FY 2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2004
Exhibit R-2

BA: 02 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

COST: (Dollars in Thousands)

Project Number & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Power Projection Applied Research	110,232	142,626	98,831	89,335	81,799	63,367	64,558

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) addresses the technology issues involving the Navy's capability to project Naval power on the broad seas and in the littoral regions. In particular, the technology developed in this PE will support Navy power projection requirements related to fleet defense and protection of Naval assets in the littoral area, Naval strike operations against critical shore targets, and support for Naval expeditionary forces ashore. This PE supports the Time Critical Strike (TCS) Future Naval Capability (FNC) and the Autonomous Operations (AO) FNC. 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.

NOTE: This PE previously divided the program into 3 primary mission areas: Fleet Defense & Air Dominance, Naval Precision Strike, and Support for Naval Expeditionary Forces Ashore. Many of the technologies developed in this PE applied to more than one and in some cases all 3 mission areas. For example unmanned vehicle technologies are applicable to all 3 areas. Therefore, in order to provide a clearer picture and a more logical description of the program, it was decided to restructure the PE into the following technology areas: Strategic Sustainment, High Speed Propulsion and Advanced Weapon Technologies, Unmanned Vehicles, Navigation EO/IR and Sensor Technologies, Electric Weapons, and Strike Technologies. To enable to reader to track individual projects, each of the new sections contain a mapping of where the individual efforts were located in the previous submission.

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

BA: 02 PROGRAM ELEMENT: 0602114N
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PROGRAM CHANGE SUMMARY:

	FY 2003	FY 2004	FY 2005
FY 2004-2005 President's Budget Submission	105,324	114,144	107,260
Cong. Rescissions/Adjustments/Undist.Reductions	0	-1,614	0
Congressional Actions	0	30,100	0
Execution Adjustments	4,820	0	0
Inflation Savings	812	0	-352
Joint Non-Lethal Weapons Program	0	0	2,000
Rate Adjustments	0	-4	-77
SBIR Assessment	-724	0	0
Technical Adjustments	0	0	-10,000
FY 2005 President's Budget Submission	110,232	142,626	98,831

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not Applicable.

Schedule: Not Applicable.

FY 2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2004

Exhibit R-2a

BA: 02 PROGRAM ELEMENT: 0602114N PROGRAM ELEMENT TITLE: Power Projection Applied Research

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COST: (Dollars in Thousands)

Project Number & Title	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Power Projection Applied Research	110,232	142,626	98,831	89,335	81,799	63,367	64,558

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 2003	FY 2004	FY 2005
Strategic Sustainment	9,988	23,149	31,160

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. Funding increases beginning in 2004 are due to the addition of the tasks for the SSI effort.

In the prior R2 submission for this Program Element (PE), the tasks in this new activity were contained in the Naval Precision Strike Operations activity.

FY 2003 Accomplishments:

- TSSS program: Upgraded and linked RAD HARD codes and evaluated the software. The SRM effort performed code validation with legacy models and preliminary verification on new models. Developed a first order Computational Fluid Dynamics (CFD) model in drag reduction.

FY 2004 Plans:

- TSSS: RAD HARD task will continue efforts in upgrading and linking software. The SRM ignition response

effort will perform advanced nonlinear model comparisons with ground test data. Drag Reduction Devices will develop an advanced aerospike drag reduction model. The accelerometer effort will fabricate a Proof of Concept Superconducting and Atom Interferometer and Gravity Gradient Sensor.
- SSI: Initiate formulation of high performance propellants, development of the preliminary design and parametric testing for a Post Boost Control System (PBCS). Perform preliminary design of an Exploding Bridgewire (EBW) detonator and conduct evaluation of test data of the effects of the external environment on missile electronics. Begin transition of ONR's advanced transducer design and develop a new hydrophone array.

FY 2005 Plans:

- TSSS: RAD HARD System Design Tool task completes. The SRM ignition response effort completes code validation and verification with flight test data. The Drag Reduction Devices task completes the development of an aero elasticity tool for performance prediction of missiles with drag reduction devices. Gravity Gradient Sensors and a new technology accelerometer for the Fiber Optic Gyro Navigator (FOGN) unit will be tested.
- SSI: Missile propulsion effort continues with subscale static motor tests. PBCS will develop thermal/mechanical valve and flow impingement models. Ordnance Initiation technology effort will conduct design reviews and purchase prototype systems for evaluation. Missile electronics will continue the model development. Navigation Sonar will initiate development of a common electronics architecture to accommodate affordable hardware.

	FY 2003	FY 2004	FY 2005
High Speed Propulsion and Advanced Weapon Technologies	31,919	16,884	30,034

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.

Funding drop from FY03 to FY04 was due to the end of one year programs that were not funded in FY04. The increase from FY04 to FY05 was due to increased funding for the National Aerospace Initiative (NAI) hypersonics effort (+12M) and additional funding in HyFly in FY05 (+4M).

In the prior R2 submission for this PE, the following tasks were previously described in the Fleet Defense & Air Dominance activity: Asymmetric Threat Defense weapons, Advanced Reactive Materials, and the Integrated High Performance Rocket Propulsion Technology (IHPRPT). These tasks were in Naval Precision Strike Operations activity: HyFly, Ordnance for High Speed Penetration, Precise Tactical Targeting (PTT), Weapons Supersonic

Airframe Control, Advanced Reactive Weapons for Hard and Deeply Buried Targets (HDBT), Configurable Automatic Target Recognition (ATR), Microelectromechanical System (MEMS) antenna, Intelligence Surveillance and Reconnaissance (ISR) targeting, and the High Supersonic Turbine Vehicle (HSVT) Technology Base. The High Energy Density Materials (HEDM) task was in the Support for Naval Expeditionary Forces Ashore activity.

FY 2003 Accomplishments:

- Advanced Reactive Material: A one year program that completed development of advanced reactive material compositions for warhead fragments that combine both kinetic and chemical energy.
- Ordnance Systems for High Speed Penetration: A one year program that developed advanced fuze, warhead and structural components for strike weapons that are used to attack high value, deeply buried targets.
- Advanced Reactive Weapons for Hard and Deeply Buried Targets (HDBT): A one year program that developed and examined alternate methods of production for advanced energetic materials that provide high levels of exothermic energy.
- Weapons Program Supersonic Airframe Control: Completed with a ground test to demonstrate an integrated control concept extendable into the hypersonic speed regime.
- PTT: Completed with ground and aircraft testing.
- HEDM: Completed with performance evaluation of HEDM candidates; continued fabrication and testing of HEDM structural composites.
- HyFly National Aerospace Initiative (HyFly NAI): Continued development of a lightweight Dual Combustion Ramjet (DCR) concept Mach 5+ vehicle and demonstrated full-scale combustion control.
- IHPRPT: Continued with full scale testing of an aluminized boost propellant and investigation of propellant ingredient and formulations.
- Asymmetric Threat Defense: Initiated concept definition and preliminary design of the weapons control, launcher, ordnance, and guidance/seeker components of the weapons system required to counter the asymmetric (swarming, small boat) threat to ships in the littorals.

FY 2004 Plans:

- HyFly: Continue air vehicle and fuel system testing and validation of the operational flight program software using hardware in-the-loop testing.
- IHPRPT: Continue development of surface launch component technologies.
- Asymmetric Threat Defense: Continue subsystem design and development of detection/tracking algorithms and components for the Ship-Linked Interceptor (SLI) and Laser Annointed Interceptor (LAI) including the Inertial Measurement Unit (IMU), warhead, fuzing, explosive, control actuators, and signal processing algorithms.
- National Aerospace Initiative High Supersonic Turbine Vehicle (NAI HSTV) technology base: Program supports

the development of high-supersonic turbine engine and airframe technologies for expendable weapons applications. Initiate flow path and turbine engine component development and demonstration effort to increase the performance of inlet and nozzles, high temperature compressor and turbine.

FY 2005 Plans:

- IHPRPT: Continue surface launch component development and begin initial design for the air launched demonstration effort.
- Asymmetric Threat Defense: Continue development of detection and continuous target tracking algorithms. Continue design and fabrication of the SLI and LAI.
- NAI HSTV: Continue development and validation of flow path and turbine engine components and continue component rig testing. Begin design and fabrication of airframe components and assessment of thermal management techniques.
- Non-Leathal Weapons: Initiate a program for research, study, assessment, and demonstration of technologies that could provide a non-lethal capability or target effect. Initial effort will examine non-lethal target effects/characterization of technologies spanning the non-lethal taxonomy.

	FY 2003	FY 2004	FY 2005
Unmanned Vehicles	15,280	14,548	11,354

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.

In the prior R2 submission for this PE, the UAV advanced technology and UAV radar systems tasks were in the Naval Precision Strike Operations activity. The Micro UAV sensors, UUV sensors and control task, UAV propulsion and power technology, IA, and the UGV development tasks were in the Support for Naval Expeditionary Forces Ashore activity.

FY 2003 Accomplishments:

- UAV sensor: Completed with demonstration of a magnetic sensor to be made available for Micro UAV applications.
- IA: Continued developing and testing technologies for UV dynamic replanning, autonomous vehicle control,

alert management, maritime situation awareness, and multi-vehicle distributed cooperation.
- UUV: Continued development of deployed Intelligence, Surveillance and Reconnaissance (ISR) electro-magnetic and electro-optic (EM/EO) sensors, software, and integrated autonomous control approaches for Maritime Reconnaissance (MR) mission capabilities.
- UAV control: Continued development of a single frequency, multi-UAV imaging operations capability. Developed single operator command, control and information display for multiple UAVs. Began installation of Firescout UAV, and completed UAV see and avoid demonstration.
- UGV: Completed Phase I of the technology development and preliminary design phase, completed critical design reviews and down selected to two contractors.
- UAV propulsion: Continued component design, fabrication and component rig testing of UAV propulsion components and began design and fabrication of the Mach 3.5 capable missile demonstrator engine.
- UAV radar: Continued with field and lab tests of the system.

FY 2004 Plans:

- UAV radar: Completes by performing airborne testing using a Piper Aztec as a surrogate platform.
- IA: Continue development of dynamic replanning and autonomous control and operations technologies. Complete UAV/UGV reconnaissance demonstration jointly with Defense Advance Research Projects Agency (DARPA), and in-water maritime situation awareness demonstration.
- UUV: Continue development of EM/EO sensors, software, sensor data fusion, integrated autonomous control approaches for MR, and multi-vehicle Undersea Search and Surveillance (USS) and communication link development.
- UAV control: Continue testing of threat detection/collision avoidance software and the development of secure jam resistant communications and multiple UAV information displays.
- UGV: Continue development of robotic communication technologies in support of the Marine Corps Gladiator Tactical Unmanned Ground Vehicle (TUGV) program and transition them to the Marine Corps for System Design and Development (SDD).
- UAV propulsion: Continue development fabrication and rig testing of Navy UAV propulsion component technologies under the Integrated High Performance Turbine Engine technology (IHPTET) program, including the advanced PW-800 commercial gas generator core and the XTL-17 supersonic missile engine.
- Autonomous Mobile Platform (AMP): Initiate effort to create small sensor platforms capable of extended endurance. Develop propulsion/energy storage/replenishment, navigation/guidance systems, and locomotion technologies.

FY 2005 Plans:

-IA: Continue development of dynamic replanning and autonomous control technologies. Conduct simulation demonstration of multi-vehicle distributed cooperative control jointly with Air Force for ISR and strike missions.
- UUV: Continue development and transition of UUV-deployed ISR EM/EO sensors and software, multi-vehicle USS and communication link development.
- UAV control: Continue development of command, control and displays for multiple UAVs, and single frequency multi-point UAV communications.
- UAV propulsion: Ground test demonstrator engine and a Mach 3.5 capable expendable turbine engine.
- AMP: Integrate energy replenishment and storage with a mobile platform and demonstrate replenishment and relocation operation.

	FY 2003	FY 2004	FY 2005
Navigation, Electro Optic/Infrared (EO/IR), and Sensor Technologies	10,298	13,259	12,283

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

In the prior R2 submission for this PE, the Advanced Imaging Seeker Countermeasures, low cost EO/IR airborne sensor tasks were located in the Fleet Defense & Air Dominance activity. The Network Centric Navigation Task, GPS and Navigation Device threat analysis, Network centric task, and Controlled Radiation Pattern Antenna (CRPA) isolation improvement tasks were in the Naval Precision Strike Operations activity.

FY 2003 Accomplishments:

- Smart Sensor Network: Completed linking of sensors into a grid to demonstrate different sensor packages observing and tracking targets in urban environments.
- Relative Navigation: Completed latency assessment task for GPS and Link 16; completed the high precision light source FOG task by developing the alternative laser design of the FOG system now in the acquisition process; and completed the Geophysical Low Observable Bathymetric Estimator (GLOBE) which is awaiting SP-24 implementation.

- Long Wave Infrared (LWIR) fiber: Completed production of fiber transmitting at wavelengths of 8-12 um, with a 100 micron diameter core, in lengths greater than 100 m, and having strength greater than 100 kpsi.
- Multispectral Infrared Focal Plane Array (IRFPA): Completed program by demonstrating via simulation the advantages of three-color IRFPAs for mid-course interceptors for missile defense. Initiated development of low-cost EO/IR sensors.
- Distributed Time Standards: Continued effort and associated Time Scaling algorithms, the Network Centric Navigation task by determining the latency of representative networks, and the Rb Double Bubble Maser Atomic Clock effort.
- Initiated three projects: the tightly-Coupled GPS/INS (Inertial Navigation System) to improve GPS receiver jamming immunity, Distributed Time Scale algorithm development to increase temporal precision in networks, and the CRPA element coupling reduction project.

FY 2004 Plans:

- Tightly coupled GPS/INS: Complete zero-age ephemeris and CRPA mutual coupling reduction projects.
- Multispectral IRFPA: Complete demonstration of two color longwave focal plane based algorithms for missile defense.
- Continue development of high-performance, low-cost EO/IR airborne surveillance sensors for unmanned aerial vehicles, and ultra-high performance EO/IR Imagers. Continue work to develop auto-target identification techniques for Laser Range-gated imagers.
- Distributed Time Standards, Rb Double Bubble Maser Atomic Clock, algorithm development for Distributed Time Scaling: Continue FY03 work.
- Network Centric Navigation: Continue FY03 effort by assessing the time synchronization and precision time transfer.
- Advanced Imaging and the Seeker Countermeasure (AISCM): Initiate effort to develop imaging infrared countermeasures (IRCM) against imaging missiles using a unique state of the art hybrid approach. Implement preprocessing and track algorithms into imaging surrogates.
- Millimeter Wave (MMW) threat detection: Initiate effort to develop preliminary hardware and software designs for channelized and photonic Ka/W band Electronic Warfare (EW) receiver designs.

FY 2005 Plans:

- Network-Centric Navigation: Complete effort by demonstrating the transfer of Precision Time and Time Interface.
- Distributed Time Scaling: Complete algorithm development for deeply coupled GPS/INS with nonlinear filter.
- Multispectral IRFPA: Continue assembly of a brassboard three-color seeker and testing in a simulation

facility.
- AISCM: Continue development of generic cooperative imaging IRCM techniques.
- MMW threat detection: Continue fabricating channelized and photonic prototype receivers.
- Continue development of high-performance, low-cost EO/IR airborne surveillance sensors for unmanned aerial vehicles, and ultra-high performance EO/IR Imagers. Continue work to develop auto-target identification techniques for Laser Range-gated imagers.
- Continue Distributed Time Standards Technology and Rb Double Bubble Maser Atomic Clock projects.
- Initiate the following four projects: Mirco Electronic Mechanical System (MEMS) INS device development, Communication Navigation and Identification (CNI) device, GPS receiver for landing systems, and Space and Frequency Adaptive Processing for GPS Anti-Jam (AJ) antennas.

	FY 2003	FY 2004	FY 2005
Electric Weapons	5,780	13,400	10,000

The goal of this work is to complete and commission upgrades to the infrared (IR) Free Electron Laser (FEL) and develop technologies related to average power scaling. If successful, the FEL could be considered for shipboard applications as a defense weapon against advanced cruise missiles and asymmetric threats.
In the prior R2 submission for this PE, the tasks in this new activity were contained in the FEL activity.

FY 2003 Accomplishments:

- FEL: Developed an optical klystron to extend the FEL performance into the IR bands. Continued commissioning and demonstration of the 10kW FEL.
- Femtosecond laser: This was a one year task to determine physical characteristics and the damage mechanisms involved with using femtosecond lasers as ship defense weapons. Conducted experiments on the interaction/damage mechanism of the femtosecond laser on thin radome; model beam propagation.

FY 2004 Plans:

- FEL: Complete commissioning and demonstration of a 10 kW FEL. Perform FEL beam quality experiments at the 10 kW level and conduct design studies for advanced injector configurations. Initiate design studies to evaluate multiple design alternatives and costs involved with the development, fabrication, and demonstration of a 100 kW FEL.
- Electromagnetic (EM) gun: Initiate program to develop EM gun technology. Initial effort will focus on rail wear issues, energy storage, and pulsed power switching. Transitions to PE 0603123N in FY05.

FY 2005 Plans:

- FEL: Continues with fabrication of high current, high brightness injectors including superconducting Radio Frequency (RF) cavity base design. Conduct 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.

	FY 2003	FY 2004	FY 2005
Strike Technologies	7,300	5,417	4,000

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.

In the prior R2 submission for this PE, the Mission Responsive Ordnance (MRO), and Unmanned Combat Air Vehicle-Navy (UCAV-N) tasks were previously in the Naval Precision Strike Operations activity. The Enhanced Target Acquisition, and Location System (ETALS), and Advanced Gun Barrel Technology (AGBT) tasks were previously in the Support for Naval Expeditionary Forces Ashore activity.

FY 2003 Accomplishments:

- MRO: Performed mid-scale penetration tests, demonstrated dispenser component functionality, and performed static ground tests of the effectiveness of the warhead against various real world targets (missiles, trucks, aircraft, etc.) MRO was discontinued at the end of FY03 due to lack of transition.
- ETALS: Target Location Designation and Handoff system (TLDHS) effort completed a limited user test for the AN/GVS-5 and TLDHS, and developed an interface prototype and AN/GVS-5 production interfaces.
- AGBT: Completed the analysis of material thermal transfer and the development of structural and thermal predictive models for the next generation/high barrel life, gun barrel design for current and future Naval gun systems.

FY 2004 Plans:

- ETALS: Complete development of the mechanical, electrical, and software interfaces between the Miniature Azimuth Gyrocompass Unit-1 (MAGU-1) and the TLDHS Lightweight Laser Designator/Rangefinder (LLDR). Conduct operational testing of the MAGU-1 to verify that it is suitable for the planned replacement for the AN/GVS-5.
- AGBT: Continue development of refractory materials, coating/liner application processes, metal matrix composites, and integration into two advanced barrel concepts for use on the DD(X) ship.

FY 2005 Plans:

- AGBT: Continue initial work necessary for full scale fabrication of a prototype 155mm gun barrel with advanced interior. Develop more advanced functionally graded material designs and fabricate a composite barrel test section.

CONGRESSIONAL PLUS-UPS:

	FY 2003	FY 2004
ACCELERATE DEVELOPMENT OF LOW COST SWARM UAV	2,380	0

This effort accelerated the development of Smart Warfighting Array Reconfigurable EO/IR RF modules SWARM for long endurance (UAV).

	FY 2003	FY 2004
ADVANCED DEVELOPMENT AND DEMONSTRATION OF ELECTRIC ACTUATOR TECH	0	1,187

This effort will develop and demonstrate an electronic actuator to replace hydraulic actuators on Navy ships and enable the realization of the all electric ship. The electronic actuator will incorporate technologies to improve heat dissipation, increase motor power density, and optimize compatibility with energy storage devices.

	FY 2003	FY 2004
ADVANCED MULTI-INT EXPLOITATION SYSTEMS (AMIES)	0	2,769

This effort will develop a suite of airborne multi-intelligence sensors (SIGINT and ELINT) along with existing advanced sensors. Develop the required signal processing algorithms and optimize them for real-time sensor fusion.

	FY 2003	FY 2004
CHEMICAL WEAPON DETECTION FOR UAV APPLICATIONS	0	1,384

This effort will develop a standoff (non-contact up to 1000 feet away) passive sensor of chemical weapon agents for use on the Silver Fox expendable UAV or if reconfigured for use as a handheld device. The new sensor will be based on differential absorption radiometer (DAR) technology.

	FY 2003	FY 2004
COMBUSTION LIGHT GAS GUN	0	4,203

This effort will involve the development of the technologies to develop a hyper-velocity weapon based on high-energy electric plasma ignition heating of injected light gas. Effort will include modeling and simulation of light gas ignition and combustion, installation of 45mm light gas gun test bed, and test firings of the gun at full velocity.

	FY 2003	FY 2004
DEVICE INTEGRATION OF WBG SEMICONDUCTORS AND CRYSTALINE OXIDES	0	1,384

This effort will develop techniques and instrumentation to improve passive oxide components for tunable power microwave amplifiers for application to the Advanced Multifunction Radio Frequency System.

	FY 2003	FY 2004
FIRELIDAR	0	1,483

This effort will develop an eyesafe laser imaging system complementary to Infrared (IR) imagers. Firelidar will use a 1.5 micron laser and a highly transmissive narrow band filter to minimize blooming from fire sources, to see through smoke, water, and glass.

	FY 2003	FY 2004
FREE ELECTRON LASER	0	6,923

This effort will develop technologies to support the development of a high average power Free Electron Laser (FEL) system that is applicable to shipboard self defense.

	FY 2003	FY 2004
GALLIUM NITRIDE (GAN) MICROELECTRONICS AND MATERIALS DEVELOPMENT	0	2,967

This effort will develop a reliable Gallium Nitride (GaN) Radio Frequency (RF) Power Technology that is more reliable and affordable by bringing 4 inch wafer processing on line and through the use of High Density Dielectric Passivation (HDDP) processes.

	FY 2003	FY 2004
HIGH EFFICIENCY PIEZOELECTRIC CRYSTALS	1,668	2,076

FY03 - This effort developed piezoelectric devices based on new growth techniques to dither infrared focal plane arrays for extremely high resolution.
FY04 - This effort develop defect-free lead magnesium niobate-lead titanate (PMN-PT) piezoelectric crystal material for significant (2-10) cost and performance improvement in Navy sonar and hydrophones, laser-acoustic modulators, focal plane micro-dither, and electronic beam steering applications.

	FY 2003	FY 2004
HYBRID FIBER OPTIC/WIRELESS SYSTEM FOR SECURE COMMUNICATIONS	952	0

This effort developed a millimeter wave, optical transmitter that will generate the optical and millimeter carriers within a mode-locked microchip laser. The laser operated an eye safe optical wavelength of 1.55mm with a millimeter modulation of 60 GHz for covert communications.

	FY 2003	FY 2004
HYBRID LIDAR-RADAR FOR IMPROVED OPTICAL IMAGING	0	1,682

This effort will develop frequency modulation techniques on 3D laser ranged imaging sensor to mitigate the effects of medium backscatter and stray light interference. These techniques will allow imaging in murky water and through clouds.

	FY 2003	FY 2004
INTEGRATED BIOLOGICAL WARFARE TECHNOLOGY PLATFORM	3,813	5,092

FY03 – This effort supported development of a small, low powered chemical sensor and includes a biological detection capability. (Semi-conducting Metal Oxides (SMO's) are currently used for chemical detection and it is anticipated that this effort will enable molecular beacons to be used for biological weapon detection.)
FY04 – This effort will apply the integrated Biological and Chemical Warfare Defense decision analysis technology software to survey vessels approaching aircraft carriers on the high seas.

	FY 2003	FY 2004
INTEGRATED HIGH PAYOFF ROCKET PROPULSION TECHNOLOGY PROGRAM (IHPRPT)	0	989

This effort will develop technologies that increase the performance of solid propellents used in tactical missiles. Tasks involve synthesis of high energy propellent ingredients and formulations and investigate advanced propulsion technologies to meet the IHPRPT performance goals.

	FY 2003	FY 2004
INTELLIGENT CONTROL SYSTEMS FOR SWARM UNMANNED AERIAL VEHICLES	0	4,203

This effort will develop the algorithms and intelligent control technologies to enable the employment of multiple UAV's for the completion of a variety of operational missions. The FY03 funds are listed under the Plus-up title "Accelerate Development of Low Cost SWARM UAV".

	FY 2003	FY 2004
INTERROGATOR FOR HIGH-SPEED RETRO REFLECTOMETER COVERT COMMUNICATIONS	1,627	1,978

FY 03 – This effort developed a retro-reflector modulator for laser data link that can support megabit per second data rates for hyperspectral electro-optical and infrared sensors and synthetic aperture radar data. Furthermore adapt this technology to small (4') unmanned aerial vehicles to allow exchange of space-time information for geolocation and time sensitive targeting.
FY04 – This effort will increase retro reflector data rate to 10-50 Megabits per second. Develop cats-eye lens for wide intercept angle to minimize laser interrogator pointing accuracy.

	FY 2003	FY 2004
KILL ASSIST ALL-WEATHER TARGETING SYSTEM (KAATS)	0	3,115

This effort will develop technologies to support a system that will provide precision targeting and weapon delivery in adverse weather for time critical missions. Will develop, demonstrate and test a targeting capability using stereo SAR and a data link to provide relative coordinates for the simulated missile.

	FY 2003	FY 2004
LOW COST FUSED REMOTE SENSORS	954	0

This effort developed the feasibility of using fused low cost remote sensing technology sensors such as hyperspectral imaging sensors, Synthetic Aperture Radar (SAR) and Lidar Sensors for the identification of targets for Navy power projection missions.

	FY 2003	FY 2004
MILLIMETER WAVE INFRARED IMAGING	1,620	0

This effort performed work 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 2003	FY 2004
MINATURIZED HIGH DEFINITION DIGITAL CAMERA	952	0

This effort developed flight worthy, high definition, color video surveillance camera for a small (4 ft) unmanned aerial vehicle.

	FY 2003	FY 2004
NANOCOMPOSITE WARHEADS	0	2,521

This effort will support 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.

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	FY 2003	FY 2004
NAVAL PRECISION STRIKE (SAR FOR ALL WEATHER TARGETING)	6,712	0

This effort developed a time critical targeting system using Global Positioning System (GPS) information to provide an all weather precision target location and weapon guidance capability that will significantly increase the accuracy of precision weapons. Developed a prototype relative GPS system for guided weapons and integrated the Stereo Synthetic Aperture Radar (SAR) targeting package into the Lynx targeting system.

	FY 2003	FY 2004
NON-LINEAR DYNAMICS - CONTROL OF CHAOS	0	3,362

This effort initiate a new research institute focused in the broad area of nonlinear dynamics with specific research topical areas such as chaos-excited nondestructive evaluation, micromechanical/microfluidic devices, adaptive antenna arrays, and autonomous vehicle controls.

	FY 2003	FY 2004
PANORAMIC NIGHT IMAGING SYSTEM	3,240	0

This effort developed large area infrared focal plane arrays and associated signal processing, including imaging systems and sensor evaluation.

	FY 2003	FY 2004
PULSE DETONATION ENGINE RISK REDUCTION	1,003	0

This effort designed, fabricated and tested a compound flow nozzle system for a 5 combustor test vehicle. Conducted structural and thermal analysis of alternative engine configurations.

	FY 2003	FY 2004
RADAR INFRARED IMAGING	0	2,076

This effort will develop a new type of passive millimeter wave (MMW) imager based on the imposition of MMW side bands on an optimal carrier. If successful, this approach will significantly improve MMW imaging sensitivity performance.

	FY 2003	FY 2004
REAL WORLD BASED IMMERSIVE IMAGING	1,907	0

This effort developed a low power optimized single instruction multiple data (SIMD) system processor for enhanced real-time hyperspectral image processing on-board a small (4') unmanned aerial vehicle. The processor will also support hyperspectral data compression/de-compression and encryption/decryption.

	FY 2003	FY 2004
THERMAL MANAGEMENT OF ENVIRONMENTALLY ENCLOSED GROUND STATIONS AND COMPUTING SYSTEMS	0	5,191

This effort will evaluate and demonstrate advanced cooling techniques for military processing systems. It will include the cooling of a classified telecommunications processing system which has Special Operations Forces (SOF) deployment requirements. It will also ruddedize high capacity imagery and data fusion processing airborne hardware.

	FY 2003	FY 2004
TUNABLE OXIDE FILM AND CAPACITOR TECH & INTEGRATION OF OXIDE FILM AND WIDE BANDGAP SEMICONDUCTOR TECH FOR THE ADV MULTI FUNCTION RF SYSTEM	1,625	0

This effort developed the feasibility of integrating electro-optic films into semiconductor microwave device structures.

	FY 2003	FY 2004
ULTRA SHORT PULSE LASER MICROMACHINING	1,214	1,384

FY 03 - This effort developed near-term, ultra short laser micromachining for electronics and fuel injectors.
FY 04 - This effort will establish a micromachining testbed to assist the transfer of ultra-short pulse laser machining technology. Develop precise micro-machining with negligible heat affected zones, improved holes in turbine blades, fuel injectors and airframes, semiconductor machining on Infrared focal plan arrays, etc.

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 0602235N (Common Picture Applied Research)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0603114N (Power Projection Advanced Technology)
PE 0603640M (Marine Corps 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 0602173C (Support Technologies - Applied Research)
PE 0603763E (Marine Technology)
PE 0603739E (Advanced Electronics Technologies)
PE 0602702E (Tactical 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