisms. The high speed projectile technologies are intended to support long range Naval Fire Support weapons.

The decrease from FY 2007 to FY 2008 is due to the completion of the 6.2 portion of the National Aerospace Initiative (NAI) RATTLRS Hypersonic Turbine program.

FY 2007 Accomplishments:

- IHPRPT: Completed propellant formulation. Initiated demonstration of air-to-air system that uses new

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

energetic ingredient compositions to meet Phase III IHPRPT performance goals. Continued development of surface launch component technologies.
- NAI High Supersonic Turbine Vehicle (HSTV): Completed development of component/sub-system technologies for high supersonic turbine powered weapon systems. Conducted validation, ground testing and demonstrations.
- Asymmetric Threat Defense: Continued development of propulsion and high temperature materials technologies to enable high speed weapons. Continued demonstrating dual mode warhead effectiveness in both above and below water detonations.

FY 2008 Plans:

- IHPRPT: Continue FY 2007 efforts, less those noted as completed.
- Asymmetric Threat & Laser Control Technologies: Continue development of propulsion and high temperature materials technologies to enable high speed weapons. Continue demonstrating dual mode warhead effectiveness in both above and below water detonations.

FY 2009 Plans:

- IHPRPT: Complete program through demonstration of Solid Rocket Motor Phase III goals at the subsystem level.
- Asymmetric Threat & Laser Control Technologies: Initiate high speed projectile technology development. Initiate High Power Microwave (HPM) technology development.

	FY 2007	FY 2008	FY 2009
NAVIGATION, ELECTRO OPTIC/INFRARED (EO/IR), AND SENSOR TECHNOLOGIES	12,165	10,922	5,403

This activity describes Navy Science and Technology (S&T) investments in the areas of EO/IR devices and advanced sensors and includes NRL investment/performance in the technology areas of Electronics, Electronic Warfare, and Communications.

Change in funding from FY 2007 to FY 2008 is due to the transfer of the Navigation Technologies program to PE 0602271N under the RF Navigation Technology activity. Reduction in funding from FY 2008 to FY 2009 is a result of realigning efforts more appropriately budgeted under the Strike and Littoral Combat Activity in this PE.

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

FY 2007 Accomplishments:

- Navigation Technologies: Continued Rb Clock development and testing, Fiber Optic Ring Gyroscope development, Magnetic Passive reset for Inertial Navigation System (INS), and Advanced Global Positioning System (GPS)/INS systems for strike weapons. Initiated self-locked Intra-Cavity Alkali Vapor Laser (ICAL) opto-atomic clock project and Repeat spoofer detection and location project. Completed Network Centric Navigation (Link-16 Time Transfer), Distributed Time Standards, and Tightly Coupled GPS/INS/Loran efforts.
- EO/IR: Completed development of low cost piezoelectric motion and jitter compensation for high resolution visible and infrared sensors. Continued Millimeter Wave (MMW) and TeraHertz (THz) Imaging project. Completed development of ultra low noise uncooled nanotechnology infrared sensors and continued development nanoatomic sensor nonvolatile memories. Completed development of electronic liquid crystal based directional field of view and zoom imagers. Completed multi-sensor (visible, infrared, millimeter wavelength, terahertz and laser imagers) fusion for objection recognition effort.
- Electronics: Completed demonstration of high laser power through IR transmitting Hollow Core Photonic Band Gap (HC-PBG) fiber. Completed performance optimization and scaling law development for the Radiation Balanced Laser. (NRL)
- Electronic Warfare: Completed 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: Continued covert high bandwidth communications effort. Continued development of free space laser communications systems with the development of a hybrid infrared system with dramatically lower power requirements at the sensor/transmitter. Continued small hyperspectral sensor development. (NRL)
- Completed long-term demonstration of multiple sensor-equipped vehicles, covering autonomous sensing operation and multiple replenishment/relocation cycles under autonomous or semi-autonomous control. (NRL)
- Completed development of small autonomous mobile expendable Electronic Warfare (EW) vehicles that can replenish their energy supply. Selected multi-mode locomotion method and energy harvesting technique and constructed and demonstrated vehicles. (NRL)
- Continued development of Micro Air Vehicle (MAV). (NRL)
- Autonomous Systems: Continued development of near optimal trajectory planners to enhance the capabilities of Unmanned Aerial Vehicles (UAVs) and other distributed autonomous systems. (NRL)

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

FY 2008 Plans:

- Navigation Technologies: Program funded in PE 0602271N under the RF Navigation Technology activity.
- EO/IR: Continue MMW and THz Imaging effort, development of ultra low noise uncooled nanotechnology infrared sensors, and development of electronic field of view and zoom imagers. Continue development of new processes/methodologies to enable construction of composite countermeasures that fit the engagement timeline while maintaining effectiveness against existing and emerging IR guided threats (NRL). Continue the development of an active optics system that can survey a wide area and instantly, non-mechanically zoom-in on an area of interest for target tracking/identification (NRL).
- Communications: Complete small hyperspectral sensor development (NRL).
- Autonomous Systems: Continue development of near optimal trajectory planners to enhance the capabilities of UAVs and other distributed autonomous systems (NRL). Continue design and development of a disposable MAV which will enable the airborne delivery and precision placement of miniature EW sensors and payloads (NRL). Continue the design of an advanced auto gyrator that combines a swashplateless rotor system and active stability augmentation for autonomous systems (NRL).
- Complete development of a compact, efficient heavy fuel engine for UAVs (NRL).
- Initiate the development of a novel beam steering method in phased array radar using optical fiber based slow light techniques. (NRL)
- Initiate the development of machine-vision algorithms and guidance strategies to enable the precision autonomous recovery of small sensor platforms on moving naval vessels. (NRL)
- Initiate the development of an autonomous soaring capability and intelligent path planning for extracting energy from the environment thereby conserving onboard fuel stores of autonomous air vehicles. (NRL)
- Initiate development of high power fiber lasers in mid-IR (2-5 μm) based upon highly nonlinear IR transmitting chalcogenide photonic crystal fibers. (NRL)

FY 2009 Plans:

- EO/IR: Continue development of ultra low noise uncooled nanotechnology infrared sensors. Continue development of electronic field of view and zoom imagers. Complete THz Imaging project through transition to 6.3 development. Continue the development of an active optics system that can survey a wide area and instantly, non-mechanically zoom-in on an area of interest for target tracking/identification. Continue development of new processes/methodologies to enable construction of composite countermeasures that fit the engagement timeline while maintaining effectiveness against existing and emerging IR guided threats (NRL).
- Autonomous Systems: Complete development of near optimal trajectory planners to enhance the capabilities of

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

UAVs and other distributed autonomous systems (NRL). Complete design and development of a disposable MAV which will enable the airborne delivery and precision placement of miniature EW sensors and payloads (NRL). Complete the design of an advanced auto gyrator that combines a swashplateless rotor system and active stability augmentation for autonomous systems (NRL).
- Continue the development of a novel beam steering method in phased array radar using optical fiber based slow light techniques. (NRL)
- Continue the development of machine-vision algorithms and guidance strategies to enable the precision autonomous recovery of small sensor platforms on moving naval vessels. (NRL)
- Continue the development of an autonomous soaring capability and intelligent path planning for extracting energy from the environment thereby conserving onboard fuel stores of autonomous air vehicles. (NRL)
- Continue development of high power fiber lasers in mid-IR (2-5 µm) based upon highly nonlinear IR transmitting chalcogenide photonic crystal fibers. (NRL)

	FY 2007	FY 2008	FY 2009
DIRECTED ENERGY AND EM GUNS (FORMERLY ELECTRIC WEAPONS)	30,414	42,006	48,227

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 defensive 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.

The increase from FY 2007 through 2009 is due to a larger investment in advance technology component development and testing required as the FEL program progresses to the higher power weapons-level outputs.

FY 2007 Accomplishments:

- DE: Completed gun performance tests. Completed 750 MHz Cryounit integration and low power characterization. FEL development task, completed cryomodule design. Continued cryomodule construction. Continued 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. Continued 1 micron filamentation, halo limitation, and short Rayleigh range studies. Continued lethality testing and optical propagation studies. Continued testing of Radio Frequency (RF) gun High Voltage Power

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

Supply (HVPS) components which are required for the 100 kW high current injector.
- EM Gun: Completed preliminary designs of 32MJ muzzle energy electromagnetic demonstration launchers and began detailed design with industry partners in preparation for fabrication (FY08/09) and demonstration (FY10). Continued 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. Finalized projectile conceptual designs from two industry vendors and began projectile preliminary design. Initiated conceptual design of rotating machine pulsed power. Continued Integrated Product Team (IPT) collaborations between industry, Navy and the Army Electromagnetic Launch program to ensure consistent, non-duplicative technology maturity activities.
- Continued investigation of surface treatments such as advanced coatings or "MAX-phase" materials to harden the rails in electromagnetic railguns. (NRL)
- Continued development of designs for viable novel electric weapon architectures that enhance performance and maintainability. (NRL)

FY 2008 Plans:

- DE: Continue cryomodule and FEL component development at the FEL testing and integration facility. Initiate investigations of high power microwave sources, fiber lasers, and beam control technologies for target detection, acquisition, tracking, aimpoint maintenance of DE systems for ship and air target engagements. Initiate development of high power optical and amplifier components for high power weapons level lasers. Initiate aero-optical mitigation techniques for DE applications.
- EM Gun: Continue material, physics and thermal property research for both launchers and projectiles. Continue launcher and projectile component investigations and preliminary development, lethality studies and preliminary design for projectile, Bore Life Launcher component testing, IPT and bore life consortium collaborations between industry, Navy and the Army electromagnetic launch program. Complete preliminary design of the electromagnetic demonstration launchers with industry partners. Initiate preliminary designs of pulse power systems and begin examination of system interface with ship integration.
- Complete investigation of surface treatments such as advanced coatings or "MAX-phase" materials to harden the rails in electromagnetic railguns. (NRL)
- Complete development of designs for viable novel electric weapon architectures that enhance performance and maintainability. (NRL)

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

FY 2009 Plans:

- DE: Continue cryomodule and FEL component development and investigations of fiber lasers, high power microwave sources, and high power weapons-level component development.
- EM Gun: Continue material, physics and thermal property research for both launchers and projectiles. Continue launcher and projectile development. Continue preliminary design and lethality studies of projectile, design of next generation pulse power systems, IPT and Bore Life Consortium collaborations. Initiate development of modeling and simulation capability to support bore life development and testing.

	FY 2007	FY 2008	FY 2009
STRIKE AND LITTORAL COMBAT TECHNOLOGIES	8,253	8,051	10,448

The focus of this activity 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.

The net increase in funding between FY 2008 and FY 2009 is due to the realignment of efforts from the Navigation EO/IR activity and the planned reduction of funding for FNC efforts in this activity.

FY 2007 Accomplishments:

- Marine and UxV Tactical ISR (MUTI): Initiated and completed effort to develop improved radar that provided real-time tactical targeting and improved sensor processing which provided improved access to available ISR products. Specific tasks included: 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): Initiated effort to develop the capability to improve the processing of dynamic targets from 100 to 400 targets per day. It improved UAV performance in the areas of increased endurance and support for more autonomous operations. Specific tasks included the development of: decision support algorithms for dynamic target engagement, remote sensor fusion hardware for ground sensors, an ultra endurance UAV, and a GMTI sensor for use on UAVs. (formerly funded in PE's 0602235N, 0603640M, and 0603114N)
- Hostile Fire Detection and Response Spiral 1 (HFDR): Completed effort to develop technologies for hostile fire detection and active response capabilities that increased individual Marine and tactical level unit

survivability and mobility. Specific efforts included: advanced ammo packaging, 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): Completed 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 included: 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)
- Completed W-band decoy development with a demonstration of active Electronic Counter-Measures (ECM) techniques. (NRL)
- Completed the development of improved processing algorithms by incorporating algorithmic tools into existing Synthetic Aperture Radar (SAR) system for testing. (NRL)
- Continued Image-While-Scan (IWS) technology development. (NRL)
- Continued genetic algorithm selection process for communication jamming. (NRL)
- Initiated development of passive interferometric imaging system to detect millimeter wave RF anomalies within the background environment by using exotic signal processing techniques. (NRL)

FY 2008 Plans:

- Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets: Initiate development of Weapons Data Link terminal to improve in-flight control of weapons in real time. Initial work will focus on research to improve RF amplification at high bandwidths and low-observable, high gain weapon mounted antennas.
- Dynamic Target Engagement: Continue development of Decision Support System for dynamic target engagement.
- Increased Capability Against Moving and Stationary Targets: Initiate development of Direct Attack Seeker Head (DASH) by developing low cost multi-passive array technology using Imaging Infrared (IIR) and millimeter Wave (mmW) in a common aperture architecture. Initiate development of Multi-Mode Sensor/Seeker (MMSS) technology development to develop advanced signal processing techniques to classify and identify moving targets using Automatic Target Recognition (ATR).
- Continue development of passive interferometric imaging system to detect millimeter wave RF anomalies within the background environment by using exotic signal processing techniques. (NRL)
- Complete IWS technology development. (NRL)
- Complete genetic algorithm selection process for communication jamming. (NRL)
- Initiate the development of signal processing techniques to improve situational awareness and autonomous

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

detection of hostile fire events in a dynamic urban clutter environment. (NRL)
- Initiate the development of techniques to combine current IR/EO technology and recent findings on the characteristics of the eye to classify and identify optical devices and individuals in real time at militarily significant ranges. (NRL)
- Initiate the development of a process to detect hostile camouflaged or hidden targets in shadows and diverse backgrounds of militarily challenging environments. (NRL)

FY 2009 Plans:

- Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets: Continue development of Weapons Data Link terminal toward weapon scalability and modularity.
- Dynamic Target Engagement: Complete development of Decision Support System for dynamic target engagement.
- Increased Capability Against Moving and Stationary Targets: Complete the mmW component design for the DASH multi-sensor weapon seeker and begin the mmW sensor fabrication and testing. In conjunction with building the sensor suite of the Multi-mode Sensor/Seeker, continue development of advanced signal processing techniques, which will classify and identify moving targets using ATR.
- Enhanced Weapons Technologies: Initiate three new products to expand current Counter Air / Counter Air Defense capabilities by providing improved range and end-game maneuverability while decreasing Time-of-Flight. Specific tasks to begin design and development phase are: Counter Air Advanced Medium-Range Air-to-Air Missile (AMRAAM) Improvements / Counter Air Defense Improvement / High Speed Components.
- Initiate development and apply emerging technologies that support delivery of Technology Oversight Group approved FNC enabling capabilities structured to close operational capability gaps in power projection; package emerging power projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period; and mature power projection technologies that support naval requirements identified within the Sea Strike and FORCEnet naval capability pillars.
- Continue development of passive interferometric imaging system to detect millimeter wave RF anomalies within the background environment by using exotic signal processing techniques. (NRL)
- Continue the development of signal processing techniques to improve situational awareness and autonomous detection of hostile fire events in a dynamic urban clutter environment.
- Continue the development of techniques to combine current IR/EO technology and recent findings on the characteristics of the eye to classify and identify optical devices and individuals in real time at militarily significant ranges. (NRL)
- Continue the development of a process to detect hostile camouflaged or hidden targets in shadows and diverse backgrounds of militarily challenging environments. (NRL)

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

CONGRESSIONAL PLUS-UPS:

	FY 2007	FY 2008
ADVANCED PROPULSION FOR GUN LAUNCHED PROJECTILES AND MISSILES	0	796

This effort will develop advanced propulsion technologies to be used to improve the performance of gun launched projectiles and missiles.

	FY 2007	FY 2008
AGING EVALUATION OF ADVANCED MATERIALS USED FOR MILITARY AIRCRAFT	0	1,192

This effort will develop aging evaluation technologies for analysis of the advanced materials which are used in military aircraft.

	FY 2007	FY 2008
CLUSTERED MILLIMETER WAVE IMAGING SENSORS & MANUFACTURING	0	1,589

This effort will develop clustered millimeter wave imaging sensors and the manufacturing technologies required to produce those sensors.

	FY 2007	FY 2008
COMBUSTION LIGHT GAS GUN PROJECTILE	3,985	3,179

FY 2007: This effort facilitated continued development of the 155 mm Combustion Light Gas Gun. Initiated test firings of the 155 mm system with a cryogenic feed system. Performed active analysis of the aeroballistics of the projectile.

FY 2008: This effort will support combustion light gas gun projectile research.

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

	FY 2007	FY 2008
COMPUTATIONAL DESIGN TOOLS FOR HIGH POWER SOURCES FOR DIRECTED ENERGY APPLICATIONS	996	0

This effort supported the application of a 3 dimensional design tool to model a charge particle beam of the type used in a Free Electron Laser (FEL).

	FY 2007	FY 2008
DEVELOPMENT PROCESSES FOR FULL SCALE PRODUCTION OF SILICON CARBIDE WAFERS	1,445	0

This effort developed processes for competitive commercial production of Silicon Carbide semiconductor substrates for use in high power electronics device applications such as DOD's electric vehicles, electromagnetic (EM) rail gun and EM aircraft launch systems.

	FY 2007	FY 2008
DEVICE INTEGRATION OF WIDE BAND GAP SEMICONDUCTORS AND MULTIFUNCTIONAL OXIDES	2,192	0

This effort supported the monolithic integration of multi-functional oxide devices with wide band gap semiconductor high power amplifiers in defense radar-microwave devices.

	FY 2007	FY 2008
ELECTRONIC MOTION ACTUATION SYSTEMS	2,192	0

This effort supported electronic motion actuation systems research by extending knowledge from work previously performed on 20,000 in-lb, three position ball valve actuators and 20,000 in-lb two position ball valve actuators for submarine applications. An additional focus was the development of a full scale controller to be used with a full scale control surface actuator.

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

	FY 2007	FY 2008
H-264 VIDEO COMPRESSION	996	0

This effort supported the application of H.264 video compression for high speed data compression.

	FY 2007	FY 2008
HALOH ENGINE	1,296	0

This effort designed, developed and experimentally validated virtual testing modeling and simulation software for the analysis of hybrid solid/liquid rocket engines.

	FY 2007	FY 2008
HIGH ENERGY CONVENTIONAL ENERGETICS (PHASE ONE)	0	4,969

This effort will develop high energy conventional energetics for use in advanced Naval weapons.

	FY 2007	FY 2008
HIGH ENERGY DENSITY CAPACITORS FOR MILITARY APPLICATIONS	2,491	0

This effort supported high energy density capacitors for military applications.

	FY 2007	FY 2008
HIGH ENERGY SUPERIOR BATTERY TECHNOLOGY FOR DEFENSE APPLICATIONS	996	0

This effort developed high energy battery technology for Navy aircraft applications.

	FY 2007	FY 2008
HIGH PERFORMANCE ALLOY MATERIALS, STEEL CASTINGS	0	1,987

This effort will develop high performance alloy materials and steel castings for use in Naval applications.

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

	FY 2007	FY 2008
HIGH PERFORMANCE FREQUENCY MODULATED (FM) FIBEROPTIC LINK	1,096	0

This effort designed and characterized a wideband optical RF down conversion using mach-zender optical modulator and optical phased locked loop.

	FY 2007	FY 2008
HIGH POWER FREE ELECTRON LASER (FEL) DEVELOPMENT FOR NAVAL APPLICATIONS	0	1,987

This effort will develop advanced high power components that will be used to improve the operation and performance of FEL when used in Naval applications.

	FY 2007	FY 2008
MARINE MAMMAL HEARING AND ECHOLOCATION RESEARCH	1,494	0

This effort supported research for the hearing of marine mammals, including special hearing and acoustic signal processing adaptations for biological sonar (echolocation).

	FY 2007	FY 2008
MARINE MAMMALS - EFFECTS OF SOUND	0	796

This effort will study the effect of various sounds on multiple types of Marine mammals.

	FY 2007	FY 2008
MILLIMETER TERAHERTZ IMAGING ARRAYS	1,245	0

This effort developed enhanced capabilities for optically based millimeter-wave distributed aperture imaging.

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

	FY 2007	FY 2008
MODULAR PAYLOAD SYSTEMS	0	1,987

This effort will develop modular payload systems for use in Naval applications.

	FY 2007	FY 2008
MULTI-SENSOR HYPERSPECTRAL SYSTEM FOR DAY/NIGHT RECONAISSANCE	3,587	0

This effort continued development and delivery of compact hyperspectral sensor hardware for day and night operation, light-weight hyperspectral processing hardware, and real-time hyperspectral data processing software. This program supported the Intelligence, Surveillance, and Reconnaissance mission.

	FY 2007	FY 2008
MULTIFUNCTIONAL OXIDE MATERIALS APPLICATIONS AND DEVICES	996	0

This effort investigated deposition and improved the crystal quality of thin crystalline films of complex oxides for application in defense radar-microwave devices.

	FY 2007	FY 2008
MULTIFUNCTIONAL OXIDE MATERIALS APPLICATIONS AND DEVICES (MFMA)	996	1,987

FY 2007: This effort investigated deposition and improved the crystal quality of thin crystalline films.

FY 2008: This effort will continue development of complex oxides for application in defense radar-microwave devices.

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

	FY 2007	FY 2008
RETROREFLECTING OPTICAL COMMUNICATIONS FOR SPECIAL OPERATIONS	2,989	0

This effort developed and built a set of compact lasercomm terminals capable of direct and retro-reflecting mode optical links. The control software for these terminals was enhanced to allow more autonomous operation which will enable net centric warfare by providing high bandwidth (Mbps-Gbps) LPI/LPD/AJ links between platforms.

	FY 2007	FY 2008
STRIKE WEAPON PROPULSION (SWEAP)	0	1,987

This effort will develop advanced propulsion technologies for use in precision strike weapons.

	FY 2007	FY 2008
THERMAL MANAGEMENT SYSTEMS FOR HIGH DENSITY ELECTRONICS	4,979	0

This effort supported thermal management systems for high density electronics.

	FY 2007	FY 2008
UNMANNED AERIAL VEHICLE FUEL CELL POWER SOURCE	0	1,987

This effort will develop unique fuel cell power sources for use in Unmanned Aerial Vehicles.

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 (ATD)
PE 0603790N NATO Research and Development

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

OTHER PROGRAM FUNDING SUMMARY - 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 0602203F Aerospace Propulsion
PE 0602601F Space Technology
PE 0602602F Conventional Munitions
PE 0603216F Aerospace Propulsion and Power Technology

D. ACQUISITION STRATEGY:

Not Applicable.