FY 2003 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2002

BUDGET ACTIVITY: 2

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

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2001 ACTUAL	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Power Projection Applied Research	**	83,413	76,612	63,221	61,206	62,659	63,125		
Defense Emergency Response Fund (DERF)			7,300	20,300	20,000	19,000	13,900	CONT.	CONT.

**The Science and Technology Program Element (PEs) were restructured in FY 2002. The work described in FY 2001 was funded in PEs 0602111N, 0602122N, 0602232N, 0602270N, and 0603217N.

A. (U) 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. In particular the technology developed in this Program Element (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.

(U) Fleet Defense & Air Dominance: The focus of this thrust is on those technologies that will support defense of the fleet in the littoral area and to provide for air dominance in all of the operating areas that Naval forces will operate in the future. Technology areas include: advanced Air-to-Air (A-A) missile seeker and propulsion technologies, Infrared focal plane arrays (IRFPA) and hyperspectral algorithms for target detection, laser tracker and identification, automatic target recognition (ATR) for air targets, High Energy Lasers (HEL) and Directed Energy weapons, advanced warhead and fuzes for use against high speed maneuvering threats, Radio Frequency (RF) photonics to increase bandwidth and reduce size/weight of phased array detectors, radar detection technology in clutter, and advanced Counter-Counter Measure (CCM) techniques for improved missile performance.

(U) Naval Precision Strike Operations: The focus of this thrust 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. Some of the technologies employed to support the Navy strike capability include: Unmanned Air Vehicles (UAV) to locate, identify, and target critical enemy resources and weapons, rapid targeting technologies to enable rapid employment of long range precision strike weapons, smart/high speed weapons to support the attack of time critical targets, and improved explosives with energetic capabilities that will inflict greater damage against the target. This area also includes advanced navigation S&T which is developing technologies in the areas of precision clock and time distribution, Precision Terrain Aided Navigation (PTAN), Laser light sources for fiber optic gyros (FOG), and Relative Navigation.

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(U) Support for Naval Expeditionary Forces Ashore: The focus of this thrust is on those technologies that will support expeditionary operations of marines operating in the littoral areas. Some of the technologies developed in this thrust include: advanced gun launched seekers and propulsion techniques that will provide more accurate Naval Fire Support (NFS) at longer ranges, Unmanned Ground Vehicles (UGV) development to provide improved surveillance/targeting support to marines on the ground, smart sensor networks to link UAVs in urban environments, and improved explosive formulations that will provide greater lethality against NFS type targets.

(U) Due to the number of efforts in the PE, the programs described are representative of the work included in the PE.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the APPLIED RESEARCH Budget Activity because it investigates technological advances with possible applications toward the solution of specific Naval problems, short of a major development effort.

B. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 2001 ACCOMPLISHMENTS:

- (U) ($4,159K) FLEET DEFENSE & AIR DOMINANCE (FY01 accomplishments were funded in PE 0602111N.)

  (U) The Air weapons effort is focused on the goal of developing anti-air weapons for ship defense and aircraft. The Aim Airframe control task developed lightweight high temperature material airframe components and peak demand, low drag airframe control concepts. The Surface Wave antenna guidance (SWAG) task performed Ultra High Frequency (UHF) seeker design tradeoffs and completed a test of antennas on Advanced Medium Range Air-to-Air Missile (AMRAAM) test body and composite test fixture. The reactive material warhead Target Interaction, Lethality, and Vulnerability (TILV) task continued lethality testing for model development and validation purposes. The Clutter Rejection Involving Temporal Techniques in the Infrared (CRITTIR) task utilized previously collected data to demonstrate that algorithms based on clutter and target fluctuation statistics could successfully aid early target detection and tracking targets within the solar corridor, completing the effort. The Integrated/Aimed Warhead and the Cumulative Damage TILV tasks were terminated.

  (U) The Integrated High Performance Rocket Technology (IHPRPT) program is a joint Air Force, Army, Navy, NASA, and industry initiative sponsored by DDR&E. The goal of the IHPRPT program is to double rocket propulsion performance by 2010. The Navy is responsible for the tactical rocket propulsion portion. Completed air-to-air missile static test of hardware for two dual-movable nozzle thrust vector control concepts, and baseline testing of low/no erosion, reduced smoke, propellant nozzle materials. The IHPRPT program conducted full-scale gun launched rocket motor firings of aluminized propellant nozzle materials. The IHPRPT program conducted full-scale gun launched testing of an advanced aluminum metal matrix composite gun munition motor case. Surface launched demo program conducted subscale tests of pintle motor operation with reduced smoke propellant.

- (U) ($14,102K) NAVAL PRECISION STRIKE OPERATIONS:
  (U) The Autonomous Operations (AO) Unmanned Air Vehicle (UAV) technology program identified key autonomy technology drivers (autonomous guidance, navigation and control; collaborative communications; intelligent autonomy). Also, developed a database that defined industry state-of-the-art technologies for increasing UAV mission capabilities. (FY01 accomplishments were funded in PE's 0602122N and 0602111N).
  (U) The Micro UAV (MAV) program developed technologies (autonomous flight, radar micro-jammer, low Reynolds number aerodynamics) that enable valuable Navy missions (close-in radar jamming, over-the-hill reconnaissance) with the smallest practical unmanned air vehicles. In FY01 MAV efforts demonstrated an altitude hold capability using optical flow sensors. Small test vehicles were flight-tested thereby demonstrating both the flight operations of the vehicles, as well as the sensor operation aboard these MAVs. (FY01 accomplishments were funded in PE 0602270N).
  (U) The Global Positioning System (GPS) effort developed technology to mitigate GPS limitation and develop back up capabilities if GPS is denied. The Distributed Time Standards (DTS) task designed a system to synchronize multiple high precision clocks (e.g. GPS, Joint Tactical Information Distribution System (JTIDS), Tomahawk) that are on Naval ships. DTS task developed a preliminary design for a DTS system and acquired the testbed hardware. The GPS-JTIDS/Enhanced Position Location Reporting System(EPLRS) task performed a Threat Analysis of the GPS-JTIDS/EPLRS Relative Navigation and Communications System Capabilities. Performed a Threat Analysis in the area of GPS. The Navigation task developed a Precision Terrain-aided Navigation capability that will provide terrain information for ship and aircraft navigation and a polarized Fiber Optic Gyro (FOG) laser source.(FY01 accomplishments were funded in PE 0602232N).
  (U) The Mission Responsive Ordnance (MRO) effort developed ordnance technologies that enable a single ordnance configuration to modify its kill mechanism in flight to optimize lethality against a variety of targets. Completed the down select of various ordnance concepts for implementation into Tactical Tomahawk and produced a draft performance specification for the MRO payload. (FY01 accomplishments were funded in PE 0602111N)
  (U) The Technology for Strategic System Sustainment (TSSS) Program goal is to sustain, reduce operational and maintenance costs, maintain the industrial capability, for the existing strategic weapon systems. In addition, the TSSS program will also improve strategic system capabilities by developing the technology for higher performance and more affordable systems. FY01 tasks completed include: definition of requirements and integration of radiation hardened (RAD HARD) codes into database; development of modeling codes for solid rocket motor (SRM) propellant ignition and flight performance; and development of Computational Fluid Dynamics (CFD) software for flight performance prediction and drag reduction. (FY01 accomplishments were funded in PE 0602232N)
  (U) The Hypersonic Weapons Development effort is focused on the development of the technologies necessary to demonstrate a high speed (Mach 6.0+) missile that can be used to attack high value, buried and/or time critical targets. Demonstrated Dual Combustion Ramjet (DCR) efficient combustion of tactically acceptable hydrocarbon fuels at Mach 4 to Mach 6. Completed durability tests of Leading Edge (LE) component materials. Fabricated and conducted high temperature tests on sub-scale and limited full-scale seeker windows and domes. Investigated advanced airbreathing flow control sensors and actuators. (FY01 accomplishments were funded in PE's 0602111N and 0603217N)

(U) The Weapons program Supersonic Airframe control task performed detailed design assessment of conformal control concepts. The Configurable Automatic Target Recognition (CATR) task developed an ATR framework, developed confidence propagation factors, and characterized algorithm performance. The Micro Electro Mechanical Systems (MEMS) antenna task designed and fabricated the space feed and initiated the design of the demonstration seeker aperture. Testing continued on explosive survivability for high-speed ordnance application. The Rapid Ordnance Dispense System systems/technology analysis was completed and folded into the TCS FNC MRO project. (FY01 accomplishments were funded in PE's 0602111N and 0603217N).

- (U ($13,903K) SUPPORT FOR NAVAL EXPEDITIONARY FORCES ASHORE:
(U) As part of the Micro UAV Sensor program a demonstration of remote telemetry of magnetic sensors was performed. In addition, the analysis and lab measurements of thermal sensors task was completed leading to the development of a unique thermal sensor for Micro UAV applications. (FY01 accomplishments were funded in PE 0602270N).
(U) The Weapons program Precise Tactical Targeting (PTT) task incorporated real time processing and began the development station. The Energetic Gun Propulsion task began a co-layered disk propellant investigation and shredder propulsion investigation. The High Energy Density Materials (HEDM) task completed mechanical property and response characterization and began fabrication and testing of HEDM structural composites in weapon shapes. The Mission Responsive Ordnance task completed and transitioned to TCS FNC funding for FY02. The Aeroprediction task that developed improved aerodynamic prediction models for NFS projectiles was completed. The Image and Video Analysis task completed and transitioned to TCS FNC funding for FY02. The Low Cost Gun-Launched Seeker task was terminated. (FY01 accomplishments were funded in PE 0602111N).

(U) FY 2001 Congressional Plus-ups:

- (U)($4,826) Free Electron Laser (FEL) upgrade: Completed Phase 1 deliverables for the FEL program. Deliverables included complete design for the 10-kilowatt (k W) upgrade, RF power upgrade, RF power system, and the high power Infrared (IR) wiggler for 2-10 microns. (Funded in PE 0602111N in FY 01).

- (U)($2,899) Hyperspectral Research: Developed advanced algorithms and processor architecture for Hyperspectral sensors. Optimized, validated, and demonstrated these algorithms for transition to hyperspectral sensors such as the planned F-18 SHARPS POD. (Funded in PE 0602232N in FY 01).

- (U)($4,833) Pulse Detonation Engine Technology: Completed development of Integrated Test Rig (ITR) for single converter. Conducted successful engine test using Ethylene and Propane fuel. (Funded in PE 0602111N in FY 01).

- (U)($3,868) Solid Fuel RAMJET: Completed database of solid fuel ramjet technology. Determined the missile performance, propulsion thrust and fuel characteristics for the axi-symmetric nose inlet and the chin inlet

configurations. Performed mission trajectory and booster performance trade off analyses and flight vehicle thermal analysis. (Funded in PE 0602111N in FY 01).

- (U)($3,963) Spike Urban Warfare System: Completed the subsystem level designs for the guidance section electronics, servo drives, aero surfaces, and rocket motor designs. Performed final tests on the rocket motor igniter, three different warhead designs, and initial rocket motor propellant tests. (Funded in PE 0602111N in FY 01).

2. (U) FY 2002 PLAN:

- (U) ($9,620) FLEET DEFENSE AND AIR DOMINANCE

(U) The longwave Infrared (LWIR) program goal is to develop low loss, high strength fibers (8-12um) required for the Navy's threat warning system and infrared countermeasures. The LWIR fiber task in FY02 will produce fibers at 75 kpsi strength and multifiber coherent bundles up to 3m in length.

(U) The Multispectral Infrared Focal Plane Array (IRFPA) effort will develop advanced infrared detectors and focal plane arrays that will improve sensitivity, operating range, field of view (FOV), and counter measure hardness in Forward Looking Infrared Receivers (FLIR), missile seeker, missile warning and surveillance sensors. In FY02 the IRFPA task will demonstrate improved color detector materials, an improved long wavelength detector, and laser hardening approaches for uncooled detectors.

(U) The Electro Optic/Infrared (EO/IR) effort will develop sensors and nanotechology-based gyroscope/accelerometer sensor stabilization mechanisms to provide more accurate targeting and identification of potential targets. The Hyperspectral algorithm effort will evaluate and improve algorithm packages for a family of hyperspectral sensors to improve detection and identification of targets in camouflage and complex environments. The Laser tracker and identification Automatic Target Recognition (ATR) effort will demonstrate the ability to detect, track and identify air targets. The effort will develop an approach that uses laser vibrometry to classify/ identify threats. This work will fly a stabilized, eye safe laser on a gimbal to measure sensor and platform vibration. The purpose is to determine the impact of vibration and atmospheric turbulence on laser beam divergence and coherence.

(U) The Air-to-air weapons effort will complete this year. The Aim Airframe control task will fabricate and assess an advanced high temperature missile section. The Surface Wave Antenna Guidance (SWAG) effort will conduct field test and evaluation to evaluate the performance of the SWAG seeker in potential air-to-air environments. The Short Pulse Laser Target Detection Device (TDD) task will complete with demonstrations against targets in fog and clutter. A systems assessment for weapon needs addressing asymetric threats will be conducted. A systems assessment of high performance, solid state RF seeker technology that is appropriate for the advanced cruise missile defense problem will be initiated. The Reactive Material Warhead TILV effort will continue.

(U) The High Energy Laser (HEL) weapons development effort will initiate the fabrication of test equipment to be used for propagation measurements of beam coherence in aerosol rich environments. Analyze existing climatology data for aerosol microphysical and meteorological properties in maritime and coastal environments. Develop multi-

year climatologies and probabilities of severe propagation impacts in sensitive marine/coastal regions. A field test will be conducted in a sensitive region of the world to provide a short term, detailed characterization of the vertical distribution of aerosols. Demonstrate 10 kW output on a Free Electron Laser (FEL).
(U) The IHPRPT program will demonstrate an air launched rocket with a high-pressure nozzle and composite motor case. The air-to-air project will demonstrate a flight weight, high pressure, highly loaded, full scale air-to-air motor incorporating an end-burner motor with reduced smoke propellant, advanced composite case (T-1000 & Ultra High Modulus (UHM) fibers), dual movable nozzle, and thrust vector control (TVC). The gun launched motor project will demonstrate in flight a high pressure, highly loaded, full scale, gun launched munition motor incorporating an end-burner motor with aluminized propellant, and advanced composite case (aluminum metal matrix) technologies. The surface launched effort will conduct full scale testing of a 40 to 1 turndown ratio pintel motor with aluminized boost propellant.

- (U) ($34,345) NAVAL PRECISION STRIKE OPERATIONS
(U) The AO UAV technology task will develop software to detect threats, collision situations and targets of opportunity with operator, and pre-programmed reaction. Develop secure jam resistant communications links and architecture for networking and multi-vehicle operations. Develop command, control and information display for multiple UAVs conducting simultaneous imaging missions using a single UAV operator. Develop software technologies that permit single frequency multi-point communications between multiple UAVs and their ground station.
(U) UAV Radar effort will be started to develop a radar concept and signal processing algorithms for the Navy's planned Tactical Ultra Light Unmanned Air Vehicles (UAV's). This will provide the Navy with the ability to safely detect and direct weapons against over-the-horizon, slow moving, ground targets. FY 02 work will include obtaining and assembling components, and the integration and test of the UAV radar system and instrumentation hardware.
(U) The MAV program will demonstrate autonomous flight, conduct mission demonstrations and integrate payloads and sensors/autopilots with Micro Air Vehicles. The applied research portion of this program will transition to next-generation advanced single vehicle and distributed multiple-vehicle programs.
(U) The DTS portion of the GPS task will develop an initial specification for the DTS and fabricate the testbed. The Navigation task will develop a Precision Terrain-aided Navigation capability that will provide terrain information for ship and aircraft. Perform a Threat Analysis of the GPS-JTIDS/EPLRS Relative Navigation and Communications System Capabilities and Threat Analysis in the area of GPS. Complete polarized Fiber Optic Gyro (FOG) laser source development.
(U) The Weapons Imagery Link (WIL) program is a RF communications link, which will provide data bandwidth for the transport of moving imagery (video) and weapon control data for standoff weapons such as SLAM-ER. Will conduct a test of a dynamic network using a complex array of terminals, a simulated weapons delivery under multiple scenarios, and a video relay through two terminals and a long distance video relay. This effort will transition to PE0603114N in FY03.

(U) The MRO effort will perform Small Scale Penetrator Tests to quantify various design constraints against depth in concrete. Down select to two structural concepts and two safe arm architectures. Select baseline warhead size.
(U) The Hypersonic Weapons Development will complete Leading Edge airframe component testing and test data analysis. The seeker window/dome task will prototype window/airframe integration. The airbreathing hypersonic propulsion task will integrate flow control algorithms and actuators into test hardware and demonstrate the ability to control combustion. Direct connect measurements of the DCR will be completed and free jet tests will be performed.
(U) The TSSS program will involve upgrading Radiation Hardened (RAD HARD) models, codes and databases. The Solid Rocket Motor (SRM) effort will produce structural and gas dynamic coupled models. The drag reduction device task will finalize the database, identify Computational Fluid Dynamics (CFD) tool candidates, and identify the static stability method.
(U) The Weapons program Supersonic Airframe control task will select, fabricate and integrate the control concept for the strike weapon, and investigate the extendibility of the concept into the hypersonic speed regime. The Configurable ATR task will define the tasks necessary for the ATR LADAR identification of targets and evaluate reconfigurable architectures for the CATR system. The Micro Electro Mechanical Systems (MEMS) antenna task completes the fabrication of the demonstration seeker and will investigate the applicability of MEMS in high power RF seeker applications.

- (U) ($21,755) SUPPORT FOR NAVAL EXPEDITIONARY FORCES ASHORE

(U) The AO Unmanned Undersea Vehicle (UUV) task will develop enabling technologies in autonomy, navigation, sensors, energy, and communication in support of UUV missions. Initiate development of UUV-deployed Intelligence, Surveillance and Reconnaissance (ISR) electro-magnetic and electro-optic (EM/EO) sensors; software to detect, evaluate and avoid obstacles and threats using various sensor inputs; sensor data fusion for situational awareness; and integrated autonomous UUV control approaches for Maritime Reconnaissance mission capabilities.
(U) The AO UAV propulsion and power technology development task for the Navy UAV will refine Navy UAV propulsion technologies through individual component design, fabrication and component rig testing under realistic operational conditions under the Integrated High Performance Turbine Engine Technology (IHPTET) program. Demonstrate the UAV engine component technologies that will provide high performance and robust operational utility, reduce parts count and decrease component costs when integrated into an advanced UAV turbine engine.
(U) The AO Intelligent Autonomy task will develop system and associated sensor processing for unmanned vehicles to enable adaptation and independent actions. Develop architecture for combining reactive and deliberative behaviors for autonomous vehicles.
(U) The Unmanned Ground Vehicle (UGV) program will focus on technologies that address capability gaps in robotic communications and control, mobility, survivability, durability, modularity, and signature reduction in support of the Marine Corps Gladiator Tactical Unmanned Ground Vehicle (TUGV) program.

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(U) The Micro UAV sensor program will demonstrate a magnetic fiber micro sensor and complete the development of a radiometer.
(U) The Enhanced Target Acquisition & Location System (ETALS) effort will develop an advanced, affordable, azimuth sensing Micro-Electro-Mechanical-Sensor (MEMS) based gyroscope. ETALS will enable improved and more rapid targeting when operating in urban environments and areas of high iron concentration. Develop a gyrocompass model for ETALS. Perform ETALS Selective Availability Anti-Spoofing Module (SAASM) integration test and MAGU-1 (Miniature Azimuth Gyrocompass Unit) gyrocompass test.
(U) Smart sensor network effort will evaluate and demonstrate different sensor packages linked to form a grid for surveillance and tracking of targets in urban environments.
(U) The Weapons program Precise Tactical Targeting (PTT) task will begin ground and aircraft testing. The Energetic gun propulsion will begin preliminary support to the barrel wear and advanced propulsion FY03 tasks. The High Energy Density Materials (HEDM) task will continue performance enhancement evaluation of selected HEDM candidates.

(U) FY 2002 Congressional Plus-ups:

- (U)($3,469) Combustion Light Gas Gun: This work will develop options for cryogenic storage and handling, gas fuzing and electronic ignition of the propellant gas used in the gun. In addition Computational Fluid Dynamic (CFD) modeling and systems analysis will be performed to identify scaling parameters for future gun systems.

- (U)($1,982) Fast Pattern Processor, SLAM-ER: This effort will develop a dedicated Application Specific Integrated Circuit (ASIC) implementation of algorithms that perform correlation based Automatic Target Recognition (ATR). These pattern recognition algorithms will perform rapid comparison of stored and real time images, using gradient and frequency transformations, to emphasize features of military targets that can be correlated.

- (U)($1,388) Hybrid Fiber Optic/Wireless System for Secure Communications: This effort will develop a millimeter wave, optical transmitter that will generate the optical and millimeter carriers within a mode-locked microchip laser. The laser will operate an eye safe optical wavelength of 1.55mm with a millimeter modulation of 60 GHz for covert communications.

- (U)($4,163) Hyperspectral SAR: Develop 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.

- (U)($2,478) Integrated Biological & Chemical Warfare Defense Technology Platform: This effort supports development of a small, low powered chemical sensor and expands the R&D to include a biological detection capability. Semi-conducting Metal Oxides (SMO's) will be used for chemical detection and it is anticipated that molecular beacons will be developed for biological weapon detection.

- (U)($1,239) Real World Based Immersive Imaging: Develop 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.

- (U)($2,974) SAR for All Weather Targeting: This effort will develop 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. The FY02 effort will develop a prototype relative GPS system for guided weapons and integrate the Stereo Synthetic Aperture Radar (SAR) targeting package into the Lynx targeting system.

3. (U) FY 2003 PLAN:

- (U) ($13,602) FLEET DEFENSE AND AIR DOMINANCE

(U) The LWIR fiber development will produce 8-12 um fiber at greater than 100 kpsi strength and 1 micron core material in lengths greater than 1 km.
(U) The Multispectral Infrared Focal Plane Array (IRFPA) will demonstrate color techniques for air to surface targeting and transition IRFPA hardening techniques to industry.
(U) The gyro stabilization portion of the EO/IR effort will fabricate and test the gyroscope, accelerometer, and inertial measurement unit designs. The Hyperspectral task will demonstrate the algorithm packages in operational exercises. The ATR effort will upgrade a high coherence eyesafe laser and demonstrate laser vibrometry ATR of airborne platforms and target discrimination (threat vice non-threat). Demonstrate extended range laser tracker and identification of air targets.
(U) Asymetric threat weapon systems technologies as identified by FY02 analysis efforts will be initiated. Development of high performance solid state RF seeker technology for defeat of advanced anti-ship cruise missiles will continue. A study of technology requirements to enable hit-to-kill missile defense against anti-ship cruise missiles will be performed. The Reactive Material TILV effort will conclude. The HEL weapons development effort will continue to make detailed propagation measurements to evaluate the performance of the HEL when conducting shipboard operations in the ocean/littoral environment.
(U) The Advanced Reactive Material effort will continue development of advanced Reactive Material compositions. Reactive Materials are warhead material formulations that result in warhead fragments that combine both kinetic and chemical energy. This combination of kinetic and chemical energy produces structural kills rather than the component kills that inert fragments generate.

(U) The IHPRPT surface launched demonstrator will include full scale testing of an aluminized boost propellant. Concept evaluation will begin for the advanced Thrust Vector Control (TVC) concepts incorporating pitch, yaw, and roll control along with thrust magnitude control capability. Propellant ingredient and formulation investigations will begin for advanced reduced smoke propellant for air-launched applications.

- (U) ($39,170) NAVAL PRECISION STRIKE OPERATIONS
(U) The UAV advanced technology task will develop single frequency, multi-UAV imaging ops capability using only the secondary UHF data link. Develop command, control and information display for multiple UAVs conducting simultaneous imaging missions using only a single UAV operator.
(U) Conduct lab and field tests of UAV radar system.
(U) The DTS portion of the GPS task will define the Precision Time subsystem interfaces between the GPS, JTIDS and other system clocks. Complete the development of the GPS navigation Precision Terrain-aided Navigation task.
(U) The MRO effort will perform mid-scale penetration tests to validate survivability of structure. Demonstrate dispenser component functionality. Perform static arena tests of warhead against various targets.
(U) The TSSS program will involve upgrading and linking Radiation Hardened (RAD HARD) codes and evaluating the software. The Solid Rocket Motor (SRM) effort will perform code validation with legacy models and preliminary verification on new models. The drag reduction device task will develop a first order CFD model, complete the CFD model test trials, and integrate static stability models.
(U) The Ordnance Systems for High speed penetration work will develop advanced fuze, warhead and structural components that can be integrated into high speed strike weapons which are used to attack high value, deeply buried targets.
(U) The Hypersonic Weapons Development program will develop a lightweight Dual Combustion Ramjet (DCR) concept vehicle for the airframe integration task. The advanced airbreathing propulsion task will develop a full-scale test device and demonstrate full-scale combustion control. The supersonic inlet task will begin evaluation of inlet concepts and the preliminary inlet design.
(U) The National Aerospace Initiative effort will design and develop flight weight hardware that can be integrated into a hypersonic strike vehicle.
(U) The Weapons program Supersonic Airframe control task will design for a ground test to demonstrate a section level integrated control concept extendable into the hypersonic speed regime. The Configurable ATR work, which has integrated a family of tunable algorithms, will continue with the development of a process oversite manager that will provide for the tuning of the ATR algorithms. The Micro Electro Mechanical Systems (MEMS) antenna task will evaluate the fabricated seeker and then begin development of the high power RF seeker. Initiate the development of moving target and ATR algorithms. An effort will be initiated to advance the technologies needed to further automate the management and control of several retargetable weapons and unmanned vehicles providing ISR/targeting functions.

- (U) ($23,840) SUPPORT FOR NAVAL EXPEDITIONALRY FORCES ASHORE
(U) Continue development of AO UUV-deployed Intelligence, Surveillance and Reconnaissance (ISR) electro-magnetic and electro-optic (EM/EO) sensors; software to detect, evaluate and avoid obstacles and threats using

various sensor inputs; sensor data fusion for situational awareness; and integrated autonomous UUV control approaches for Maritime Reconnaissance mission capabilities. Continue multi-vehicle undersea search and survey and communication link development.

(U) The AO UAV propulsion and power technology development effort for the Navy UAV will refine Navy UAV propulsion technologies through individual component design, fabrication and component rig testing under realistic operational conditions under the IHPTET program. Demonstrate the UAV engine component technologies that will provide high performance and robust operational utility, reduce parts count and decrease component costs when integrated into an advanced UAV turbine engine.

(U) The AO Intelligent Autonomy task will develop system and associated sensor processing for unmanned vehicles to enable adaptation and independent actions. Develop architecture for combining reactive and deliberative behaviors for autonomous vehicles.

(U) The UGV program will develop technologies that address capability gaps in robotic communications and control, mobility, survivability, durability, modularity, and signature reduction in support of the Marine Corps Gladiator Tactical Unmanned Ground Vehicle (TUGV) program.

(U) Develop ETALS Target Location Designation and Handoff system (TLDHS) interface prototype. Develop AN/GVS-5 production interfaces for ETALS. Perform a Limited User Test for the AN/GVS-5 and TLDHS.

(U) To complete the Micro UAV Sensor program, a micro acoustic sensor will be demonstrated and, along with the other sensors developed by the program, they will be made available for Micro UAV applications.

(U) To complete the Smart sensor Network, sensors will be linked into a grid to demonstrate different sensor packages observing and tracking targets in urban environments.

(U) The Advanced Gun Barrel and propulsion task will develop a complete, next generation, gun barrel design for current and future Naval gun systems. This system will yield significant improvement in barrel life and gun system performance. Tasks will involve analysis of thermal transfer between materials and load transfer between layers. Structural and thermal predictive models will be developed.

(U) The Weapons program Precise Tactical Targeting (PTT) task will complete ground and aircraft testing and begin the 1-meter targeting effort. The High Energy Density Materials (HEDM) task will continue performance enhancement evaluation of selected HEDM candidates and continue fabrication and testing of HEDM structural composites. An effort will be initiated to address moving targets using tactical/expeditionary assets such as tactical UAVs and guided projectiles. An effort will be initiated to further the technologies needed for next-generation high performance gun systems for land attack (light gas or EM).

(U) **Accelerate technology modernization of strategic systems.**

C. (U) PROGRAM CHANGE SUMMARY:

	FY 2001	FY 2002	FY 2003
FY 2002 President’s Submission	**	66,322	
Adjustments from FY 02 PRESBUDG:			
Congressional Plus-ups		+17,850	
Section 8123 Management Reform Initiative		-744	
Reduction			

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FFRDC Reduction		-15	
FY 2003 President's Submission:	**	83,413	76,612

**The Science and Technology PEs were restructured in FY 2002. FY 2001 efforts were funded in PEs 0602111N, 0602122N, 0602232N, 0602270N, and 0603217N.

(U) PROGRAM CHANGE SUMMARY EXPLANATION:

(U) Schedule: Not applicable
(U) Technical: Not applicable

D. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) RELATED RDT&E:

(U) NAVY RELATED RDT&E:
- (U) PE 0601152N (In-house Laboratory Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602123N (Force Protection Applied Research)
- (U) PE 0602235N (Common Picture Applied Research)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0603114N (Power Projection Advanced Technology)
- (U) PE 0603640M (Marine Corps Advanced Technology Demonstration)
- (U) PE 0603790N (NATO Research and Development)

(U) NON NAVY RELATED RDT&E:
- (U) PE 0602303A (Missile Technology)
- (U) PE 0602618A (Ballistics Technology)
- (U) PE 0602624A (Weapons and Munitions Technology)
- (U) PE 0603004A (Weapons and Munitions Advanced Technology)
- (U) PE 0602173C (Support Technologies – Applied Research)
- (U) PE 0603763E (Marine Technology)
- (U) PE 0603739E (Advanced Electronics Technologies)
- (U) PE 0602702E (Tactical Technology)
- (U) PE 0602203F (Aerospace Propulsion)
- (U) PE 0602601F (Space Technology)
- (U) PE 0602602F (Conventional Munitions)

FY 2003 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2002

BUDGET ACTIVITY: 2

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

(U) PE 0603216F (Aerospace Propulsion and Power Technology)

E. (U) SCHEDULE PROFILE: