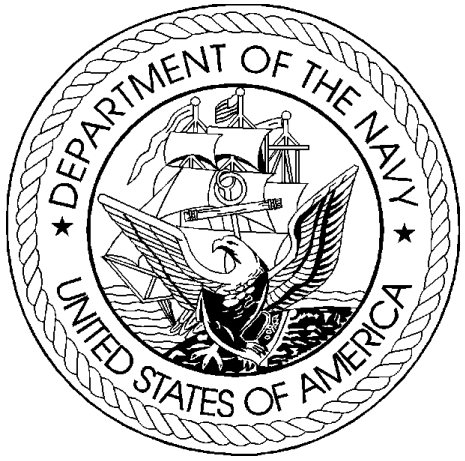
DEPARTMENT OF THE NAVY
FISCAL YEAR (FY) 2002
AMENDED BUDGET SUBMISSION



JUSTIFICATION OF ESTIMATES
JUNE 2001

RESEARCH, DEVELOPMENT, TEST & EVALUATION, NAVY
BUDGET ACTIVITIES 1-3

FY 2002 RDT& E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research (ILIR)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
0601152N	15,262	16,193	16,291

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program sustains U.S. naval science and technology (S&T) superiority, provides new technological concepts for the maintenance of naval power and national security, and helps avoid scientific surprise, while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). It responds to S&T directions of the Department of the Navy (DON) Integrated Warfare Architecture Requirements (IWARs) for long term Navy and Marine Corps improvements, is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command, and enables technologies to significantly improve the JCS's Future Joint Warfighting Capabilities. It is managed by the Chief Scientist of the Office of Naval Research and executed by the Commanding Officers (COs) and Technical Directors (TDs) of the Naval Warfare Centers, Navy Personnel Research and Development Center, and Bureau of Medicine and Surgery laboratories.

The vision of the DON S&T strategy is "to inspire and guide innovation that will provide technology-based options for future Navy and Marine Corps Capabilities", where "Innovation is a process that couples Discovery and Invention with Exploitation and Delivery". DON Basic Research, which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental and life sciences, is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in 22 Research Areas. These in turn support the major motivational research focus areas of the Navy and Marine Corps after Next: maritime and space environments that impact operational capability, information science/knowledge management in network-centric operations, sensors and electronic systems for surveillance and tactical applications, energy/power/propulsion for performance gain and sustainment advanced air/surface/undersea and multi-environment Naval platforms design/signature reduction, and superior human performance/training/care of Sailors and Marines.

This portion of the DON Basic Research Program provides participating Navy Centers and Laboratories with funding for basic research to support the execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to naval problems, to

promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and DOD laboratories, in particular the corporate Naval Research Laboratory (NRL).

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within BASIC RESEARCH, Budget Activity 1, because it supports pursuit of fundamental knowledge for the solution of identified military problems.

(U)PROGRAMS PLANS AND ACCOMPLISHMENTS: Navy ILIR procedures were revised in FY00 to further encourage collaboration and the participation of new scientists, to relate the program more closely to the overall DON S&T strategy and the ONR/NRL thrusts, and to strongly encourage projects comprising teams of investigators that are of sufficient scope and risk to have a potentially significant impact on DON priorities. It is expected that this change will be accompanied by additional S&T initiatives between ONR and the Naval Warfare Centers and laboratories in FY02, with the objective of facilitating 'disruptive' approaches to innovation to improve Fleet/Force capabilities and reduce vulnerabilities. ILIR status, results, and management are reported annually to the Deputy Under Secretary of Defense (Science and Technology).

ILIR projects are selected by Center/Lab COs and TDs near the start of each FY through internal competition. Projects typically last 3 years, and are generally designed to assess the feasibility of new lines of research. Successful efforts attract external, competitively awarded funding. Because the Warfare Centers and Labs encompass the full range of naval technology interests, the scope of ILIR topics parallels that of ONR, per the list of ‘Continue’ items in the R2 for 0601153N, Defense Research Science. In FY00, about 50 projects were completed and 80 initiated. Accomplishments in completed projects included higher speed field effect transistors, improved underwater communications (Telesonar), techniques for biochemical decompression and modulation of oxygen toxicity for divers, several new signal processing techniques and algorithms (for antisubmarine warfare, computational fluid dynamics, and communications), new functional, energetic and structural materials and improved understanding of material properties, new designs for optical and acoustic sensors, and advances in fuels, fuel cells, and battery technologies. Examples of new projects that started in FY00 and continued in FY01 include microemulsions for biological decontamination, bistatic acoustic scattering, application of chaos theory to diesel combustion, matched field tracking for feature extraction in ASW, mapping of underwater human sounds, advances in laser and spin-density-wave dielectric materials, a new spectral wave model, data/knowledge mining in R&D and command and control, wideband antenna design for submarine communications, and kinetics of energetic materials.

(U) PROGRAM CHANGE SUMMARY:

FY 2002 RDT& E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research (ILIR)

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	15,544	16,343	16,494
Adjustments from FY 2001 President's Budget:			
Program Adjustment	0		-23
NWCF Rate Adjustments	0	0	-191
Congressional Rescission	-61	-150	0
SBIR Adjustment	-15	0	0
Execution Adjustment	-206		
Non-Pay Inflation Adjustments			11
FY 2002 President’s Budget Submission	15,262	16,193	16,291

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY:

(U) NAVY RELATED RDT&E:
(U) 0601153N Defense Research Science

(U) NON NAVY RELATED RDT&E:
(U) 0601101A In-House Laboratory Independent Research (Army)
(U) 0601101F In-House Laboratory Independent Research (Air Force)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Science

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
0601153N	351,867	377,642	389,829

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:. This program sustains U.S. naval science and technology (S&T) superiority, provides new technological concepts for the maintenance of naval power and national security, and helps avoid scientific surprise, while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). It responds to S&T directions of the Department of the Navy (DON) Integrated Warfare Architecture Requirements (IWARs) for long term Navy and Marine Corps improvements, is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command, and enables technologies to significantly improve the JCS's Future Joint Warfighting Capabilities. It is managed by the Office of Naval Research (ONR) through Program Officers at ONR Headquarters, and the base program of the corporate Naval Research Laboratory (NRL).

The vision of the DON S&T strategy is "to inspire and guide innovation that will provide technology-based options for future Navy and Marine Corps Capabilities", where "Innovation is a process that couples Discovery and Invention with Exploitation and Delivery". DON Basic Research, which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental and life sciences, is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in 22 Research Areas. These in turn support the major motivational research focus areas of the Navy and Marine Corps after Next: maritime and space environments that impact operational capability, information science/knowledge management in network-centric operations, sensors and electronic systems for surveillance and tactical applications, energy/power/propulsion for performance gain and sustainment, advanced air/surface/undersea and multi-environment Naval platforms design/signature reduction, and superior human performance/training/care of Sailors and Marines.

Key aspects of the program are the four ONR Grand Challenges which 'inspire and guide' the direction of research: Naval Battlespace Awareness, Electric Power Sources for the Navy and Marine Corps, Naval Materials by Design, and Multifunctional Electronics for Intelligent Naval Sensors; and the National Naval Responsibilities (NNRs), fields upon which a wide range of fundamental naval capabilities depend, and in which ONR is and likely will remain the principal US research sponsor. NNRs are ratified only after close scrutiny, and currently comprise Ocean Acoustics (starting FY99) and Underwater Weapons (starting FY02) with ongoing assessment of Naval Architecture and Hydrodynamics.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Science

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within BASIC RESEARCH, Budget Activity 1, because it supports pursuit of fundamental knowledge for the solution of identified military problems.

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS: Basic research in each ONR thrust includes a continuing core program to advance the state of knowledge and maintain top talent with interest and skill in naval problems. Core programs are supplemented by initiatives at the ONR/NRL, department, or division level, to explore promising new avenues or take advantage of breakthroughs and potentially disruptive technologies. Initiatives typically last 2 to 5 years. Here we display a selection of significant initiatives, including the potential start of new NNRs; many fewer starts than completions are shown in this submission because of the newness of this approach and the tendency for successful initiatives to spark enhancements in the core, and because of the institution of new processes (e.g., NNRs, new focusing programs in mechanics and materials, reconstruction of many programs) in response to the FY02 start of the FNCs.

	FY00 - $351,867	FY01 - $377,642	FY02 - $389,829
Initiate	• Compact man portable power supplies (USMC) • Control of multiple autonomous vehicles • Bulk Nanoscale Structural Materials • Human behavior in modeling and simulation • Geologic Clutter • Air-Sea Interaction at Extremes • Visualization of uncertainty • Low noise in GaN • Immune response during hemorrhage	• Ultra-wide band LPI comms(USMC) • National Nanoscience Initiative • Computational Materials • Uncertainty in Naval Battlespace Awareness • Physics based modeling • Compliant computing • Malaria Vaccine • Mobile Augmented Reality	• Comms in the MOUT environment (USMC) • Arabian Gulf Dynamics • Dual drain, magnetically controlled FETs • Collective behavior of collaborating robots • NNR in Undersea Weapons • NNRs in Hydrodynamics/Naval Architecture, and Underwater Weaponry • NNR in Precision Time and Time Interval (Proposed) • NNR in diving medicine (Proposed)
Continue	• Mathematics, Computer and Information Sciences • Electronics and electronic materials • Communications • *RF and *EO/IR sensors	• Mathematics, Computer and Information Sciences • Electronics and electronic materials • Communications • RF and EO/IR sensors	• Mathematics, Computer and Information Sciences • Electronics and electronic materials • Communications • RF and EO/IR sensors

	• Battlespace Environments; oceanographic and meteorological processes • Signal Processing • Acoustics • Physical and Chemical sciences • Functional and Structural Materials • Hydromechanics • Naval Architecture • Energetics and Combustion • Combat Casualty Care • Aviation and Undersea Medicine • Cognitive, neural and biomolecular science • Robotics • Marine Mammals • Environmental microbiology • Fuels and power sources • Nonlinear dynamics • Research Instrumentation • Graduate Education and Postdoctoral Fellowships • *HBCU/MI/TCU Education	• Battlespace Environments; oceanographic and meteorological processes • Signal Processing • Acoustics • Physical and Chemical sciences • Functional and Structural Materials • Hydromechanics • Naval Architecture • Energetics and Combustion • Combat Casualty Care • Aviation and Undersea Medicine • Cognitive, neural and biomolecular science • Robotics • Marine Mammals • Environmental microbiology • Fuels and power sources • Nonlinear dynamics • Research Instrumentation • Graduate Education and Postdoctoral Fellowships • HBCU/MI/TCU Education	• Battlespace Environments; oceanographic and meteorological processes • Signal Processing • Acoustics • Physical and Chemical sciences • Functional and Structural Materials • Hydromechanics • Naval Architecture • Energetics and Combustion • Combat Casualty Care • Aviation and Undersea Medicine • Cognitive, neural and biomolecular science • Robotics • Marine Mammals • Environmental microbiology • Fuels and power sources • Nonlinear dynamics • Research Instrumentation • Graduate Education and Postdoctoral Fellowships • HBCU/MI/TCU Education
Complete	• Coastal Benthic Optical Properties • Sandy Duck Nearshore Experimental Series • Compliant substrates, *FET resonant tunneling • Mechanisms of non-freezing cold injury	• High Frequency Benthic Acoustic Scattering • SiC low power switching • Non-linear filtering for tracking • Condition-based maintenance • Mechanisms of hemorrhagic shock	• Shoaling Wave Dynamics via Remote Sensing • Angstrom materials • Volumetric visualization

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Science

SBIR	FY00	FY01 ($6,759K)	FY02
	•	• Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.	•

* RF=Radio Frequency; EO/IR=Electro-Optic/Infrared; HBCU/MI/TCU= Historically Black Colleges and Universities/Minority Institutions/Tribul Colleges and Universities; FET=Field Effect Transistor

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	358,757	381,139	376,751
Adjustments from FY 2001 President's Budget:			
Program Adjustment	0	0	3,737
NWCF Rate Adjustments			1,849
Congressional Rescission	-1,405	-3,497	0
Federal Technology Transfer	-22	0	0
SBIR Adjustment	-5,910	0	0
Execution Adjustment	447		
Non-Pay Inflation Adjustments			492
FY 2002 President's Budget Submission	351,867	377,642	382,829

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable

(U) NAVY RELATED RDT&E:
(U) PE 0601152N In-House Independent Lab Research

(U) NON NAVY RELATED RDT&E:
(U) PE 0601102A Defense Research Sciences (Army)
(U) PE 0601102F Defense Research Sciences (Air Force)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Science

Activities are coordinated through Defense S&T 6.1 Reliance Scientific Planning Groups

(U) SCHEDULE PROFILE: Not applicable.

)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research
(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE
	**	**	66,322

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and FY 2001 were funded in PEs 0602111N, 0602122N, 0602232N, 0602233N, and 0602234N.

(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 project 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. The fleet defense and protection thrust includes technology development related to Air Superiority, Ship based defense, and Unmanned Air Vehicles (UAV's) which is part of the Autonomous Operations (AO) Future Naval Capabilities (FNC). The Expeditionary support work includes Naval Fire Support (NFS), Surveillance and Global Positioning System (GPS), Unmanned Ground Vehicles (UGV's) research, and Unmanned Undersea Vehicles (UUV). The Naval Strike thrust includes technology related to the Time Critical Strike (TCS) FNC, precision strike, and UAV's.

(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 technical advances with possible applications toward solution of specific Naval problems, short of a major development effort.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

(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) for target detection, advanced warhead and fuzzes 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.

	FY00	FY01	FY02 $9,820
Initiate	• Network centric air dominance weapon concepts • Next Generation Dual range Air to Air (A-A) missile concept • Terminal defense concepts for Asymmetric threats	• Physics based lethality prediction for reactive warheads • 8 to 12 um transmitting fibers • Air and sea dominance Technology payoff analyses	• Air and sea dominance weapons technology development.
Continue	• All aspect A-A Radar Seeker based on surface wave missile body. • Counter-Counter Measure (CCM) techniques against Pyrophoric countermeasures. • Point target against ground clutter Infrared (IR) seeker database. • Advanced rocket propulsion technology development. Also known as Integrated High Performance Rocket Propulsion Technology (IHPRPT) program. • Advanced propellant formulation and ingredient research • Temporal sea glint clutter rejection signal processing • Short pulse laser target	• Network centric air dominance weapon • CCM techniques against Pyrophoric countermeasures. • Point target against ground clutter IR seeker database. • Advanced rocket propulsion technology development (IHPRPT). • Advanced propellant formulation and ingredient research • Short pulse laser target detection fuse • High Speed modulators, Multi-spectral IRFPAs	• Physics based lethality prediction for reactive warheads • 8-12 um transmitting fiber • CCM techniques against Pyrophoric countermeasures. • Point target against ground clutter IR seeker database. • Network-centric air dominance weapon. • Advanced rocket propulsion technology development. • Advanced propellant formulation and ingredient research • Multispectral IRFPAs

	detection fuse • Integrated aimed warhead development • Cumulative damage lethality projection. • High Speed modulators, Multi-spectral IRFPAs • Mid IR Quantum Wall (QW) and fiber lasers, photonic transmitters and receivers		
Complete	• Fixed aimed ordnance lethality assessment • Environmentally Adaptive Sensitivity Time Control for Multi-Function Radar for ship defense. • Widebandwidth RF seeker • 3 to 5 um transmitting fibers	• All aspect A-A Radar Seeker • Next Generation Dual range A-A missile • Terminal defense concepts for Asymmetric threats • Temporal Sun Glint Clutter rejection signal processing • Integrated aimed warhead development • Cumulative damage lethality prediction • Mid IR QW and fiber lasers, photonic transmitters and receivers	• Short pulse laser target detection fuse • High speed modulators • Air and sea dominance Technology payoff analyses

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

(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.

	FY00	FY01	FY02 $34,642
Initiate	• Concepts for selective effects based munitions • Develop advanced propulsion techniques for surface launched weapons • Active combustion control techniques for advanced weapons • Cook off model validation study • Navy unique propulsion concepts for UAV operations from surface fleet • UAV mission planning, monitoring control prototype • Define requirements and integrate Radiation hardened codes into database; develop modeling codes for solid propellant boost motors ignition and flight performance; develop Computational Fluid Development (CFD) software for flight performance prediction	• Weapon performance analyses to counter moving targets.	• Development of system and associated sensor processing to enable adaptation and independent actions • Development of secure jam resistant communications links and architecture for networking and multi-vehicle ops. • UAV signature management, ballistic hardening, modular payload, and hybrid-electric power preliminary development • UAV propulsion and power technology development for Navy UAV. • Selective effects weapons components • Prototype aircraft based weapon control data link

Continue	• Advanced sensor, optics, and circuit design based on insect physiology. • Phased array radio frequency (RF) seeker antenna based on Micro Electrical Mechanical Systems (MEMS) phase shifters • Automatic weaponeering tool for real time strike ops • Configurable Automatic Target Recognition (ATR) and Target recognition prediction algorithm for Laser Radar terminal homing seeker • Advanced database structure for precision guided munitions • High Energy Density Materials (HEDM) weaponization • Survivable Explosive penetration • High speed weapon system integration, airframe design, advanced control system research, ordnance investigation, and heat transfer technology investigation.	• Coordination with other agencies in the development of joint UAV Technology Goals and leveraging of technology investments • Concepts for selective effects based munitions • Develop advanced propulsion techniques for surface launched weapons • Active combustion control techniques for advanced weapons • Navy unique propulsion concepts for UAV operations from surface fleet • UAV mission planning, monitoring control prototype • Advanced sensor, optics, and circuit design based on insect physiology. • Phased array RF seeker antenna based on MEMS phase shifters • Automatic weaponeering tool for real time strike ops • Configurable ATR and Target recognition prediction algorithm for Laser Radar terminal homing seeker • High Energy Density Materials weaponization • Survivable Explosive penetration • High speed weapon system integration, airframe design,	• Coordination with other agencies in the development of joint UAV Technology Goals and leveraging of technology investments • Develop advanced propulsion techniques for surface launched weapons • Active combustion control techniques for advanced weapons • Navy unique propulsion concepts for UAV operations from surface fleet • Advanced sensor, optics, and circuit design based on insect physiology. • Phased array RF seeker antenna based on MEMS phase shifters • Configurable ATR and Target recognition prediction algorithm for Laser Radar terminal homing seeker • High speed weapon system integration, airframe design, advanced control system research, ordnance investigation, and heat transfer technology investigation. • High Energy Density Materials weaponization • Survivable Explosive penetration • UAV mission planning, monitoring control prototype • Define requirements and integrate radiation hardened codes into database; develop modeling codes

		advanced control system research, ordnance investigation, and heat transfer technology investigation. • Define requirements and integrate Radiation hardened codes into database; develop modeling codes for solid propellant boost motors ignition and flight performance; develop CFD software for flight performance prediction	for solid propellant boost motors ignition and flight performance; develop CFD software for flight performance prediction High speed multimode ordnance
Complete	• Define UAV Autonomous operations program plan leveraging technologies from industry, government and academia. • Target recognition image processing for Laser Radar seeker • RF seeker clutter resistant Target Detection Device (TDD) • Mission responsive ordnance (MRO) concepts analysis • Counter flow Thrust Vector control (TVC)	• Advanced database structure for precision guided munitions • Cook off model validation study	• Concepts for selective effects based munitions • **Automatic weaponeering tool for real time strike ops**

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

(U) Support for Naval Expeditionary forces ashore: This 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, micro UAV and Unmanned Ground Vehicles (UGV) development to provide improved surveillance/targeting support to marines on the ground, and improved explosive formulations that will greater lethality against NFS type targets.

	FY00	FY01	FY02 $21,860
Initiate	• Develop advanced propulsion techniques for surface launched weapons • Tactical Micro UAV for battlefield surveillance	• Mission responsive warhead for advanced gun system	• Initiate multi-vehicle undersea search and survey and communication link development • Unmanned Ground Vehicles (UGVs) signature management, ballistic hardening, mobility and payload modularity development • Development of Enhanced Targeting and Locating System (ETALS) targeting gyro mechanism
Continue	• Signal processing to provide protection from Global Positioning System (GPS) jamming • Real time tactical target location and coordinate extraction • Gun launched low cost seeker • Energetic gun propulsion technologies • Precise projectile guidance • Automated image and video analysis for tactical UAVs • Micro UAV Flight control development for autonomous	• Signal processing to provide protection from GPS jamming • Energetic gun propulsion technologies • Precise projectile guidance • Real-time tactical target location and coordinate extraction • Automated image and video analysis for tactical UAVs • Micro UAV Flight control development for autonomous operations • Development of UUV technologies for autonomy, ISR	• Signal processing to provide protection from GPS jamming • Real time tactical target location and coordinate extraction • Energetic gun propulsion technologies • Precise projectile guidance • Automated image and video analysis for tactical UAVs • Micro UAV Flight control development for autonomous operations • Development of UUV technologies for autonomy, ISR sensors, and

	operations • Development of Unmanned Underwater Vehicle (UUV) technologies for autonomy, Intelligence Surveillance and Reconnaissance (ISR) sensors, and data fusion. • Research into UUV technologies for group and network behavior, Vehicle communications, standard communication and navigation protocols for UUVs.	sensors, and data fusion. • Research into UUV technologies for group and network behavior, Vehicle communications, standard communication and navigation protocols for UUVs.	data fusion. • Research into UUV technologies for group and network behavior, Vehicle communications, standard communication and navigation protocols for UUVs.
Complete	• Advanced gun launched rocket propellant • Variable output explosive • Explosive response modeling • Gun launched rocket propulsion technologies • Aircraft launched expendable Micro UAV	• Gun launched low cost seeker • Advanced propulsion techniques for surface launched weapons • Tactical Micro UAV for battlefield surveillance.	

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Adjustments from FY 2001 President's Budget:			
Program Restructure			66,527
Minor Program Adjustment			-82
Non-Pay Inflation			+81
NWCF Adjustment			-204
FY 2002 President's Submission	**	**	66,322

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and FY 2001 were funded in PEs 0602111N, 0602122N, 0602232N, 0602233N, and 0602234N.
.

(U) CHANGE SUMMARY EXPLANATION:
(U) Funding: FY02: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.
(U) RELATED RDT&E: This P.E. adheres to Defense S&T Reliance agreements with oversight provided by the JDL.
(U) PE 0602203F (Aerospace Propulsion)
(U) PE 0602302F (Rocket Propulsion and Astronautics Technology)
(U) PE 0602303A (Missile Technology)
(U) PE 0602601F (Advanced Weapons)
(U) PE 0602602F (Conventional Munitions)
(U) PE 0602618A (Ballistics Technology)
(U) PE 0602624A (Weapons and Munitions Technology)
(U) PE 0603004A (Weapons and Munitions Advanced Technology)
(U) PE 0603216F (Aerospace Propulsion and Power Technology)
(U) PE 0603790D (NATO Research and Development)
(U) This is in accordance with the ongoing Reliance joint planning processes.
(U) NAVY RELATED RDT&E:
(U) PE 0601152N (In-house Independent Lab 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)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602114N
PROGRAM ELEMENT TITLE: Power Projection Applied Research

(U) PE 0603114N (Power Projection Advanced Technology)
(U) PE 0603640M (Marine Corps Advanced Technology Demonstration)
(U) NON NAVY RELATED RDT&E:
(U) PE 0603763E (Marine Technology)
(U) PE 0603739E (Advanced Electronics Technologies)
(U) PE 0602702E (Tactical Technology)
(U) PE 0602173C (Support Technologies – Applied Research)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: Force Protection Applied Research

COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Force Protection Applied Research	**	**	117,072

** The Science and Technology Program Element (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0602111N, 0602121N, 0602122N, 0602232N, 0602233N, 0602234N, 0602270N, and 0602633N

MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with all naval platforms (surface e.g. electric warship technologies, including directed energy, subsurface, terrestrial and air) and the protection of those platforms. The goal of this project is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement to resist and control damage while preserving operational capability.

The technology areas specific to the platforms themselves are: signature control, structural systems, power and automation, and propulsion and dynamic control. Signature control addresses electromagnetic (EM), infrared (IR) and acoustic signature tailoring. Structure addresses development of new structural system approaches for surface ships and submarines, including the management of weapons effects to control structural damage and the improvement of structural materials. The power and automation area addresses development and automation of propulsion, electrical and auxiliary systems for efficient operation and fight through capability. The propulsion and dynamic control area addresses hydrodynamic technologies, including the signature aspects of the hull-propulsor interface.

Although it also applies to platform protection, the technology area specific to force protection is the development of individual or multi-spectral (Electro-Optic (EO), IR, Radio Frequency (RF), EM, visual and acoustic) sensors and associated processing. To defend the force from current and advanced threats in an at-sea and littoral environment, sensor systems capable of over-the-horizon multi-spectral detection and distribution of specific “weapons laying” information throughout the Theater are required. Also required are optimization of sensor and shooter assignment based

upon threat priority and weapon systems capable of early engagement to provide a depth-of-fire to increase probability of kill against all targets threatening the force.

Aircraft Technology develops manned and unmanned airborne platform technologies for future joint warfighting capabilities to promptly engage regional forces in decisive combat on a global basis. These technologies enable employment of a range of capabilities more suitable to actions at the lower end of the full range of military operations, allowing achievement of military objectives with minimum casualties and collateral damage.

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

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

PROGRAMS PLANS AND ACCOMPLISHMENTS:

Ship & Submarine Hull, Mechanical, & Electrical (HM&E)	**FY00**	**FY01**	**FY02** **$56,064**
Initiate	• Quiet Electric Drive -Reduced scale control demo • Topside Structures & Signature Control - Integrated topside signature reduction • Electromagnetic Signature Control -Alternative Uses for Degaussing/Deamping	• Advanced Machinery Support System - ¼ scale machinery raft demo • Electromagnetic Signature Control - Active and passive degaussing/ deamping control techniques • Hull Structures	• Automated Damage Control - Advanced Damage Counter-measures • Acoustic Signature Control - Surface Ship Acoustic Control • Electromagnetic Signature Control - Advanced Degaussing/Deamping - Near Field Deamping • Enabling technologies for all

	• Hull Structures - Hull life assurance methodology • Weapons Effects - Shock/acoustic mount design methods - Improved magazine protection - Improved survivability to air and underwater threats • Maneuvering & Seakeeping - Low-signature turning and maneuvering predictions - Validation of advanced maneuvering prediction codes • Integrated Hull/Propulsor - Noise model for reduced complexity propulsors - Minimal cavitation propulsor designs - Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Advanced Electrical Systems - Advanced energy management and control concepts - High Voltage Switch technology - High Voltage Passive Component technology	- Double-hull signature reduction technologies for electromagnetic signatures - Joining major components of Hybrid Composite Hulls - Hybrid Composite Hull response to explosive load - Reliability assessment for composite and hybrid composite hulls - Small scale acoustic testing of double hull • Integrated Hull/Propulsor - End-to-end hydrodynamic signature prediction capability - Assessment of non-rotating propulsion devices - Stern Flaps • Advanced Electrical Systems - Solid-state technology for high power distribution systems	Electric Platforms (DoD Initiative) • Advanced Electrical Systems -Electric Actuators and Auxiliary System Components
Continue	• Quiet Electric Drive • Advanced Machinery Support System	• Quiet Electric Drive • Advanced Machinery Support System	• Quiet Electric Drive • Advanced Machinery Support System

	• Automated Damage Control • Topside Structures & Signature Control • Acoustic Signature Control • Electromagnetic Signature Control • Hull Structures • Weapons Effects • Maneuvering & Seakeeping • Integrated Hull/Propulsor • Advanced Electrical Systems	• Automated Damage Control • Topside Structures & Signature Control • Acoustic Signature Control • Electromagnetic Signature Control • Hull Structures • Weapons Effects • Maneuvering & Seakeeping • Integrated Hull/Propulsor - Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Advanced Electrical Systems	• Automated Damage Control • Topside Structures & Signature Control • Acoustic Signature Control • Electromagnetic Signature Control • Hull Structures • Weapons Effects • Maneuvering & Seakeeping • Integrated Hull/Propulsor - Stern Flaps - Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Advanced Electrical Systems

Sensors & Associated Processing	**FY00**	**FY01**	**FY02** **$14,278**

Initiate	• Infrared (IR) Search and Track (IRST)/Laser Detection and Ranging (LADAR) For Non Cooperative Target Recognition (NCTR) • Ship based IRST • Spectrally Balanced Decoy Materials against Advanced IR Surface-to-Air and Air-to-Air Missiles (SAMs-AAMs) • Shipboard Laser Acquisition System for Self protection	• 3rd Generation Airborne IRST For E-2C • Integrated Electro-Optic (EO)/IR ship self-protection	• MSW Missile Warning System • EO/IR Laser Jammer for TACAIR • Shipboard EO/IR Closed loop Self Protection • EO/IR Self Protection for Small Ground Vehicles • EUT++ (Higher Power/BW) • EO/IR Laser-based Jammer • Imaging IR Countermeasures • Long wave IR decoy Material • Electrical IR Decoy Launcher
Continue	• Multicolor IR Threat Warning for tactical missile launch detection • Electrical IR Decoy Launcher • Hyperspectral/Imaging for Surveillance and Targeting (HI-STAR)	• Ship based IRST • Shipboard Laser Acquisition System for self-protection • Electrical IR Decoy Launcher	• 3rd Generation Airborne IRST For E-2C • Ship based IRST • Electrical IR Decoy Launcher • Integrated EO/IR ship-self protection
Complete	• E-2C Surveillance IRST Sensor • Shipboard IR decoy countermeasures against modern Air-to-Surface Cruise Missile seekers	• Spectrally Balanced Decoy Material against Advanced IR SAMs-AAMs • Multicolor Threat Warning for tactical missile launch detection • Hyperspectral/Imaging for Surveillance and Targeting (HI-STAR)	• Shipboard Laser Acquisition System

Missile			

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: Force Protection Applied Research

Defense/Directed Energy	**FY00**	**FY01**	**FY02** **$33,804**
Initiate	• Risk reduction relating to Distributed Collaborative Engagement & Network Centric Warfare and enhanced command decision		• Affordable Components for Wide Area Protection • Infrared Sensors • Littoral Affordability • Directed Energy and Advanced Electric Weapons • Theater Sensor Resource management technology
Continue		• Technologies to Enhance Command Decision - Development of decision aid and sensor technologies designed to enhance Command decision to engage	• Advanced Methods for Air Defense to include command decision • Composite Threat Evaluation and Weapons Assignment (TEWA) • Advanced Energetics and Payload Delivery Technologies

Navy Air Vehicle Technology	**FY00**	**FY01**	**FY02** **$10,288**
Initiate	• Prediction of dynamic load effects on structural fatigue life for 1) rotary- and 2) fixed-wing aircraft. • Development and real-time hardware demonstration of flight systems damage and failure diagnostics /		

	prognostics approaches for reconfigurable flight control, condition-based maintenance, and improved pilot situational awareness to improve safety, survivability, and affordability.		
Continue	• Abrupt Wing Stall (AWS) Modeling • Corrosion-Fatigue Interaction • Shipboard Handling of V/STOL • Adaptive and Intelligent • Flight Control System (FCS) Simulation Study • Adaptive Fault-tolerant Flight Control System for Ship-Board Auto-Land	• Abrupt Wing Stall (AWS) Modeling • Dynamic load effects on structural fatigue • Corrosion-Fatigue Interaction • Automated/Assisted Maneuvering Flight Control System (FCS) Development and Simulation • Adaptive Fault-tolerant Flight Control System for Ship-Board Auto-Land • Development, Simulation, and Real-Time Hardware Demo of Flight Systems Damage & Diagnostics	• Dynamic load effects on structural fatigue • Automated/Assisted Maneuvering Flight Control System (FCS) Development and Simulation • Adaptive Fault-tolerant Flight Control System for Ship-Board Auto-Land • Development, Simulation, and Real-Time Hardware Demo of Flight Systems Damage & Diagnostics
Complete	• CFD methods validated in predicting quasi-steady flow fields, shockwave/flow separation interactions and boundary layer transition effects. Validated several design concepts using CFD and the wind tunnel. Correlated buffet onset with flight and wind tunnel. Identified wing	• Initial non-real-time simulation of adaptive control for shipboard auto-land of unconventional aircraft • Intelligent and Adaptive Guidance and Control Law Simulation Study for Automated/Assisted Maneuvering • Development of design guidelines & procedures to	• Non-Real-Time Simulation of Automated/Assisted Maneuvering Approaches to improve lethality and survivability for Naval Mission tasks. • Non-Real-time individual component simulation testing for flight systems damage and failure diagnostics / prognostics approaches for reconfigurable

	mid-span location as the most susceptible to AWS.	prevent AWS	flight control, condition-based maintenance, and improved pilot situational awareness • AWS flow model development, demonstration of aircraft design guidelines and figures

Underwater Platform Self Defense	**FY00**	**FY01**	**FY02** **$2,638**
Initiate			• Next Generation Countermeasures (NGCM)
Continue	• Anti-torpedo Torpedo component development in propulsion, Microelectromechanical Systems (MEMS), and Guidance and Control (G&C)	• Anti-torpedo Torpedo component development in propulsion, MEMS, and G&C	• Anti-torpedo Torpedo (ATT) component development in propulsion, MEMS, and G&C

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: Force Protection Applied Research

PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	-
Adjustments from FY 2001 President's Budget:			
PE Restructure			82,147
Minor Adjustments			-101
NWCF Adjustments			-99
Non-Pay Inflation Adjustment			125
Additional Program Adjustment			35,000
FY 02 PRESBUDG Submission	**	**	117,072

** The Science and Technology Program Element (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0602111N, 0602121N, 0602122N, 0602232N, 0602233N, 0602234N, 0602270N, and 0602633N

CHANGE SUMMARY EXPLANATION:

Funding: Not Applicable.
Schedule: Not Applicable.

OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
PE 0601153N (Defense Research Sciences)
PE 0603123N (Force Protection Advanced Technology)
PE 0603502N (Surface and Shallow Water MCM)
PE 0603513N (Shipboard System Component Development)
PE 0603514N (Ship Combat Survivability)
PE 0603553N (Surface Anti-Submarine Warfare)
PE 0603561N (Advanced Submarine Systems Development)
PE 0603563N (Ship Concept Advanced Design)
PE 0603564N (Ship Preliminary Design and Feasibility Studies)
PE 0603573N (Advanced Surface Machinery Systems)
PE 0603721N (Environmental Protection)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602123N
PROGRAM ELEMENT TITLE: Force Protection Applied Research

PE 0603726N (Merchant Ship Naval Augmentation Program)
PE 0604558N (New Design SSN Development)
PE 0604561N (SSN-21 Development Program)

NON-NAVY RELATED RDT&E:
PE 0602270A (Electronic Warfare Technology)
PE 0602204F (Aerospace Avionics)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0603569E (DARPA S&T Program)

SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E, N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Marine Corps Landing Force Technology	17,233	12,180	31,248

(U) The Marine Corps is tasked to develop, in conjunction with the Navy, Army, and Air Force, those phases of amphibious operations that pertain to tactics, techniques, and equipment used by the landing force. It is organized into five Amphibious Expeditionary Warfighting Capabilities. These Amphibious Expeditionary Warfighting Capabilities are: Maneuver, Firepower, Command and Control, Logistics, and Training and Education.

(U) The primary objective of this PE is to develop and demonstrate the technologies needed to meet the Marine Corps' unique responsibility for amphibious warfare and subsequent operations ashore. This PE provides the knowledge base to support Advanced Technology (6.3) and is the technology base for future amphibious/expeditionary warfare capabilities. This PE supports the Concept Based Requirements System of the Marine Corps Combat Development Command and responds directly to the USMC Science and Technology process. Due to the number of efforts in this PE, the programs described are representative of the work included in this PE.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within APPLIED RESEARCH, Budget Activity, because it investigates technical advances with possible applications toward solution of specific Naval Amphibious Expeditionary Warfighting problems, short of a major development effort.

FY 2002 RDT&E, N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

MANEUVER	FY00 $6,634	FY01 $2,436	FY02 $1,393
Initiate	• Integration of laser illuminators with airborne multi-spectral mine detector	• Airborne testing of TFMC • Multi-sensor data fusion algorithm development • Unmanned ground vehicle technology assessment • Lightweight armor/structural materials development	• Lightweight vehicle power technologies • Advanced vehicle mobility
Continue	• Field testing of Tunable Filter Multi-spectral Camera (TFMC) • Algorithm development for automatic target recognition/mine detection • Transition of data to Coastal Battlefield Reconnaissance and Analysis (COBRA) program Mine Countermeasures(MCM) Future Naval Capability (FNC)efforts • Light vehicle survivability studies and urban terrain modeling	• Integration of laser illuminators & TFMC • Algorithm development for automatic target recognition/mine detection • Light vehicle survivability studies and urban terrain modeling	• Test-bed flight testing of TFMC and laser illuminators • Algorithm development for automatic target recognition/mine detection • Light vehicle survivability development • Lightweight armor/structural materials development
Complete	• Acceptance lab testing of TFMC, hybrid laser and laser diode array illuminators	• Static field testing of TFMC • Transition of data to COBRA program/MCM FNC efforts	• Urban mobility modeling • Unmanned ground vehicle technology assessment

FY 2002 RDT&E, N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

FIREPOWER	FY00 $1,553	FY01 $1,828	FY02 $6,940
Initiate	• Multi Role Radar System (MRRS) integration study		• Evaluate alternative methods of integration of low cost mobile sensor and missile system components into advanced combat systems • Identify required command and control integration risks
Complete	• TEAMS Modeling & simulation of sensor to shooter high-level architectureT-3 connectivity for Testing Evaluation Assessment Modeling and Simulation (TEAMS) facility	• MRRS integration study Transitions to Missile Defense (MD) FNC for inclusion in 6.3 MD FNC program	

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

COMMAND AND CONTROL	FY00 $3,877	FY01 $2,411	FY02 $3,748
Initiate			• Mobile Networking: Begin development of advanced expeditionary networking management tools and protocols in support of Information Distribution Future Naval Capability (FNC) and JTRS. Initiate conformal vehicle antenna effort in support of JTRS. • Intel: Reinitiate TDOA effort. Examine methods of data file size reduction such as feature extraction. • Computer Technolgies: Initiate high-density date storage applied research program. Build initial prototype device for testing purposes. • Computer Software: Initiate Advanced Computing Technology to examine methods of distributed database synchronization and statistical trend analysis.
Continue	• Continued development of Marine Corps specific	• Devise JTRS Software Communications Architecture	• Mobile Networking: Continue JTRS architecture and modeling

	requirements and network modeling capabilities in support of the Joint Tactical Radio System (JTRS) Program • Developed JTRS wideband wearable antennas for use with man-pack and hand-held variants based on FY99 feasibility studies. • Two-station, PC-based, portable time-difference of arrival (TDOA)—define architecture, research processing and location techniques and initiate development of processing package. • PC-based Mobile Direction Finding (MDF)—research automated classification methods; research real-time antenna orientation method; develop architecture; initiate prototype development and system integration	version 1.0 Standard • Inject Marine Corps specific requirements into and perform network modeling of proposed JTRS Program wide-band network waveforms (WNW); begin JTRS WNW standardization process • Prototype and system development of JTRS wide-band wearable antennas. Develop Cooperative Research and Development Agreement • Continue TDOA processing package development and technology demonstrations. • MDF-complete prototype development and system integration; demonstrate system	efforts. Select WNW standard 1.0. • Intel: Continue MDF refinement in concert with TDOA effort.
Complete			• Intel: Transition selected capabilities to Advanced Technology Development for Team Portable Collection System

			• Mobile Networking: JTRS Wearable Antenna: perform antenna pattern analysis for different antenna/Marine orientations. Write Final Report.

LOGISTICS	FY00 $3,274	FY01 $2,436	FY02 $2,167
Initiate	• Initiate efforts to expand logistics capabilities to accommodate emerging concepts of employment and evolving sea base platforms by developing Tactical Logistics Model	• Packaging initiatives to conform to seabased, unitized loading, air delivery systems characteristics trade off analysis	• Investigate Expeditionary Energy technologies and alternative power sources to reduce logistics demand
Continue	• Continued system development of Logistics Information Systems, focusing on decision support tools and data warehousing • Continued corrosion and materials research and testing with insertion of technologies in Light Armored Vehicle/Medium Tactical Vehicle Replacement/Logistics Vehicle System (LAV/MTVR/LVS) • Continue development of fuel quantity sensors • Continued use and testing of	• Logistics Information System development, assessment of military utility. • Continue development and testing of fuel quality and quantity sensors, fuel reconditioning capabilities • Continue development of Onboard Vehicle Refueler Communication System and its link to the Logistics Information System	• Continue development and testing of fuel automated quantity sensors with link to Logistics Information System • Continue development of Onboard Vehicle Refueler Communication System and its link to the Logistics Information System. • Add software modules for Logistics Information System. • New materials for reduced tare and flexible packaging

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

	Tactical Logistics Model		
Complete		• Finalize software coding on Tactical Logistics Model • Complete corrosion and materials research for inclusion in Total Ownership Cost FNC starting in 02	

TRAINING AND EDUCATION	FY00 $1,895	FY01 $2,801	FY02 $2,000
Initiate	Marine Air Ground Task Force Federated Object Model (MAGTF FOM) • Develop MAGTF FOM) Ver. 0.1 • Develop scenario for FOM Demo • Identify Demo options for Ver. 1.0 • Identify interface Control Documents • Describe system behavior • Identify Real-Time Platform-Level Reference (RPR) attributes • Develop Federation Agreements /Interface Document (FAID) Tactical Decision-Making Games (TDG)	MAGTF FOM • Develop Supportability Estimates for incorporating the MAGTF FOM into training systems (emerging and existing) • Determine Tech. Feasibility for incorporation of MAGTF FOM into existing training system. • Transition Plans to go to 6.3 and programs (e.g., Closed-Loop Artillery Simulations System (CLASS), Combat Vehicle Appended Trainer (CVAT), etc.) • TDG Close Combat-Marine Prototype design • Beta Prototypes on MAGTF XXI	MAGTF FOM • Transition to MARCORSYSCOM (PMTRASYS) for MAGTF FOM 1.0 development and Proof of Concept demonstration.TDG • Transition to Training and Education 6.3.

	• Tactical Decision-Making Games MAGTF XXI Prototype. Simulation Based Acquisition (SBA) Toolkit • Survey of logistics throughput models for possible inclusion in toolkit	• Testing on MAGTF XXI • Development of After Action Review capability for MAGTF XXI. • Transition Plan to go to 6.3	
Continue	MAGTF FOM • Conduct Design Reviews to ensure all requirements for the different platforms are addressed • ID/Approve RPR attributes • Develop a draft Concept of Demonstration Plan • Develop a draft Baseline Interoperability Spec **T**DG • Develop an Alpha Prototype for evaluation. SBA Toolkit • Develop models for virtual urban proving ground	MAGTF FOM • Develop MAGTF FOM Ver. 0.2 and follow-on ver. To Ver. 1.0 • Finalizing the Baseline Interoperability Spec • Review the draft Concept of Demonstration Plan • Develop Federation Agreements /Interface Document (FAID) • Develop Supportability estimates report • Develop technology feasibility report • Develop Transition Plan TDG • Evaluate Tactical Decision-Making Games MAGTF XXI Beta Prototype • Develop Control Features on Marine 2000 • Develop Scenarios/Missions on	

		Marine 2000 • Develop Regiment-Level Commands Marine 2000. • Develop Transition Plan SBA Toolkit • Integration of mine blast prediction and survivability models into dynamic modeling toolkit	
Complete	MAGTF FOM • Draft MAGTF FOM Version 0.1 released for staffing • Scenario development • Demo options approved TDG • Alpha Prototype. SBA Toolkit • Survey of potential mine blast prediction and survivability models for possible integration into dynamic modeling toolkit. • Urban obstacle characterization	MAGTF FOM • Scenario Developed • Release Ver. of MAGTF FOM 0.X for final staffing • Detailed Concept of Demo Plan approved • Baseline Interoperability Spec approved • Transition Plans approved TDG • Transition MAGTF XXI to MC University. • Tactical Decision-Making Games Marines 2000 Alpha Prototype • 6.3 Transition Plan approved SBA Toolkit • Survey of logistics throughput models	

		• Demonstrate models for urban proving ground • Transition Plan approved	
SBIR	FY00	FY01 $268	FY02
		• Portion of FY01 extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 328	

Littoral Combat and Power Projection Future Naval Capability	FY00	FY01	FY02 $15,000
Initiate			• Initiate Littoral Combat Future Naval Capability to provide combatant commanders with scalable, interoperable, combined arms Marine Air Ground Task Forces; Naval Expeditionary Forces ready to fight and prevail, and shape the national security environment.

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

			Developmental efforts will optimize the Marine Corps' operating forces, support and sustainment base, and its unique capabilities to respond to the complex spectrum of crises and conflicts.

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	17,437	9,793	11,539
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
Congressional Plus-ups		+2,500	
Congressional Rescission	-68	-113	
NWCF Rate Adjustment			-55
SBIR/STTR Transfer	-259		
PE Rebalance			+4,740
Non-Pay Inflation			+24
Program Adjustment	+123		+15,000
FY 2002 President's Submission	17,233	12,180	31,248

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:

(U) This program adheres to Tri-Service Reliance Agreements in Chemical/Biological Defense; Command, Control and Communications; Conventional Air/Surface Weaponry; Electronic Devices; Ground Vehicles; Ships and Watercraft; Manpower and Personnel; and Training Systems.

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0204163N (Fleet Communications)
(U) PE 0602235N (Common Picture Applied Research)
(U) PE 0602782N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0603782N (Mine and Expeditionary Warfare Applied Research)
(U) PE 0603235N (Common Picture Advanced Technology)
(U) PE 0206623M (Marine Corps Ground/Supporting Arms Systems)
(U) PE 0603640M (Marine Corps Advanced Technology Demonstrations)
(U) PE 0603612M (Marine Corps Mine/Countermeasures Systems)
(U) PE 0603635M (Marine Crops Ground Combat/Support System)
(U) PE 0206313M (Marine Air Ground Task Force Command/Control/Communications/Computers & Intelligence)

(U) NON NAVY RELATED RDT&E:
(U) PE 0603004A (Weapons and Munitions Advanced Technology)
(U) PE 0603005A (Combat Vehicle and Automotive Advanced Technology)
(U) PE 0603606A (Landmine Warfare and Barrier Advanced Technology)
(U) PE 0603607A (Joint Service Small Arms Programs)
(U) PE 0603619A (Landmine Warfare and Barrier Advanced Demonstrations)
(U) PE 0603772A (Battlefield Force Integrations)

FY 2002 RDT&E, N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) PE 0604710A (Night Vision Systems-Engineering Development)
(U) PE 0604808A (Landmine Warfare and Barrier Engineering Development)
(U) PE 0602301E (Computing Systems and Communications Technology)
(U) PE 0602702E (Tactical Technology) Technology Demonstrations (ATDs)
(U) PE 0603226E (Experimental Evaluation of Major Innovative Technologies)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	
	**	**	83,557	CONT.

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work descried in FY 2000 & 2001 was funded in PE(s) 0602232N, 0602270N, 0602233N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE supports Naval missions ranging from expeditionary and littoral warfare to theater level collaborative planning and execution. The need is to develop Common Picture technologies that provide a capability to do theater wide collaborative target tracking and situational awareness for major Command Centers, surface, subsurface, space and air platforms including the warfighter ashore. Applied research in this program focuses on the location, extraction, fusion/multi-source integration and management of relevant, time sensitive, critical information. This information is tailored for distribution across robust Naval communications/ information networks to decision makers at various Command echelons. Technology developments within this PE include: high assurance information systems; advanced/asymmetric networking protocols; dynamic bandwidth and network management techniques; network centric battle management architecture and infrastructure; knowledge based software agents; image processing and exploitation; multi-source integration; interoperable cooperative engagement networking; advanced decision support tools; optimized resource management; interactive collaborative tools; advanced visualization displays, intuitive human computer interaction, virtual and augmented reality and multi-modal interaction with very large screen wall-displays; and Naval fires coordination, deconfliction and cueing for combat systems. The major goal of this effort is to provide the Navy with the capability for future Battle Space Dominance through a seamless information network of warfighting systems that gather, process, disseminate and use information to formulate a consistent common operational/tactical picture across Command echelons. This program develops technologies in support of Future Naval Capabilities (FNCs) including: Knowledge Superiority and Assurance (KSA), Missile Defense, Littoral Anti-Submarine Warfare and Platform Protection.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

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

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

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

- (U) COMMUNICATION AND NETWORKS. This area supports development of key wireless communications network technologies for air, ship, submarine and land platforms that are critical to the performance and robustness of Naval communications networks. Technology developments include Quality of Service (QoS) protocols, bandwidth and network management techniques for robust highly dynamic environments, interoperable wireless networks for secure communications, protocols, and bandwidth and network management techniques that can effectively manage and allocate bandwidth across tactical and theater levels in support of wireless network centric operations.

COMMUNICATION AND NETWORKS	FY00	FY01	FY02 ($10,580)
Initiate	• Dynamic Networking for Tactical Data Links • Multicast Congestion Control	• Networking of Phased Arrays • Real Time Composite Networking • Mobility Management for Heterogeneous Networks	• Underwater Surveillance Data Link Network • Asymmetric Secure Network Access for Vulnerable Assets
Continue	• Expeditionary Warfare Mobile Networking	• Dynamic Networking for Tactical Data Links • Multicast Congestion Control	• Dynamic Networking for Tactical Data Links • Networking of Phased Arrays • Real Time Composite Networking • Mobility Management for Heterogeneous Networks • Interoperable networks for Secure Communication

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

Complete	• High Performance Networking	• Expeditionary Warfare Mobile Networking	• Multicast Congestion Control

• (U) MULTI-SOURCE INTEGRATION AND COMBAT IDENTIFICATION(CID): This thrust focuses on development of Navy's Surface & Aerospace needs for multi-source integration (MSI), fusion, systems architecture, automated sensor management and algorithms to fuse, filter and correlate on-board sensor and off-board battlespace information from tactical data links, satellite communications and interoperable cooperative engagement networks that support Missile Defense Operations. MSI technologies such as platform level, theater level and Combat Identification are currently planned for transition programs for E-2C Airborne Early Warning Aircraft, EP-3 Aircraft, United States Marine Corps (USMC), AEGIS and Amphibious Assault Platforms.

MULTI-SOURCE TECHNOLOGY	**FY00**	**FY01**	**FY02 ($11,453)**
Initiate	• Combat Identification (ID) Technology For Air Defense	• Affordable Ground Based Radar • System Resource Manager for Missile Defense Systems • US/UK Data Fusion Technology for Interoperability	
Continue	• Platform (E-2C) Multi-Source Integration • Corporate Engagement Capability (CEC) P3I/Advanced Sensor Networking Technology (ASNT)	• Platform (E-2C) MSI • CEC P3I/ASNT • Combat ID Technology For Air Defense	• Platform E2-C MSI • CEC P3I/ASNT • Combat ID Technology for Air Defense • Affordable Ground Based Radar • System Resource Manager for Missile Defense Systems • US/UK DATA Fusion Technology for Interoperability

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

- (U) NETWORKED COMMAND, CONTROL & COMBAT SYSTEMS. The focal point for this effort is development of technologies to network geographically dispersed warfighting elements (computing platforms and systems) to provide a Force multiplier effect through sharing, integrating and correlation of information, thereby improving speed of command and self synchronization of forces in the execution of Naval misions. Technology developments include: dependable information assurance that provides for timely quality of service (QoS), and secure delivery of data; image processing and information exploitation to enhance target detection and identification; visualization and information management technologies that encompass the extraction, distribution, management and presentation of information; tactical decision aids to assist geographically dispersed human decision makers in mission planning (i.e.; task-to-fleet resource allocation, weapon-to-target allocation, route planning and target deconfliction, target tracking and prediction, real-time retargeting and resource allocation); interactive collaborative-planning technologies; and interoperable C2 and Combat System's architecture, interconnected through middleware and software wrappers, to provide a network centric environment capable of operating in real- and non real-time.

NETWORKED COMMAND, CONTROL & COMBAT SYSTEMS	FY00	FY01	FY02 ($23,330)
Initiate	• Collaborative Cryptographic Protocols • Synthetic Aperture Radar (SAR) to Map Registration • Theater Battle Management • Collaborative Mission Planning Testbed • Consistent Network Information System(CNIS)	• Secure Architecture for Intelligent Agents • Intrusion Detection Algorithms • Distributed Computing and Collaboration Framework	• Multimodal Battlefield Interaction • Distributed Situation Assessment • Visualization of Uncertainty • Active Network Defense in Depth • Science and Technology Research In Distributed Experiments (STRIDE) • Assisted Decision Making in a

			Network Centric Environment
Continue	• Rules of Engagement • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Intelligent Information Exploitation and Retrieval • Image Processing Exploitation (IPEX) • Combat Systems Technology • Airborne Battle Management • Case Based Reasoning • Distributed, Interactive Rehearsal Environment • Land Attack Pre-designation • Real Time Execution Decision Support (REDS) • Interactive Planning, Monitoring and Re-planning	• Collaborative Cryptographic Protocols • Theater Battle Management • Collaborative Mission Planning Testbed • Rules of Engagement • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Intelligent Information Exploitation and Retrieval • Combat Systems Technolog Airborne Battle Management • Land Attack Pre-designation	• Secure Architecture for Intelligent Agents • Intrusion Detection Algorithms • Distributed Computing and Collaboration Framework • Collaborative Cryptographic Protocols • Theater Battle Management • Rules of Engagement • Collaborative Mission Planning Testbed • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Combat Systems Technology • Airborne Battle Management • Land Attack Pre-designation
Complete	• Information Assurance Software Spec. • Multi-level Secure Workflow Architecture • Distributed Data Fusion • Real-time Cockpit Imagery • Head Motion Tracker	• SAR to Map Registration • IPEX • CNIS • REDS • Interactive Planning, Monitoring and Re-planning • Distributed, Interactive	• Intelligent Information Exploitation and Retrieval

		Rehearsal Environment • Case Based Reasoning	

(U) PLATFORM AWARENESS AND PROTECTION. Current small platforms (both surface and airborne) have no situational awareness or self-protection against threat missile weapon systems. The goal of this effort is to provide for the ability of these platforms to achieve very accurate hemispheric direction-finding. This capability when Integrated with emitter identification, Low Probability of Intercept detection systems will provide netted targeting information and cueing that allows for platform self protection against various threat systems. Developments include utilization of small compact digital electronics, integrated circuits and digital synthesis technology.

PLATFORM AWARENESS AND PROTECTION	FY00	FY01	FY02 ($1,912)
Initiate		• Advanced Anti-Ship Cruise Missile (ASCM) Techniques	• Compact Small Platform Electronic Attack • Compact Small Platform Situational Awareness
Continue	• Force Level Simulation	• Force Level Simulation	• Advanced ASCM Techniques
Complete	• Radio Frequency (RF) & Infrared (IR) Scene Assessment		• Force Level Simulation

• (U) DECISION SUPPORT SYSTEMS. This effort supports the KSA FNC with particular emphasis on the development of operational capabilities in: common consistent knowledge; distributed collaborative planning and execution; and time sensitive decision making. Focused efforts include: Decision aids and Collaborative tools and technologies to aid the tactical decision maker in his mission planning, rehearsal, plan-execution, mission monitoring, re-planning and re-targeting of assets. The network centric environment requires decision aids and decision support techniques that are

distributive, collaborative and interactive among multiple decision makers. Additional technologies include knowlwdge wall displays for situational awareness, environmental visualization software, optimization algorithms for selecting the appropriate resources for executing planned missions, browser based collaboration tools, and real time, distributed, collaborative, mission planning software.

DECISION SUPPORT SYSTEMS	FY00	FY01	FY02 ($26,769)
Initiate			• Knowing What We Know (KNOW) • STORYMAKER Precision Geolocation • Human Alerting & Interuption Logistics (HAIL-SS) • Demonstration of a Scalable Architecture for Common Undersea Picture (CUP) • Environmental Visualization (ENVIRIZ) • Sea Combat Module for Embarking Staff (SCCM) • Comprehensive, Analysis, Real-Time Execution in Joint Air operations (CARTE) • Image Processing and Exploitation Architecture (IPEX) • Real-Times Executable Decision Support (REDS) • Integrated Marine Multi-Agent Command and Control Technology

			• Sea Combat Commanders Module for Embarked Staff (SCCM) • eXtensible Tactical C4I Framework (XTCF) • Air Operations Decision Support (AODS) • Joint Mission Planning System - GATOR Surface Assault Planning • Analytic Support Architecture (ASA) • Cryptologic Mgmt & Analysis Support Sys (CMASS) • Middleware & DII COE Interoperability • Course of action Analysis Tool for Identifying Mobile Time Sensitive Targets (CAAT). • Integrated Decision Support System Product Suite (IDPS) • Universal Data Exchange Manager for Net-Centric Warfare (UDEM) • Tomahawk Land Attack Naval Fire Control System Decision Support Capability • Knowledge Web Technologies (KWT) • Virtual information Center for Open Source Requirements (VICTORII)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

- (U) Human Computer Interface: The goal of this area is to improve platform, task force and battle group operations by developing human-centric decision support factors technology for incorporation into operational systems. General objectives of the area are to enhance human performance effectiveness, improve decision support and decision-making collaboration, improve human-centered design and accelerate insertion of advanced HFE technology into existing and new weapons systems.

Human Computer Interface	FY00	FY01	FY02 ($9,513)
Initiate	• Technology for Command and Control Collaboration • Human Agent Collaboration Architecture	• Hybrid Collaborative Environments • Dynamic task Allocation • Interfaces for Information Analysis • Intelligent Mission Monitoring • Geo-Plot Decluttering • Command 21 • Perspective View Technology • User-centered Design Interaction	• Generative Decision Support Architecture • Effects Based Models for Intelligent Surveilance Reconnaissance • Optimization Algorithms for Joint Operations Center • Knowledge Visualization • Human Centric Decision Support
Continue	• Adaptive Architecture for Command and Control • Advanced Audio • Attention Management Tools • Control Systems Supervisory Support	• Technology for Command and Control Collaboration • Human Agent Collaboration Architecture • Adaptive Architecture for Command and Control • Advanced Audio	• Hybrid Collaborative Environments • Dynamic task Allocation • Interfaces for Information Analysis • Intelligent Mission Monitoring • Geo-Plot Decluttering • Command 21

			• Perspective View Technology • User-centered Design Interaction • Technology for Command and Control Collaboration • Human Agent Collaboration Architecture • Adaptive Architecture for Command and Control • Advanced Audio
Complete	•	• Attention Management Tools • Control Systems Supervisory Support	

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
Program Restructure			73,557
NWCF Adjustments			
Program Adjustment			10,000
FY 2002 OSD Submission	**	**	83,557

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work descried in FY 2000 & 2001 was funded in PE(s) 0602232N, 0602270N, 0602233N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Science)
(U) PE 0602271N (RF Systems Applied Research)
(U) PE 0603114N (Power Projection Advanced Technology)
(U) PE 0603123N (Force Protection Advanced Technology)
(U) PE 0603235N (Common Picture Advanced Technology)
(U) PE 0603271N (RF Systems Advanced Technology)
(U) PE 0603640M (Marine Corps Advanced Technology)

(U) NON NAVY RELATED RDT&E:
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602782A (Command, Control and Communications (C^3) Technology)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602702F (Command, Control and Communications)

(U) SCHEDULE PROFILE: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602236N
PROGRAM ELEMENT TITLE: Warfighter Sustainment Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Warfighter Sustainment Applied Research	**	**	71,294

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0602121N, 0602122N, 0602233N, and 0602234N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE funds applied research supporting Future Naval Capabilities (FNC) (Capable Manpower, Expeditionary Logistics, Total Ownership Cost (TOC) Reduction, and Warfighter Protection) and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower, personnel, and human factors (HF); Naval systems training; expeditionary logistics; energy conversion; Naval materials, maintenance reduction and TOC reduction; medical technologies environmental quality, and biocentric technologies

(U) Due to the number of efforts in this PE, the programs described are representative of the work included in this 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 solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) MANPOWER, PERSONNEL, AND HUMAN FACTORS: These technologies enhance the Navy's ability to select, assign, and manage its people. Technology development in these areas responds to a variety of requirements, including: managing the force efficiently and maintaining readiness with fewer people and smaller budgets; providing warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems while managing individual workload and supporting optimal manning.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602236N
PROGRAM ELEMENT TITLE: Warfighter Sustainment Applied Research

MANPOWER, PERSONNEL & HUMAN FACTORS	FY00	FY01	FY02-$7,679
Initiate	•Integrated personnel simulation techniques •Student Value Model for Training and Readiness Continuum (StuVal) •Extensible Markup Language/ Data Mining Strategies for Navy Personnel Force Planning (XML/DM) • Electronic (E)-commerce Technologies for Personnel Distribution and Assignment (E-PASS)	• Realistic Job Previews/ Recruiter Screening Battery/ Recruiter Incentive System • Combat Systems Management • Managing Critical Events • Human Systems Integration Audio Management	• Models for Person-Organization Fit (PersOrg) • Psychometrics of Measures of Interests, Preferences, and Social Judgement (PsychoMeas) • Models of Aptitude and Interest (ModApt) • Ride/Join usability and Contents (UseCont) • Sailor/Marine Assignment Matchmaker (SMAM) • Service Member/Command Intelligent Agents (SMCIA) • Prototype Advanced Land Attack Console and Tasks (LAWCT) • Cognitive Work Tools to Develop/Model System Design (Cog-Tools) • Human Performance Micro Models (HumPerfMicro) • Human Characteristics in System Design • System Monitoring of Human Performance • Team Workload Distribution Methods
Continue	•Prediction of Submarine Service Disqualification (SubSchl)	•Integrated Personnel Simulation Techniques	•Realistic Job Previews/Recruiter Screening Battery/Recruiter

	•Selecting, Training Assigning and Retaining Sailors (FirsTerm) •Three Dimensional (3D) Perspective View	•StuVal •XML/DM • E-PASS	Incentive System •Integrated Personnel Simulation Techniques •StuVal •XML/DM • E-PASS • Combat systems management • Managing critical events • Human Systems Integration Audio Management
Complete	•Visual Information Filtering for Force Management (VisInfo) • New Personnel Assessment Technologies (NPAT)	•SubSchl •FirsTerm • 3D Perspective View	

(U) Training technologies enhance the Navy's ability to train effectively and affordably in classroom settings, in simulated environments, and while deployed, and to operate effectively in the complex, high-stress, information-rich and ambiguous environments of modern warfare. Technology development responds to a variety of requirements, including providing more affordable approaches to training and skill maintenance.

Training	**FY00**	**FY01**	**FY02-$10,480**
Initiate	• Computer Generated Forces (CGF) development of simulated team members to insert into team training intelligent tutoring systems. • Fleet Integration Training and Evaluation Research (FITER) develop/select test bed and begin empirical examination of various training strategies to close the "cognitive differences gap" between	• Apply virtual environment (VE) technology to the training of spatial behavior relevant to expeditionary forces. • Develop multi-sensory, spatially distributed computer interfaces and assess impact on human learning and memory. • Develop methods for measuring realism in VEs and determine the relationship between realism and training	• Instructional strategies for overcoming misconceptions • Effective feedback in dynamic task Artificial Intelligence (AI) tutoring • Instructional impact of personified pedagogical agents • Cognitive task analysis methods for subject matter experts • Measuring, Developing and Linking Shared Cognition to Team and

	differences gap" between novice and expert members in large distributed teams. Develop measures of effectiveness (MOEs) and measure of performance (MOPs) for this environment	realism and training effectiveness of VEs • Address human computer interaction issues relevant to developing a virtual cockpit	Distributed Team Performance • Advanced Maintenance Technology Support • Training and Performance Aiding Interactive Electronic Technical Manuals/Condition Based Maintenance (IETMs/CBM) Systems • Intelligent Maintainer Aid • Algorithms for Generating Optimal Mentor-Prototype Pairings • Fostering Continuous Learning On-The-Job Through Self Regulating Processes • On-Line Strategies for Collaborative Group Learning • Training Value of Multi-media Technologies • Simulation of Amphibious vehicles motion • Alternate displays for combat vehicle simulators • Distributed interaction of vehicle crew members • Simulation of human locomotion • Weapons handling for dismounted combatants • CGF: capability of CGF's to act as instructional agents for scenario generation and provide coaching and feedback. • CGF: Validate improved human cognitive and behavioral modeling

			techniques within CGF in a distributed environment as simulated teammates & adversaries • CGF: develop enhanced modeling techniques for representing individual differences such as the effects of training in CGFs • Dual Use technologies in the areas listed above
Continue	• Artifically intelligent tutoring in dynamic decision-making • Augmenting displays to enhance learning • Advancing applied cognitive task analysis • Physics tutor (mechanics) • Advanced Instructional Authoring Tools • Effective use of multi-media • Advanced AI teaching technology for thermodynamics • Integrating IETMs performance aiding and training • Self training teams	• Artificially intelligent tutoring in dynamic decision-making • Augmenting displays to enhance learning • Advancing applied cognitive task analysis • Physics Tutor (electricity and magnetism) • Advanced Instructional Authoring Tools • CGF: CGF development of simulated team members to insert into team training intelligent tutoring systems.	• Physics Tutor (electricity and magnetism) • Advanced Instructional Authoring Tools • Apply VE technology to the training of spatial behavior relevant to expeditionary forces. • Develop multi-sensory, spatially distributed computer interfaces and assess impact on human learning and memory • Develop methods for measuring realism in VEs and determine the relationship between realism and training effectiveness of VEs • Address human computer interaction issues relevant to developing a virtual cockpit
Complete	• Instruction for situation awareness • Shipboard skill remediation • CGF: establish a distributed battlespace simulation	• Effective use of multi-media • Advanced AI teaching technology for thermodynamics • Integrating IETMS, training, performance aids	• Artificially intelligent tutoring in dynamic decision-making • Augmenting displays to enhance learning

	facility dedicated to supporting research in model development, integration and evaluation for CGF • CGF: assessment of the current state-of-the-art for the realistic modeling of human behavior for use within Naval modeling and simulation projects • Exploratory research on issues and technological problems in VE training	• Self training teams • FITER: development of test-bed to study large distributed teams	• Advancing applied cognitive task analysis • CGF: CGF development of simulated team members to insert into team training intelligent tutoring systems (experiments on training effectiveness).

(U) Expeditionary Logistics addresses enabling capabilities covering distribution, command and control (C2), and readiness. Operational maneuvers from the sea (OMFTS), seabasing, and other future Naval concepts hinge on timely and responsive sustainment from the sea. Work areas encompass surface replenishment of the seabase from Naval and commercial shipping, ship-to-ship material handling to include at-sea rearming, internal seabase material handling, and ship to shore material distribution. Additionally, OMFTS will rely on managing available assets more wisely. Technology areas include improved tactical supply and maintenance systems, a comprehensive architecture for C2, battlefield sensor feeds into logistics situational awareness and consumption reduction.

Expedit-ionary Logistics	**FY00**	**FY01**	**FY02-$7,426**
Initiate		• Develop metrics, demonstration plans, and transition for the Five Year Defense Plan (FYDP) investment cycle • Create decision support technologies for Log C2 Course of Action (COA) generation	• Refined algorithms to incorporate captured use rates, improve source data quality, improve sustainment rate calculation, and establish stockage levels that are situationally dependent • Material handling technologies for Sea State 5 strike up/down applied to carriers and

			combatants, as well as logistics future platforms • Underway replenishment technologies including wave motion characterization and station keeping technology development • Explore annealing and similar algorithm optimization techniques for balancing large array logistics throughput equations • Create C2 technology functional architecture
Continue			• Ground Log C2 decision support COA
Complete		▪ Develop metrics, demonstration plans, and transition for the FYDP investment cycle	

(U) Energy Conversion efforts address technology development to provide significant improvements in energetic material systems and subsystems in terms of performance, safety, reliability, and affordability, and to transition advanced technology to the Fleet for warfighter sustainment. Goals include: advanced energetic materials for both warheads and propellants with both superior performance and acceptable insensitivity characteristics to reduce vulnerability to both personnel and platforms; and reliable simulation tools and diagnostics to (1) develop and design superior performance reduced vulnerability systems tailored to specific warfighter missions, (2) improve safety, and (3) reduce cost by enabling simulation aided design and condition-based monitoring capabilities. This work develops technologies for cost effective design, performance assessment, and vulnerability assessment of enhanced performance, insensitive munitions.

Energy Conversion	**FY00**	**FY01**	**FY02-$2,659**
Initiate	• Develop capability to predict effects of energetic components on propellant burn rate parameters	• Evaluate advanced fuels for enhanced explosive and propellant applications	• Develop diagnostics to monitor response of energetic materials to external stimuli

	• Develop capability to simulate system response to explosive effects		• Develop capability to tailor propellant performance to combustion characteristics
Continue	• Develop laboratory scale diagnostic to determine underwater explosive performance • Develop underwater explosion parameters to accurately assess structural response to attack	• Develop laboratory scale diagnostic to determine underwater explosive performance • Develop capability to simulate system response to explosive effects • Develop capability to predict effects of ammonium perchlorate (AP) size on propellant burn rate parameters	• Evaluate advanced fuels for enhanced explosive and propellant applications • Develop capability to predict effects of ballistic modifiers on propellant performance parameters
Complete	• Reactive material underwater structure burn-through mechanism	• Validated underwater explosion parameters to accurately assess structural response to attack	• Development of laboratory scale diagnostic to accurately determine underwater explosive performance with large scale test results • Development of 1st generation model to predict effects of AP size effects on propellant burn rate parameters

(U) Materials, Maintenance Reduction, and TOC reduction efforts address significant improvements in terms of affordability, reliability and performance to transition advanced technology to the Fleet for warfighter sustainment. Goals include: advanced, lightweight materials and processes to reduce weight and cost; ultrareliable materials and sensors to reduce cost by enabling condition-based and zero maintenance capabilities; environmentally acceptable long-life coatings for aircraft and ships to improve the quality of life for sailors; advanced low cost welding and joining methods, and new low cost sensors. Turbine improvement efforts cover the Navy's share of the turbine engine component development efforts under the Department of Defense (DoD)/National Aeronautics and Space Administration (NASA) Industry Integrated High Performance Turbine Engine Technology (IHPTET) program, ensuring that Navy unique design and operational

requirements are met. Also included are aircraft and ship electrical power generation and thermal management technologies. Airframe and ship corrosion efforts address an integrated approach for the control of the effects of external and internal corrosion. The work develops advanced cost effective prevention and life cycle management technologies. This is particularly significant to life extension for the aging fleet.

Materials/ Maintenance /TOC	FY00	FY01	FY02-$22,704
Initiate	• Develop friction stir welding methods for ship steels • Feasibility of oxidation-resistant Molybendum (Mo) alloys (2500^{o}F) • High Diameter Speed (DN) Bearing • Reduced Cost Integral Blade Rotors (IBRs) • Integrated Engine Health Management • Innovative composite casting technologies for ship shafts and seals • Ausform finishing of rotocraft gears	• Characterize system performance of hybrid composite/concrete with fault monitoring system • Thermal barrier technology for oxidation resistant Mo alloys • Cadmium replacement technologies • New corrosion prevention applique technologies • Tiled Blade Technology • Active Turbine Tip Control • Life Extending Control • Environmental barrier coatings for ceramics/composites	• Develop advanced smart wires for Aircraft • Non-destructive evaluation (NDE) methods for ship shaft health monitoring • Single coat corrosion control coatings for ship tanks • New wash-down process for USMC vehicles • Full Annular Combustor • Reduced Sensorload Diagnostics • Phase III Fan • Evaluate new corrosion prevention compounds (interior surfaces and avionics) • Assess new NDE technologies for inspection of corrosion degradation • Assess application of high force actuators for naval structures • Develop high strain – high force Actuators for conditioned-based maintenance
Continue	• Evaluate corrosion sensors for	• Friction stir welding for ship	• Evaluate system performance of

	ballast tanks • Evaluate weldability of stainless steel • Novel cost-reducing processing carbon heat shields • Demonstrate nanostructured coatings in selected components • Develop advanced single crystal transducer materials for medical assessment (battlefield) • Integrated Lightweight (Lt-weight) Combustor • Advanced Finger Seal • Advanced 2 stage fan • Composite Turbine Vane • Develop more affordable, higher performance ship steels • Improved filler metal for more affordable and reliable welding of High Strength Low Alloy (HSLA) steels • Develop upgraded seawater valves • Ultrasonic corrosion/erosion detection technology • Environmentally acceptable coatings for nonmagnetic ship hulls	steels • Corrosion sensors in operational ships ballast tanks • Environmentally acceptable coatings for non-magnetic ship hulls • Evaluate upgraded seawater valves in operational ships to reduce cost • Advanced carbon/carbon processes for missile heat shields • Evaluate advanced transducer materials • Advanced 2 stage fan • Composite Turbine Vane • High DN Bearing • Reduced Cost IBRs • Integrated Engine Health Management • Innovative composite casting technologies for ship shafts and seals • Develop oxidation resistant Mo alloys • Develop more affordable, higher performance ship steels • Evaluate weldability of stainless steel • Ausform finishing of rotocraft gears	hybrid composite concrete with fault monitoring • Friction stir welding for ship steels • Develop thermal barrier coatings for Mo alloys • Composite Turbine Vane • High DN Bearing • Reduced Cost IBRs • Integrated Engine Health Management • Tiled Blade Technology • Active Turbine Tip Control • Life Extending Control • Develop multi-functional transducer materials • Innovative composite casting technologies for ship shafts and seals • Develop more affordable, higher performance ship steels • Develop oxidation resistant Mo alloys • Cd replacement technologies • Corrosion resistant application technologies • Environmentally acceptable coatings for nonmagnetic ship hulls • Environmental barrier coatings for ceramics/composites

		• Demonstrate new MIL-100S welding wire for shipbuilding	• Ausform finishing of rotocraft gears/transition • Weldability of stainless steel • Advanced carbon/carbon processes for heat shields
Complete	• Carbon fiber reinforced rods in concrete (piers) • Radio-activated corrosion sensor systems for H-60 • Advanced Fan Structures • Next Generation Cooling	• Ultrasonics corrosion/erosion detection technology • Nanostructured Ni and Al based alloys, transition to shipboard use for repair, refurbishment, and life extension • Integrated Lt-weight Combustor • Advanced Finger Seal	• Transition upgraded seawater valves to acquisition • Advanced 2 Stage Fan • Corrosion sensors ballast tanks • Filler materials for HSLA steels

(U) Medical Technologies improve warfighter safety and enhance personnel performance capabilities under adverse conditions, enhance diagnosis of medical emergencies and treatment of casualties, and prevent costly occupational injury and disease in hazardous environments. Requirements which support technology development in these areas include: improving warfighting capabilities through enhanced supply and long-term storage of pre-positioned medical supplies such as blood; providing better stress endurance/control for key personnel; and providing enhanced casualty care onboard amphibious casualty receiving ships.

Medical Technol-ogies	**FY00**	**FY01**	**FY02-$12,298**
Initiate	• New methods to detect and assess environmental pathogens, toxicants, and ultrafine particles • Prophylactic agents for the prevention of oxygen toxicity and decompression sickness • Oxygen tolerance/toxicity in	• Clinical strategies to protect and restore hearing and balance • Impact of thermal stress on operational performance • Predictive measures for oxygen-induced seizures • Assessment of submarine	• Hemostatic dressing with microbicide • Casualty management tool within OMFTS and special operations • High intensity focused ultrasound device for hemostasis • Assessment of currently available hemoglobin-based oxygen carriers

	repeated and chronic hyperbaric conditions • Development of hemoglobin substitute • Evaluation of small volume resuscitation fluids in combined hemorrhage and head trauma • Evaluation of eicosenoid inhibitors in combined hemorrhage and blunt chest trauma • Evaluation of hypertonic saline resuscitation effects on the development of lung injury	watchstanding schedules • Model for clearance of (insoluble) smoke particles from the lung • Evaluation of effects of novel drugs on cellular energetics following hemorrhage • Evaluation of novel oxygen carrying resuscitation fluids • Evaluation of novel agents to reduce metabolic demand during injury • Gas diffusion enhancer assessment with prolonged circulation time • Evaluation of small volume resuscitation fluids in combined hemorrhage and head trauma	for treatment of hemorrhagic shock • Evaluation of novel pain control strategies • Evaluation of hibernation induction trigger for metabolic downregulation in hemorrhage • Evaluation of novel resuscitation fluid additives • Assessment of commercial technologies for man-portable injectable water system • Development of a smart uniform • Development of technologies for enhanced body protection against battlefield munitions • Methods to regenerate auditory and vestibular hair cells in animal models • Injury prevention and fitness optimization of next generation CVN and smart ship crews • Applied genomics (e.g. development of DNA-based prophylactics and therapies)
Continue	• Methods to determine naval aviator performance during training and in the Fleet • Evaluation of sensor technology to detect multiple toxicants • Methods to predict and counteract deleterious effects	• Prophylactic agents for the prevention of oxygen toxicity and decompression sickness • Oxygen tolerance/toxicity in repeated and chronic hyperbaric conditions • Methods to predict and counteract deleterious effects	• Model for clearance of (insoluble) smoke particles from the lung • Clinical strategies to protect and restore hearing and balance • Impact of thermal stress on operational performance

	of low-to-high frequency acceleration (motion) in operational environments • Evaluation of effects of mild hypothermia on hemorrhagic shock outcomes • Novel therapeutics for resuscitation of hemorrhagic shock • Treatment enhancements for shock; novel resuscitation fluid additives in severe hemorrhage • Investigate chemical properties of hibernation induction trigger • Evaluation of novel reperfusion injury inhibitors on hemorrhagic shock • Evaluation of effects of Food and Drug Administration (FDA) approved resuscitation fluids on the inflammatory response • Evaluation of selected cytokines as predictive indicators of trauma outcome • Immune modulators for prevention of multiple organ failure • Evaluation of potassium ATPase inhibitor in hemorrhagic shock	of low-to-high frequency acceleration (motion) in operational environments • Evaluation of effects of mild hypothermia on hemorrhagic shock outcomes • Evaluation of novel therapeutics for resuscitation of hemorrhagic shock • Treatment enhancements for shock; novel resuscitation fluid additives in severe hemorrhage • Investigation of chemical properties of hibernation induction trigger • Development of hemoglobin substitute • Evaluation of hypertonic resuscitation fluids in combined hemorrhage and head trauma • Evaluation of hypertonic saline resuscitation effects on the development of lung injury • Evaluation of novel reperfusion injury inhibitors on hemorrhagic shock • Immune modulators for prevention of multiple organ failure • Effects of FDA approved resuscitation fluids on the	• Develop predictive measures for oxygen-induced seizures • Assessment of submarine watchstanding schedules • Methods to predict and counteract deleterious effects of low-to-high frequency acceleration (motion) in operational environments • Oxygen tolerance/toxicity in repeated and chronic hyperbaric conditions • Prophylactic agents for the prevention of oxygen toxicity and decompression sickness • Evaluation of effects of mild hypothermia on hemorrhagic shock outcomes • Evaluation of novel therapeutics for resuscitation of hemorrhagic shock • Treatment enhancements for shock; novel resuscitation fluid additives in severe hemorrhage • Investigation of chemical properties of hibernation induction trigger • Evaluation of novel oxygen-carrying resuscitation fluids • Development of hemoglobin substitute • Evaluation of novel reperfusion injury inhibitors on hemorrhagic

		resuscitation fluids on the inflammatory response • Evaluation of selected cytokines as predictive indicators of trauma outcome	shock • Evaluation of effects of novel drugs on cellular energetics following hemorrhage • Gas diffusion enhancer assessment with prolonged circulation time • Evaluation of novel agents to reduce metabolic demand during injury
Complete	• Model of cardiac sensitivity to toxic chemicals • Human limitations of glare and flashblindedness from low-to medium power laser technology • Spatial thinking ability assessment in submarine personnel • Neuromodulators to treat non-freezing cold injury • Peroxynitrite scavenger in hemorrhagic shock • Small animal model of tissue transplantation immune modulation • Gas diffusion enhancer assessment in small animal hemorrhage model (transition)	• Methods to determine naval aviator performance during training and in the Fleet • Evaluation of sensor technology to detect multiple toxicants • New methods to detect and assess environmental pathogens, toxicants, and ultrafine particles • Potassium ATPase inhibitor in hemorrhagic shock (transition) • Evaluation of eicosenoid inhibitors in combined hemorrhage and blunt chest trauma • Immune modulators for prevention of multiple organ failure • Evaluation of immunological function during harsh operational conditions • Evaluation of small volume resuscitation fluids in	• Evaluation of effect of hypertonic fluids on head injury (transition) • Evaluation of hypertonic saline resuscitation effects on the development of lung injury • Evaluation of effects of FDA-approved resuscitation fluids on the inflammatory response • Evaluation of selected cytokines as predictive indicators of trauma outcome (transition)

		combined hemorrhage and head trauma	

(U) Environmental Quality (EQ) technologies enable sustained world-wide Navy operations, in compliance with all local, state, regional, national and international laws, regulations and agreements. Technology development in this area supports the Chief of Naval Operations (CNO) prioritized Navy S&T requirements and leads to systems and processes that provide the Fleet with environmentally compliant forward presence, ashore and afloat. Specifically, this area supports requirements to minimize the curtailment of military operations due to ship, shore and aircraft compulsory compliance with national and international environmental regulations, and to sustain Naval forces anywhere in a timely and environmentally compliant manner.

Environ-mental Quality	**FY00**	**FY01**	**FY02-$1,772**
Initiate	• Shipboard non-oily wastewater bioreactor treatment system process controller development • Pollutant sensor technology for Navy industrial wastewater treatment plants (IWTP)/control systems • Metal hydride battery technology for Navy aircraft • Laser induced surface improvement (LISI) technology for carrier non-skid • Dense Medium Plasma technology feasibility for treating shipboard oily and non-oily wastewater • Compliant marine coatings test facility	• Air and noise pollutant emissions control and treatment technologies for Navy platforms and assets	• Advanced environmentally compliant antifouling (AF) hull coatings for ships and submarines and compliant anticorrosion (AC) coatings for ship and submarine structures • Advanced ship and submarine liquid, air, solid emission control technology in compliance with Uniform National Discharge Standards (UNDS) and Marine Pollution Convention/ International Maritime Organization (MARPOL/IMO) • Biofouling/biocorrosion control mechanisms • Advanced pollution prevention/ waste treatment technologies for ship, submarine and shoreside applications

			• Automated underwater hull paint removal and application technology
Continue	• Biofouling control technology for submarine heat exchangers • Automated dry-dock ship painting and applique technology for elimination of over-spray and hazardous air pollutants (HAPS) • Integrated Navy sediment characterization and methodology	• Shipboard non-oily wastewater bioreactor treatment system process controller development • Pollutant sensor technology for Navy IWTP control systems and development of applique technology for ship hull and structures • Metal hydride battery technology development for Navy aircraft systems • Compliant marine coatings test facility • Automated dry dock ship paint application, overspray collection and treatment technology development.	• Air and noise pollutant emissions control/treatment technologies for Navy platforms • Compliant marine coatings test facility
Complete	• Liquid carbon dioxide shipboard pollution prevention control technology; terminated because of lack of cost effectiveness. • Information and data for establishing scientifically sound Navy copper discharge standards; transition to CNO N45, NAVSEA 05R and SERDP. • Neural net classification algorithm for Navy shipboard Oil Content Monitors (OCM);	• Integrated characterization of Navy-contaminated marine sediments • Submarine heat exchanger fouling control technology • Dense Medium Plasma technology development for ship wastewater treatment was terminated in this PE and referred to 6.1 basic research program (PE 0601153N) for obtaining a better understanding of the process	• Shipboard non-oily wastewater bioreactor treatment system process controller development • Copper sensor technology for Navy IWTP and applique technology for ship hulls and structures • Metal hydride technology for lighter, more reliable and environmentally acceptable batteries for aircraft and systems • Automated dry dock ship paint application, overspray control,

	transition to NAVSEA 05R, PE 0603721N. • LISI feasibility for ship non-skid; transition to NAVSEA/NAVAIR, PE 0603721N		collection and treatment technologies

(U) Biocentric technologies (BT) provide novel solutions for Naval needs based upon the applications of biosensors, biomaterials, and bioprocesses. This program brings the power of modern biotechnology methods to bear on Naval problems and reduces the technical risk associated with basic research advances by conducting demo-centric technology development programs. Topic areas include advanced sensors for force protection against weapons of mass destruction, novel methods for radar and acoustic signature reduction, chemical sensing in the marine environment for unexploded ordnance detection, green synthesis of energetic materials, and novel energy sources for chemical and biological sensors deployed in the littorals.

Biocentric Technolgies	**FY00**	**FY01**	**FY02-$6,276**
Initiate	• Bio-molecular barcodes for unique identification and tracing of materials • Chemical Sensing in the Marine Environment-Characterization of chemical plume structures in very shallow waters	• Chemical Sensing in the Marine Environment-Locating the source of chemical plumes in very shallow waters using sensors on autonomous underwater vehicles • Novel biosensors for explosives for underwater applications	• Green synthesis of energetic materials using enzymes tailored for optimized yields. • TNT and other explosives sensors as autonomous underwater vehicle payloads • Energy harvesting benthic fuel cells using bioelectrochemical mechanisms at the water-sediment interface • Chemical sensing from autonomous underwater vehicles for special forces applications

Continue	• Characterization of elastomeric polypeptides for Naval applications • Chemical Sensing in the Marine Environment-Characterization of source strengths of underwater unexploded ordnance • Chemical Plume Tracing inverse methods development • Radar absorbing and antenna isolation materials based upon metallized lipid tubules • Green enzymatic synthesis of explosives and related compounds.	• Chemical Sensing in the Marine Environment-Characterization of source strengths of underwater unexploded ordnance • Chemical Sensing in the Marine Environment-Characterization of chemical plume structures in very shallow waters • Radar absorbing and antenna isolation materials based upon metallized lipid tubules • Bio-molecular barcodes for unique identification and tracing of materials	• Chemical Sensing in the Marine Environment-Locating the source of chemical plumes in very shallow waters using sensors on autonomous underwater vehicles • Chemical Sensing in the Marine Environment-Characterization of chemical plume structures in very shallow waters • Novel biosensors for explosives for underwater applications
Complete	• Fate and transport of explosive chemical signatures due to biological and chemical degradation	• Characterization of elastomeric polypeptides for Naval applications • Chemical Plume Tracing inverse methods development • Green enzymatic synthesis of explosives and related compounds.	• Radar absorbing and antenna isolation materials based upon metallized lipid tubules • Bio-molecular barcodes for unique identification and tracing of materials • Chemical Sensing in the Marine Environment-Characterization of source strengths of underwater unexploded ordnance

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602236N
PROGRAM ELEMENT TITLE: Warfighter Sustainment Applied Research

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Appropriated Value			
Adjustments from FY 2001 President's Budget			
PE Restructure			70,776
NMCI Reimbursable Adjustment			+194
NWCF Rate Adjustment			+308
Non-Pay Inflation			+66
Minor Program Adjustment			-50
FY 2002 President's Budget Submission	**	**	71,294

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0602121N, 0602122N, 0602233N, and 0602234N.

(U) CHANGE SUMMARY EXPLANATION:
(U) Funding: Not applicable.
(U) Schedule: Not applicable.

(U) OTHER PROGRAM FUNDING SUMMARY:

(U) NAVY RELATED RDT&E:
(U) PE 0602114N Power Projection Applied Research
(U) PE 0602123N Force Protection Applied Research
(U) PE 0602435N Ocean and Atmospheric Technology
(U) PE 0602235N Common Picture Applied Research
(U) PE 0603236N Warfighter Sustainment Advanced Technology
(U) PE 0603513N Shipboard System Component Development
(U) PE 0603561N Advanced Submarine System Development
(U) PE 0603563N Ship Concept Advanced Design
(U) PE 0603573N Advanced Surface Machinery Systems
(U) PE 0603729N Warfighter Protection Advanced Technology
(U) PE 0604558N New Design SSN Development
(U) PE 0604561N SSN-21 Development
(U) PE 0604771N Medical Development (Engineering)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602236N
PROGRAM ELEMENT TITLE: Warfighter Sustainment Applied Research

(U) NON-NAVY RELATED RDT&E:
- (U) PE 0601102A Defense Research Sciences
- (U) PE 0602105A Materials Technology
- (U) PE 0602211A Aviation Technology
- (U) PE 0602303A Missile Technology
- (U) PE 0602601A Combat Vehicle and Automotive Technology
- (U) PE 0602705A Electronics and Electronic Devices
- (U) PE 0602709A Night Vision Technology
- (U) PE 0602716A Human Factors Engineering Technology
- (U) PE 0602785A Manpower, Personnel and Training Technology
- (U) PE 0602786A Warfighter Technology
- (U) PE 0602787A Medical Technology
- (U) PE 0603002A Medical Advanced Technology
- (U) PE 0603003A Aviation Advanced Technology
- (U) PE 0601102F Defense Research Sciences
- (U) PE 0602102F Materials
- (U) PE 0602202F Human Effectiveness Applied Research
- (U) PE 0602203F Aerospace Propulsion
- (U) PE 0602204F Aerospace Sensors
- (U) PE 0602702F Command, Control and Communications
- (U) PE 0603202F Aerospace Propulsion Subsystems Integration
- (U) PE 0603216F Advanced Propulsion and Power Technology
- (U) PE 0602712E Materials and Electronics Technology
- (U) PE 0603716D8Z Strategic Environmental Research Program
- (U) PE 0603851D8Z Environmental Security Technical Certification Program

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602271N
PROGRAM ELEMENT TITLE: RF SYSTEMS APPLIED RESEARCH

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
	**	**	62,141

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0602232N, 0602234N, and 0602270N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Radio Frequency (RF) Systems Applied Research Technology Program addresses technology deficiencies associated with naval platform needs for new capabilities in RF surveillance, RF electronic warfare, communications, navigation, RF solid state power amplifiers, vacuum electronics power amplifiers, and supporting technologies. The program supports development of technologies to enable capabilities in missile defense, directed energy, platform protection (including Electric Warship), time critical strike, and information distribution. RF Systems Applied Research Technology developments directly support the Department of Defense Joint Warfighter S&T Plan and the Defense Technology Area Plans. Projects within this PE have attributes that focus on enhancing the affordability of warfighting systems. The program also provides for technology efforts of the Naval Fleet/Force Technology Innovation Office (NFFTIO) to maintain proactive connectivity and collaboration between DoN S&T and Joint, Navy, and Marine Corps commands worldwide.

(U) Due to the number of efforts in this PE, the programs described are representative of the work included in this 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 solution of specific Naval problems short of a major development effort.

(U)PROGRAMS PLANS AND ACCOMPLISHMENTS:

(U) RF SURVEILLANCE. RF Surveillance technology emphasizes non-optical advanced sensor and sensor processing systems for continuous high volume theater-wide air, space, and surface surveillance, battle group surveillance, real time

reconnaissance and ship defense. Major technology goals include long-range target detection, discrimination, target identification (ID) and fire control quality target tracking in adverse weather, background clutter and electronic countermeasure environments.

RF Surveillance	FY00	FY01	FY02 ($13,251)
Initiate	• Advanced Airborne Early Warning (AEW) Space Time Adaptive Processing Algorithm Development	• Shipboard Digital Array • Affordable Ground Based Radar (AGBR) Technology Baseline	
Continue	• Passive Millimeterwave Radar • Digital Transmit/Receive (T/R) Modules • Littoral Small Craft Automatic Target Recognition (SCATR) • Ultra High Frequency (UHF) Electronically Scanned Array (UESA) Advanced AEW Radar • Radar Imaging • Wideband Digital Beamforming • AN/APY-6 Wideband Multi-Mode Air-	• Advanced AEW Space Time Adaptive Processing Algorithm Development • AN/APY-6 Wideband Multi-Mode Air-Ground Radar • UESA Advanced AEW Radar • Wideband Digital Beamforming	• Shipboard Digital Array • Advanced AEW Space Time Adaptive Processing Algorithm Dev • AN/APY-6 Wideband Multi-Mode Air-Ground Radar Advanced Algorithms • Wideband Digital Beamforming • UESA Advanced AEW Antenna

	Ground Radar Technology Testbed		
Complete		• Passive Millimeterwave Radar • Digital T/R Modules • Radar Imaging • Littoral SCATR	• AGBR Technology Baseline

(U) ELECTRONIC WARFARE TECHNOLOGY: Electronic Warfare technology emphasizes non-optical passive sensors and active and passive RF countermeasure systems including High Power Microwave (MW) which exploit and counter a broad range of electromagnetic threats. Program focus is on maintaining near perfect real-time knowledge of the enemy; countering the threat of cruise missiles to deployed Naval forces; and precision ID and location of threat emitters.

Electronic Warfare	**FY00**	**FY01**	**FY02 ($11,145)**
Initiate		• Next Generation Specific Emitter Identification (SEI) and Signal Processing • RF EW Threat Characterization • Long Baseline Time Difference of Arrival (ANGUILA)	• Advanced Decoy Systems • Advanced Counter Measures Development • Digital Deception Technologies
Continue	• Electronic Attack (EA) for Coherent Complex Modern Emitters • RF Early Warning (EW) Sensor Miniaturization • Specific Emitter ID (SEI) Miniturization • Wavelet Signal Processing	• EA for Coherent Complex Modern Emitters • RF EW Sensor Miniaturization • SEI Miniaturization	• EA for Coherent Complex Modern Emitters • Next Generation SEI and Signal Processing • RF EW Threat Characterization • ANGUILA
Complete	• Adaptive Distributed EA	• Wavelet Signal Processing	• RF EW Sensor Miniaturization

			• SEI Miniaturization

(U) RF COMMUNICATIONS TECHNOLOGY: Communications Technology addresses critical Navy communications technology deficiencies and needs that are not addressed by the commercial technology sector. The program emphasis is on reliable interoperable communications between U.S and coalition forces at all levels of command and rapid and reliable utilization of government and commercial telecommunications assets worldwide, that are efficient and responsive to warfighting needs.

Radio Frequency Communications	**FY00**	**FY01**	**FY02 ($12,396)**
Initiate	• Submarine Extremely Low Frequency (ELF) Noise Mitigation • Buoyant Cable Antenna Technologies • UHF Demand Assigned Multiple Access (DAMA) for Submarine Communications	• Vertical Takeoff Unmanned Air Vehicle (VTUAV) Communications Payload • Co-Site Interference Cancellation	• Very High Frequency (VHF)/UHF/L-Band Antenna Technology • X/Ku-Band Antenna Technology • Littoral Mobile Wireless Networking
Continue	• Large Aperture Multifunction Submarine Antenna • K/Ka Band Satellite Communication (SATCOM) Antennas • Bandwidth Efficient Advanced Modulation • High Data Rate SATCOM	• Large Aperture Multifunction Submarine Antenna • K/Ka Band SATCOM Antennas • Submarine ELF Noise Mitigation • Buoyant Cable Antenna Technologies • UHF DAMA for Submarine Communications • Bandwidth Efficient Advanced	• VTUAV Communications Payload • Co-Site Interference Cancellation • K/Ka Band SATCOM Antennas • Submarine ELF Noise Mitigation • Buoyant Cable Antenna Technologies

	• Code Division Multiple Access (CDMA) for Military Radio Communications • Multifunction Communi-cations Antennas	Modulation	
Complete	• Advanced Submarine Mast Antenna	• High Data Rate SATCOM • CDMA for Military Radio Communications • Multifunction Communications Antennas	• Large Aperture Multifunction Submarine Antenna • Bandwidth Efficient Advanced Modulation • UHF DAMA for Submarine Communications

(U) RF NAVIGATION TECHNOLOGY: Develops key navigation technologies for Naval Battle Groups, Aircraft, Unmanned Air Vechiles (UAVs), Unmanned Underwater Vehicles (UUVs), Ships, Submarines and other Navy vehicles and platforms. This technical area applies leading-edge S&T to enhance Global Positioning Systems (GPS) capabilities in order to make GPS more resistant to noise and jamming. This effort is also concerned with the coupling of GPS with inertial systems. This effort generally does not cover guided munitions nor does it duplicate Defense Advanced Research Projects Agency (DARPA) developments in Micro Electromechanical Systems (MEMS) devices.

RF Navigation	**FY00**	**FY01**	**FY02 ($2,385)**
Continue	• Anti-Jam Antennas • Communications, Navigation & Intelligence (CNI) Integration	• Anti-Jam Antennas • CNI Integration	• Anti-Jam Antennas • CNI Integration

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602271N
PROGRAM ELEMENT TITLE: RF SYSTEMS APPLIED RESEARCH

(U) RF SOLID STATE POWER AMPLIFIERS. Provides for the generation of VHF, UHF, Microwave (MW), and Millimeter Wave (MMW) power amplifiers for Navy all-weather radar, surveillance, reconnaissance, electronic attack, communications, and smart weapons systems. The technology developed cannot be obtained through Commercial Off the Shelf (COTS) as a result of the simultaneous requirements placed on power, frequency, linearity, bandwidth, weight, and size.

Solid State Amplifiers	FY00	FY01	FY02 ($4,888)
Initiate	• Wide Bandgap Pulse Power Amplifier	• Silicon Carbide (SiC) Bipolar Transistors	• Ku-Ka Band Power Amplifiers • Pseudomorphic GaN transistors
Continue	• MMW Wide Bandgap Linear Power Source • Efficient Broadband Amplifiers	• Wide Bandgap Pulse Power Amplifier • MMW Wide Bandgap Linear Power Source	• Wide Bandgap Pulse Power Amplifier • MMW Wide Bandgap Linear Power Source • SiC Bipolar Transistor

(U) RF VACUUM ELECTRONIC POWER AMPLIFIERS. Provides for the development of MW, MMW, submillimeter wave power amplifiers naval all-weather radar, surveillance, reconnaissance, EA, and communications weapons systems. The technology developed cannot be obtained through COTS as a result of the simultaneous requirements placed on power, frequency, bandwidth, weight, and size.

Vacuum Electronics	FY00	FY01	FY02 ($6,500)
Initiate	• Ka-Band Gyro-Traveling Wave Tube (TWT)	• Digital High Dynamic Range (HDR) Vac. Power Booster • 2D/3D Coupled Cavity (CC)-TWT Design Codes	• MMW Gyro-TWT • High Brightness Scandate Emitters

		• 2-D Klystron Design Codes • Time Dependent Helix TWT Codes For Digital Communications • High Brightness Scandate Emitters	
Continue	• MW Microwave Power Modules for EA • 1 Dimensional (D)/2D/3D Helix TWT Design Codes • MMW Gyro-Twystron • W-Band CC-TWT and Extended Interaction Klystron (EIK) • Noble Metal-Based Scandate Emitters • Aln-Sic Dielectric Material	• 2D/3D Helix TWT Design Codes	• Digital HDR Vacuum Power Booster • 2D/3D CC-TWT Design Codes
Complete	• W-band, 10 kW Gyro-Klystron • Ion Noise Theory	• 1-D Helix TWT Design Codes • MMW Gyro-Twystron • Noble Metal-based Scandate Emitters	• 2D/3D Helix TWT Design Codes

(U) SUPPORTING TECHNOLOGIES. Provides for the radiation, reception, control and processing of VHF, UHF, MW, and MMW power for Navy all-weather radar, surveillance, reconnaissance, EA, communications, and smart weapons systems. The technology developed cannot be obtained through COTS as a result of the requirements placed on power, frequency, linearity, bandwidth, weight, and size.

Support Technology	FY00	FY01	FY02 ($9,778)
Initiate	• Channelized Filter Bank • High Power, Wide Band,	• High Speed Microelectronic Mechanical system (MEMs)	• Wide Bandgap Transistor Reliability

	Isolators • Electronic True Time Delay	• SiC Power Converter • DDS Integral Modulator	
Continue	• High Performance Analog to Digital Converters (ADCs) • Compact Tunable Filters and Filter Banks • 100 GHz Low Noise Digital Clock • MW Frequency Direct Digital Synthesizer (DDS) • Robust, Wide Bandgap Low Noise Amplifiers • Ultra Low Noise, Broad Band, High Linearity, Receiver Amplifiers • Giant Magneto-Resistance (GMR) Non-Volatile Memories • Silicon-Based Power Converters	• Channelized Filter Bank • High Power, Wide Band Isolators • Electronic True Time Delay • High Performance ADC's • Compact Tunable Filters and Filter Banks • 100 Ghz Low Noise Digital Clock • MW Frequency DDS • Robust, Wide Bandgap Low Noise Amplifiers • Ultra Low Noise, Broad Band, High Linearity Receiver Amplifiers • GMR Non-Volatile Memories	• High Power, Wide Band, Isolators • DDS Integral Modulator • Electronic True Time Delay • High Performance ADC's • Compact Tunable Filters and Filter Banks • 100 Ghz Low Noise Digital Clock • MW Frequency DDS • Robust, Wide Bandgap Low Noise Amplifiers • Ultra Low Noise, Broad Band, High Linearity, Receiver Amplifiers • GMR Non-Volatile Memories • High Speed Mems • SiC Power Converter
Complete		• Silicon-Based Power Converters	

(U) NFFTIO. The purpose of NFFTIO is to ensure the Fleet/Force (F/F) helps shape the DoN investment in S&T, develop teaming relationships to rapidly demonstrate and transition technology, support development of technology-based capability options for naval forces, and enable warfighting innovations based on technical and conceptual possibilities. This is accomplished through proactive connectivity and collaboration between DoN S&T and Joint, Navy, and Marine Corps commands worldwide. Projects executed by NFFTIO are typically six to eighteen months in duration. Therefore, most projects that are initiated are completed in the same or the next fiscal year.

NFFTIO	**FY00**	**FY01**	**FY02 ($1,798)**
Initiate	• Virtual Information Processing	• Submarine Platform Avoid Close	• Develop and demonstrate specific

	Agent Research (VIPAR) • Robust Systems for HF and Land-line Data Transfer • Anti-terrorist Water Monitoring System • Autonomous Self-contained Acoustic Classifier • Passive Acoustic Sensor for Submarine Hull Application • Next Generation Improved Phone Distance Line for Underway Replenishment • Helicopter Vortex Ring-State Warning System • Shipboard Visual Navigation Aid for Vessels in Formation • F/A-18 Fast Tactical Imagery	Encounters/SPACE • Radiant Argon Hyperspectal Imaging • Air Warfare Training Technology Development (AWTTD) • Remote Water Craft Project/ RWC • Amphibian Suit II • Shipboard Quality of Life/QOL • Shipboard Non-tactical Automated Data Processing/SNAP • Collaborative Digital Target Folders/DTF • Environment Analysis and Receiver Systems/EARS • Fusion Box Hardware & Software Systems • Roc-N-Rol Core Network System Smart Board Systems	solutions to known operational Command Capability Issues.
Continue	• Projects are typically six to eighteen months in duration. Therefore, all projects from previous years have either been completed or will be completed this fiscal year as indicated below.	• Projects are typically six to eighteen months in duration. Therefore, all projects from previous years have either been completed or will be completed this fiscal year as indicated below.	• Projects are typically six to eighteen months in duration. Therefore, all projects from previous years have either been completed or will be completed this fiscal year as indicated below.
Complete	• Development of Amphibian Suit for Special Operations • Low Frequency Active Intercept Receiver System	• VIPAR • Robust Systems for HF and Land-line Data Transfer • Next Generation Improved Phone Distance Line for Underway	• AWTTD

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602271N
PROGRAM ELEMENT TITLE: RF SYSTEMS APPLIED RESEARCH

		Replenishment	

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			
PE Restructure			56,798
Inflation Adjustment:			65
Program Adjustment			-70
NWCF Adjustment			348
Additional Program Adjustment			5,000
FY 2002 PRESBUDG Submission	**	**	62,141

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0602232N, 0602234N, and 0602270N.

(U) CHANGE SUMMARY EXPLANATION:
(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602114N (Power Projection Applied Research)
(U) PE 0602123N (Force Protection Applied Research))

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602271N
PROGRAM ELEMENT TITLE: RF SYSTEMS APPLIED RESEARCH

(U) PE 0603271N (RF Systems Advanced Technology)
(U) PE 0603114N (Power Projection Advanced Technology)
(U) PE 0603123N (Force Protection Advanced Technology)

(U) NON NAVY RELATED RDT&E:
(U) PE(s) 0601102A, 0601102F (Defense Research Sciences)
(U) PE(s) 0602204F (Aerospace Avionics)
(U) PE(s) 0602782A, 0602702F (Command, Control and Communications (C^3) Technology)
(U) PE(s) 0602705A (Electronics and Electronic Devices)
(U) PE(s) 0602303A (Missile Technology)
(U) PE(s) 0602270A, 0602270F (Electronic Warfare Technology)
(U) PE(s) 0603270A, 0603270F (Advanced Electronic Warfare Technology)

(U) SCHEDULE PROFILE: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
N/A Ocean Warfighting Environment Applied Research	66,642	76,363	50,738

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE)-previously named Oceanographic and Atmospheric Technology - provides the unique, fundamental programmatic instrument by which basic research on the natural-environment is transformed into technology developments that provide new or enhanced warfare capabilities for the Battlespace Environment (BSE). We use natural-environment and BSE interchangeably; each term is to be understood to potentially encompass aspects of the ocean, atmosphere, space, or land.

(U) This PE also provides technologies that form the natural-environment technical base on which all systems development and advanced technology depend. This PE contains the National Oceanographic Partnership Program (NOPP)(Title II, subtitle E, of Public Law 104-201) enacted into law for FY 1997. A major component of the program supports Organic Mine Countermeasures (MCM). The objectives of the PE are met through measuring, analyzing, modeling and simulating, and applying environmental factors affecting naval materiel and operations in the BSE.

(U) Due to the breadth of efforts included in this PE, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this PE.

(U) This PE provides for BSE technology developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff. Major efforts of this PE are devoted to (1) gaining real-time knowledge of the BSE, (2) determining the natural-environment needs of regional warfare, (3) providing the on-scene commander the capability to exploit the environment to tactical advantage, and (4) developing atmospheric research related to detection of sea-skimming missiles and strike warfare.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

(U) This PE provides natural-environment applied research for all fleet operations and for current or emerging systems. This PE supports virtually all the Joint Mission Areas/Support Areas with primary emphasis on Joint Littoral Warfare and Joint Strike Warfare. Specifically:

(U) Joint Littoral Warfare efforts address issues in undersea, surface, and air battlespace. Programs include ocean and atmospheric prediction for real-time description of the operational environment, shallow water acoustics and multiple-influence sensors for undersea surveillance and weapon systems, and influences of the natural environment on mine countermeasure (MCM) systems.

(U) Joint Strike Warfare efforts address issues in air battlespace dominance. Programs include influences of the natural environment on electromagnetic (EM)/electro-optic (EO) systems used in the targeting and detection of missile weapon systems as well as improvements in tactical information management about the BSE.

(U) These efforts support the Joint Warfare Strategy "Forward From the Sea." This program fully supports the Director of Defense Research and Engineering’s Science and Technology Strategy and is coordinated with other DoD Components through the Defense Science and Technology Reliance process. Work in this PE is related to and fully coordinated with efforts in accordance with the ongoing Reliance joint planning process. There is close coordination with the US Air Force and US Army under the Reliance program in the Battlespace Environment categories of Lower Atmosphere, Ocean Environments, Space & Upper Atmosphere, and Terrestrial Environments.

(U) The Navy program includes projects that focus on, or have attributes that enhance, the affordability of warfighting systems.

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

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

BSE* SENSORS & DATA	**FY00-$16,800**	**FY01-$19,850**	**FY02-$7,349**
Initiate	• Participation in GODAE*		
Continue	• Advanced Ocean Wave Prediction • Bioluminescence Sensor • Physics-Based Models for Hyperspectral Sensors • Naval Impact of Natural Environmental Processes, especially in the Littoral Zone • AUV* Sensors and Technology for Oceanography/MCM*	• GODAE* • Advanced Ocean Wave Prediction • Bioluminescence Sensor • Physics-Based Models for Hyperspectral Imaging Sensors • Naval Impact of Natural Environmental Processes, especially in the Littoral Zone • AUV* Sensors and Technology for Oceanography/MCM*	• GODAE* • Bioluminescence Sensor • Physics-Based Models for Hyperspectral Imaging Sensors • Naval Impact of Natural Environmental Processes, especially in the Littoral Zone • AUV* Sensors and Technology for Oceanography/MCM*
Complete	• Components of AUV* Technology Transitioned to Higher Category Programs	• Preliminary Field Tests of New Digital Bioluminescence Sensor • Completion of Phase I of Testing Utility of Synthetic Aperture Sonar for Increased Ranges	• Advanced Ocean Wave Prediction

*AUV=Autonomous Underwater Vehicle; BSE=Battlespace Environment; GODAE=Global Ocean Data Assimilation Experiment; MCM=Mine Countermeasures

BSE* CONCEPT ENABLERS	**FY00-$22,902**	**FY01-$25,658**	**FY02-$20,510**
Initiate	• FY00 BAA* Awards for the National Oceanographic	• Capturing Uncertainty	• Marine Mammals Program

	• Naval Battlespace Awareness • Geoclutter	• Air-Sea Interaction	
Continue	• Precise Time/Time Interval • National Oceanographic Partnership Program • Biosensor Technology • SecNav/CNO* Ocean Chairs • Collaborative Efforts with Basic Research Programs • Dual Use Radar Effort	• Naval Battlespace Awareness • Precise Time/Time Interval • Geoclutter • National Oceanographic Partnership Program • Biosensor Technology • SecNav/CNO* Ocean Chairs • Collaborative Efforts with Basic Research Programs	• Naval Battlespace Awareness • Precise Time/Time Interval • Geoclutter • Capturing Uncertainty • Air-Sea Interaction • National Oceanographic Partnership Program • SecNav/CNO* Ocean Chairs • Collaborative Efforts with Basic Research Programs
Complete	• FY97 BAA* Projects in National Oceanographic Partnership Program • NBA* Workshop Report Published	• Dual Use Radar Tactics and Weather Effort • FY98 BAA* Projects in National Oceanographic Partnership Program	• Biosensor Technology

*BAA=Broad Agency Announcement; BSE=Battlespace Environment; NBA=Naval Battlespace Awareness; SecNav/CNO=Secretary of the Navy/Chief of Naval Operations

OCEAN AND ATMOSPHERIC MODELING/ PREDICTION AND EFFECTS	**FY00-$14,858**	**FY01-$16,901**	**FY02-$12,157**
Initiate	• Distributed Marine Environment Forecast System • Construction of an End-to-End		

	Observation/Analysis/Prediction System for Coastal Aerosols and Dust		
Continue	• Ocean Model Nowcast/Forecast at a variety of Scales (Global, Regional, Semi-Enclosed Seas, Local), including Relocateable and Nested Models • Advanced On-Board Ocean Models • Model Testing/Validation • Coupled Ocean/Atmosphere Models • Nested Atmospheric Models (Global, Regional, Local) • On-Scene Weather Prediction • Atmospheric Effects on EM/EO*	• Ocean Model Nowcast/Forecast at a variety of Scales (Global, Regional, Semi-Enclosed Seas, Local), including Relocateable and Nested Models • Advanced On-Board Ocean Models • Model Testing/Validation • Coupled Ocean/Atmosphere Models • Nested Atmospheric Models (Global, Regional, Local) • On-Scene Weather Prediction • Atmospheric Effects on EM/EO* • Construction of an End-to-End Observation/Analysis/Prediction System for Coastal Aerosols and Dust	• Ocean Model Nowcast/Forecast at a Variety of Scales (Global, Regional, Semi-Enclosed Seas, Local), including Relocateable and Nested Models • Advanced On-Board Ocean Models • Model Testing/Validation • Coupled Ocean/Atmosphere Models • Nested Atmospheric Models (Global, Regional, Local) • On-Scene Weather Prediction • Atmospheric Effects on EM/EO* • Construction of an End-to-End Observation/Analysis/Prediction System for Coastal Aerosols and Dust
Complete	• Participation in the California Air Resources Board Program "PM-10" • Distributed Marine Environment Forecast System • Field Demonstrations of the Tactical Environmental Processor		

*EM/EO=Electromagnetic/Electro-Optic

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

Naval Warfare System-Focused Efforts	**FY00-$12,082**	**FY01-$13,954**	**FY02-$10,722**
Initiate	• 3-D Geoacoustic Predictions & Inversion of Chirp Sonar Data for Seabed Inhomogeneities • Soliton Packet Predictions using Remote Acoustics		
Continue	• Remote Sensing Techniques, especially Hyperspectral Technology for the Littoral Zone • Bi-Static and Multi-Static Active Acoustics • Rapidly Adaptive Environmental Transfer Functions • Environmental Impact on Acoustics/Multi-Sensor Systems and Processing Techniques, especially in Shallow Water, at both Undersea Surveillance and MCM* Frequencies • Internal Wave/Coastal Front Influences on Acoustic Propagation	• 3-D Geoacoustic Predictions & Inversion of Chirp Sonar Data for Seabed Inhomogeneities • Soliton Packet Predictions using Remote Acoustics • Remote Sensing Techniques, especially Hyperspectral Technology for the Littoral Zone • Bi-Static and Multi-Static Active Acoustics • Rapidly Adaptive Environmental Transfer Functions • Environmental Impact on Acoustics/Multi-Sensor Systems and Processing Techniques, especially in Shallow Water, at both Undersea Surveillance and MCM* Frequencies • Internal Wave/Coastal Front Influences on Acoustic	• 3-D Geoacoustic Predictions & Inversion of Chirp Sonar Data for Seabed Inhomogeneities • Soliton Packet Predictions using Remote Acoustics • Remote Sensing Techniques, especially Hyperspectral Technology for the Littoral Zone • Bi-Static and Multi-Static Active Acoustics • Rapidly Adaptive Environmental Transfer Functions • Environmental Impact on Acoustics/Multi-Sensor Systems and Processing Techniques, especially in Shallow Water, at both Undersea Surveillance and MCM* Frequencies • Internal Wave/Coastal Front Influences on Acoustic

		Propagation	Propagation
Complete	• Characterization of Bubble Distributions in Littoral Zones • Contaminant Transport Modeling in Complex BSE*		

*BSE=Battlespace Environment; MCM=Mine Countermeasures

SBIR	FY00	FY01 - $1,264	FY02
Initiate	• N/A	• Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638	• N/A

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	72,681	60,320	63,764
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
PE Restructure			-13,826
Execution Adjustment	-4,803		
Congressional Recission	-285	-707	
Congressional Plus-up		+16,750	
Federal Technology Transfer	-6		
Non Pay Inflation			+55
NWCF Rate Adjustment			+324

NMCI- Reimbursable Funding			+421
SBIR/STTR Transfer	-945		
FY 2002 PRESBUDG Submission	66,642	76,363	50,738

(U) CHANGE SUMMARY EXPLANATION:

(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602114N (Power Projection Applied Research)
- (U) PE 0602123N (Force Protection Applied Research)
- (U) PE 0602235N (Common Picture Applied Research)
- (U) PE 0602271N (RF Systems Applied Research)
- (U) PE 0602747N (Undersea Warfare Applied Research)
- (U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
- (U) PE 0603207N (Air/Ocean Tactical Applications)
- (U) PE 0603271N (RF Systems Advanced Technology)
- (U) PE 0603747N (Undersea Warfare Advanced Technology)
- (U) PE 0603782N (Mine & Expeditionary Warfare Advanced Technology)
- (U) PE 0604218N (Air/Ocean Equipment Engineering)

(U) NON NAVY RELATED RDT&E:
- (U) PE 0602101F (Geophysics)
- (U) PE 0602601F (Phillips Lab Exploratory Development)
- (U) PE 0602784A (Military Engineering Technology)
- (U) PE 0603410F (Space Systems Environmental Interactions Technology)
- (U) PE 0603707F (Weather Systems Technology

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Undersea Warfare Applied Research	**	**	76,510

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0602315N, 0602633N and 0602314N.

(U) MISSION DESCRIPTION:

(U) In countering the proliferation of quiet diesel submarines to third world countries and Russia's continued investment in submarine technology, work within this Program Element (PE) provides an enabling capability for power projection and force sustainability. This approach protects the country's capital investment in surveillance, submarine, surface ship and air Anti-Submarine Warfare (ASW) assets by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in five to fifteen years. These technology options include research in the following areas:

- Improving reliable undersea target detection and tracking to enable on-command application of precision offensive military force. Programs include undersea sensors and arrays to provide robust shallow water surveillance and reconnaissance, and to detect undersea threats to the surface battleforce. This effort also includes Navy unique research and technology issues associated with creating a timely and intelligible tactical picture of the undersea battlespace.
- Dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs include advanced sensors and arrays for both improved ASW surveillance and enhanced battleforce self-defense, ASW data fusion for better tactical control, and low frequency active sonar and rapidly deployable surveillance systems for covert/non-covert indication and warning.
- Improving reliable undersea target detection and tracking, thus enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of the Littoral ASW (LASW) Future Naval Capability (FNC).
- Improving undersea weapons effectiveness while reducing overall costs through improvements to current systems as well as the development of new weapons concepts. The goal of Undersea Weaponry is to produce cost effective, quick reaction intelligent weapons incorporating broadband processing with battlegroup connectivity, intelligent countermeasures, hard kill torpedo defense, improved littoral operation, and weapon flexibility. Several Science and

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

Technology (S&T) challenges must be addressed including cluttered operating environments, multipath Acoustic propagation, low/no doppler targets, detonation physics, high density power sources, and fusing/safety/arming mechanics. The technology developed under this project will be transitioned to the acquisition community for incorporation into existing platforms. These efforts support the Littoral ASW FNC.

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

(U) The Navy Science and Technology program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the Applied Research Budget Activity because it investigates technological advances with possible applications toward solutions to specific Naval problems, short of an advanced development effort.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

Wide Area Surveillance	**FY00**	**FY01**	**FY02—$14,657**
Initiate	• Contract for 2 re-useable test vehicle versions of the X-glider for sensor delivery and personnel recovery support.	• Advanced pattern-recognition processing development for synthetic aperture sonar • Development of structural magnetostrictive materials • Development of PZT materials for biased operation • New Hydra design capable of full aperture (8 KM) and full hydrophone complement (48) • Design/integration of Ultra-Low Frequency (ULF) and Extremely Low Frequency (ELF) Electromagnetic (EM) sensors, signal processing and environmental noise cancellation techniques for submarine detection onto the Vertical take-off Unmanned Air Vehicle (VUAV) • Sea tests of optical standoff sensor systems • Development of ultra low power electronics	• Evaluation and transition of non-traditional scattering and advanced processing for air deployed multistatics • Advanced multistatics development • Ultra wideband waveform processing • Advanced clutter detection and rejection techniques • Hydra adaptations for use as an off-board sensor for submarines • Project to miniaturize DADS sensor/control nodes by a factor of 10 with equal or better performance for littoral applications
Continue	• Non-traditional scattering development • Phase conjugation algorithm development and evaluation • Development of large aperture, bottom-mounted array/signal processing • Development of acoustic	• Development of acoustic signal processing DCL techniques for autonomous undersea applications • Ultra-light array technology in air/sub deployed configurations at-sea experiments	• Advanced pattern-recognition processing development for synthetic aperture sonar • Development of structural magnetostrictive materials • Development of PZT materials for biased operation

	signal processing detection, classification and localization (DCL)techniques for autonomous undersea applications • Development of a mid-frequency broadband panel projector utilizing active feedback • Development of low frequency, low profile cymbal transducer • Ultra-light array technology in air/sub deployed configurations at-sea experiments • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines • Development of Deployable Autonomous Distributed System (DADS) sensor/signal processing technology and simulation of intra-field data fusion and field-level control functions • Development of Extremely Low Frequency Emission (ELFE) technology through system demonstration	experiments • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines	• Ultra-light deployable arrays • Development of a family of ultra-lightweight, ultra-low power air-, surface ship- or submarine-deployable, Matched Field Tracking Arrays to be used for barrier (Hydra) or area (Kelp) surveillance or as organic off-board sensors for submarines • Sea tests of optical standoff sensor systems • Development of ultra low power electronics.

Complete	• Shallow Water Air Anti-Submarine Warfare (ASW) assessment for deployable sensors • Assessment and report on the role of bottom-moored shallow water Acoustic and non-Acoustic surveillance methods • Optical standoff sensor systems Exploratory Development Model (EDM); initiated at-sea testing • Documentation of the Multi-sensor Acoustic/Non-Acoustic Data Fusion (MANDF) algorithm	• Non-traditional scattering development • Phase conjugation algorithm development and evaluation • Development of large aperture, bottom-mounted array/signal processing • Development of a mid-frequency broadband panel projector utilizing active feedback • Development of low frequency, low profile cymbal transducer • Assessment and report on ASW performance of Hydra and Kelp during RDS-3 experiment (Sep/Oct 2000) • DADS sensor/signal processing development for autonomous detection/classification of submarines • ELFE through data analysis /final report of demonstrations and algorithm development	• Development of acoustic signal processing DCL techniques for autonomous undersea applications • Assessment and report on full aperture Hydra performance during Seaweb 2001 (Sep 2001) • Design/integration of ULF/ELF EM submarine detection system mounted on VUAVs

Battlegroup ASW Defense	**FY00**	**FY01**	**FY02—$35,910**
Initiate	• Evaluation of piezocomposites as broadband projector materials • Advanced compact multi-static active air deployed receiver (Super ADAR) w/active & passive In Buoy Signal	• Multi-static ASW Capabilities Enhancement (MACE) multi-static processing development • At sea testing and data analysis for multi-static processing algorithm development	• At sea testing in support of algorithm development, source reliability, and system component demonstrations using multiple multi-static sources • Compact low frequency multi-

	Processing design trade studies • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)	• Design of magnetostrictive piezoelectric transducer (MPT) for high frequency (HF) submarine conformal bow program Integrated Bow Conformal(IBC) • Development of outboard power electronics for HF IBC • Development of single crystal piezoelectric materials • Development of HF broadband panel projector array for IBC • Demonstrate EAST signal processing techniques in a Fleet operational effort	static active receiver (Super ADAR) w/active & passive In Buoy Signal Processing • Passive Acoustic array testbed design and installation • Advanced Counter-Torpedo Detection, Classification, and Localization development for surface ship defense, including performance assessment, data collection, data analysis, algorithm developments.
Continue	• Development of signal processing methods/algorithms that enables improved target localization estimates and differentiation between man-made and natural transient noises • Development of off-board, Acoustic, multi-static source and associated on-board signal processing techniques • Development of Integrated Bow Conformal (IBC), Low Frequency Hull Array(LFHA), and Affordable/Volumetric towed arrays • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer	• Development of improved off-board, Acoustic multi-static source components, processing algorithms, and performance predictive tools • Development of IBC, LFHA, and Volumetric towed arrays • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer array • Development of high energy density, ambient temperature battery laboratory testing • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems	• Development of improved off-board, Acoustic multi-static source components, processing algorithms, and performance predictive tools • Development of IBC, LFHA, and Volumetric towed arrays • Development of MPT array for HF IBC program • Development of outboard power electronics for HF IBC • Development of HF broadband panel projector array for IBC • Development of electrostrictive relaxor ceramics • Development of electroactive polymer broadband transducer array

	prototype • Transition and development of broadband hybrid transducer technology from weapon to submarine (SSBN) application • Development of high energy density, ambient temperature battery • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters	in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)	• Development of high energy density, ambient temperature battery • Environmentally Adaptive Sonar Technology(EAST): Development of technical approaches for automating the operational configuration of sonar systems in response to real-time analysis of the Acoustic field and relevant (measured) environmental parameters • Demonstrate EAST signal processing techniques in a Fleet operational effort • Improved multi-static processing for the light weight sound system (LWSS) and air deployed impulsives • Advanced in-buoy automatic echo processing (S-ADAR)
Complete	• Laboratory demonstration/integration of off-board source components. • Development of thin optical towed array; transition to TB-29 • Development of a high power, high energy density thermal battery	• Development of signal processing methods/algorithms that enables improved target localization estimates and differentiation between man-made and natural transient noises • Development of signal processing algorithms for submarine towed arrays that provide improved target localization estimates • Affordable towed array construction, demonstration	• Demonstration of multi-static processing

		and transition to TB-29 • Development of broadband hybrid transducer array for SSBN application • Evaluation of piezocomposites as broadband projector materials • Advanced compact multi-static active air deployed receiver (Super ADAR) w/active & passive In Buoy Signal Processing design trade studies	

Cooperative ASW	**FY00**	**FY01**	**FY02—$912**
Initiate			• Fishline fiber optic sensor designs for submarine, surface ship & air deployed ASW arrays
Continue	• Telesonar acoustic communications system for deployable systems	Telesonar acoustic communications system for deployable systems	• Telesonar acoustic communications system for deployable systems

Neutralization	**FY00**	**FY01**	**FY02—$25,031**
Initiate	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop High Speed Supercavitating Vehicle Test Bed	• Stealth Homing Concepts • Platform/Weapon Connectivity	• Low noise integrated motor propulsor • Active control with active fiber composites

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

Continue	• Broadband Processing and Intelligent Control for Torpedo Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • Low Rate, Long Endurance Power Sources for Undersea Propulsion • High Rate/Hybrid Power Sources for Torpedoes • Feature Based Navigation and Mapping • Torpedo Noise Modeling and Control • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of active-passive vibration mounts	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop a High Speed Supercavitating Vehicle Test Bed • Broadband Processing and Intelligent Control for Torpedo Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • High Rate/Hybrid Power Sources for Torpedoes • Torpedo Noise Modeling and Control • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of active-passive vibration mounts	• Develop a Computational Capability to Perform Weapon Design Optimization • Develop a High Speed Supercavitating Vehicle concept and Test Bed • Development of Torpedo Intelligent Control Guidance and Control • Intelligent Counterweapons and Countermeasures for Integrated Torpedo Defense • Transition of Counter-torpedo technologies to PMS-415 Tripwire Torpedo Defense System Development of High Rate/Hybrid Power Sources for Torpedoes • Fuzing, Detonation processes and Target Interactions, and Enhanced Kill Mechanisms for Undersea Warheads • Development of Stealth Homing Concepts • Development of Platform/ Weapon Connectivity • Development of active-passive vibration mounts
Complete	• Unmanned Underwater Vehicles	• Feature Based Navigation and Mapping • Low Rate, Long Endurance Power Sources for Undersea Propulsion	• Development of Torpedo Noise Modeling • Development of Underwater explosive effects code • Development of Micro Electromechanical Systems (MEMs) Safing and Arming (S&A) technology (less

			Inertial Measurement Unit)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	-
Adjustments from FY 2001 President's Budget:			
PE Restructuring			76,772
NWCF Adjustments			-250
Inflation Adjustment			82
Minor Adjustment			-94
FY 02 PRESBUDG Submission	**	**	76,510

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0602315N, 0602633N and 0602314N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:

(U) PE 0601153N (Defense Research Science)
(U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
(U) PE 0602435N (Ocean Warfighting Environment Applied Research)
(U) PE 0603254N (ASW Systems Development)
(U) PE 0603506N (Surface Ship Torpedo Defense)
(U) PE 0603553N (Surface ASW)
(U) PE 0603758N (Navy Warfighting Experiments and Demonstrations)
(U) PE 0604221N (P-3 Modernization Program)
(U) PE 0604261N (Acoustic Search Sensors (ENG))
(U) PE 0604784N (Distributed Surveillance Systems)
(U) PE 0603747N (Undersea Warfare Advanced Technology)
(U) PE 0602114N (Power Projection)
(U) PE 0602123N (Force Protection)
(U) PE 0602782N (Mine & Expeditionary Warfare)
(U) PE 0603114N (Power Projection)
(U) PE 0603123N (Force Protection)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602747N
PROGRAM ELEMENT TITLE: Undersea Warfare Applied Research

(U) PE 0603758N (Naval Warfighting Experiment)

(U) NON NAVY RELATED RDT&E:
(U) PE 0603763E (Marine Technology)
(U) PE 0603739E (Advanced Electronics Technologies)
(U) PE 0602702E (Tactical Technology)
(U) PE 0602173C (Support Technologies – Applied Research)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
	**	**	57,668

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PE 0602315N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Navy program element (PE) provides technologies for naval Mine Countermeasures (MCM), U.S. Naval sea mines, Naval Special Warfare, and Department of Defense (DOD) Explosive Ordnance Disposal (EOD). It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capabilities through the development of technologies to achieve military objectives (Power Projection from the Sea) with minimal casualties and collateral damage. The PE supports the Joint Littoral Warfare Mission Area by focusing on technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. The MCM thrusts concentrate on the development and transition of technologies for organic mine countermeasures and Future Naval Capabilities supporting Ship to Objective Maneuver. These include technologies for clandestine minefield surveillance and reconnaissance, organic self-protection, organic minehunting, neutralization/breaching and clearance. The sea mining thrust emphasizes offensive sea mining capabilities. The Naval Special Warfare and EOD technology thrust concentrates on the development of technologies for near-shore mine/obstacle detection and clearance, mobility and survivability, as well as explosive ordnance disposal.

(U)MCM Technology: Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. “Desert Storm” demonstrated the U.S. Navy’s needs to counter the projected third-world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water to the beach. This task has two major thrusts: (1) Mine/obstacle detection and (2) mine/obstacle neutralization. The detection thrust includes: remote sensing techniques to survey threat mining activities and mine/obstacle field locations; advanced acoustic/non-acoustic sensors and processing technologies (e.g. biomimetic, broadband, synthetic aperture) for rapid minefield reconnaissance and determination of the location of individual mines and obstacles. The neutralization thrust includes influence sweeping technologies for influence minefield clearance, explosive and non-explosive technologies for mine/obstacle field breaching, and advanced technologies to rapidly neutralize shallow water (SW) sea mines. The overall goal of the MCM technology thrust is the reduction of MCM tactical timelines and increased stand-off.

(U)Mine Technology: The requirements for improved sea mine technologies has changed due to the reduced threat of the traditional modern submarines and surface ships. The elevated threats today are the third-world submarines and surface

ships, which may be encountered in the littoral waters of regional conflicts. Despite the diminished sophisticated threat, it is imperative that the US Navy maintains a broad-based and robust sea mining capability through advanced mine sensors, environmental characterization, and systems performance analysis technologies. Emphasis is placed on potentially high payoff advanced sensors for target detection and discrimination and on low cost, wide area sea mine system concepts, including positive command/control mechanisms and expanded weapon effectiveness for regional warfare.

(U) Special Warfare Technology: Naval Special Warfare (NSW) missions primarily support covert naval operations. The goal is to develop technology required to increase the combat range and effectiveness of Special Warfare units. A major current focus is to develop technologies to enhance the Sea-Air-Land mission of pre-invasion detection for clearance/avoidance of mines and obstacles in the very shallow water (VSW) and surf zone (SZ) approaches to the amphibious landing areas. Improvements to mission support equipment are needed to increase the probability of mission success, endurance and SEAL swimmer survivability.

(U) EOD Technology: Technology development for EOD needs addresses the DOD Joint Service and interagency responsibilities in EOD, including that required to counter and neutralize Weapons of Mass Destruction (WMD). The technologies developed are required for locating, rendering safe and disposing of Unexploded Explosive Ordnance (UXO). These operations typically occur in deep, poor-visibility water, in areas of high background noise, and in strategic operating areas contaminated by a variety of UXO. Advanced technologies are needed for gaining access to areas contaminated by sophisticated area-denial sensors and/or booby traps and for contending with WMD. These technologies are expected to transition to the Joint Service EOD Program, the Naval EOD Program or the DOD Technical Response Group.

(U) The Navy Science and Technology program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

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

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

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

Mine and Obstacle Detection	**FY00**	**FY01**	**FY02 (36,168)**
Initiate	• Field testing of thin film,	• Transition of CAD/CAC	• Real-time processing for airborne

	high temperature supercoducting gradiometer • Multi-platform, multi-sensor data fusion for organic mine countermeasures • Development of advanced electro-optic mine identification sensor • Development of automated mine identification algorithms • Mine burial prediction model development	algorithms to AQS-20 airborne mine countermeasures program • Environmentally adaptive processing	lidar/multispectral minefield detection • Development of long range SAS motion compensation and beamforming • Development of environmental tactical decision aids • Modeling and simulation for adaptive planning of amphibious operations • Development of Autonomous Underwater Vehicle (AUV) compatible low frequency, buried minehunting sonar • Transition of automated mine identification algorithms to AQS-20/X airborne mine countermeasures program
Continue	• Development of scene classification algorithms based on target optical properties • Development of broadband acoustic processing techniques/algorithms • Development of computer aided detection/classification (CAD/CAC) algorithms for side scan imagery • Development of thin film, high temperature superconducting gradiometer	• Multi-platform, multi-sensor data fusion • Development of advanced electro-optic mine identification sensor • Development of broadband acoustic processing techniques/algorithms • Environmentally adaptive processing • Automated mine identification algorithms • Mine burial prediction algorithm development	• Development of advanced electro-optic mine identification sensor • Development of broadband acoustic processing techniques/algorithms • Mine burial prediction • Development of automated mine identification algorithms

Complete	• Development of broadband sonar projector for synthetic aperture sonar (SAS) • Demonstrated CAD/CAC algorithms in very shallow water during Fleet Battle Experiment Hotel.	• Field test and assessment of thin film, high temperature superconducting gradiometer • Field testing of broadband SAS technology • Collection of electrooptic mine identification sensor data for assessment of automated mine identification algorithms • Mine burial prediction field experiment focusing on impact burial • Demonstration of minehunting technologies during 3rd Fleet training exercise (Kernal Blitz 2001)	• Transition of CAD/CAC algorithms to AQS-20 airborne mine countermeasures program

Mine and Obstacle Neutralization	**FY00**	**FY01**	**FY02 (9,900)**
Initiate	• Development of linear shaped charge array anti-obstacle technology	• Lethality studies for chemical penetrator warhead concept • Development of continuous rod warhead technology for obstacle clearance	• Development of advanced supercavitating anti-mine projectile
Continue	• Nondeterministic modeling of mine vulnerability • Development and evaluation of small unmanned bottom robotic platforms for Surf Zone (SZ) reconnaissance and targeting • Development of database for	• Nondeterministic modeling of mine vulnerability • Model development of shock interaction with and propagation through the sea bed	• Nondeterministic modeling of mine vulnerability • Model development of shock interaction and propagation through the sea bed

	damage characteristics of obstacles		
Complete	• Testing of High Energy Low Pressure (HELP) explosive technology to promote pressure impulse characterization • Transitioned mine kill criteria for new threat mines to PMS-407	• Assessment of sequential and simultaneous detonationing bombs for obstacle clearance	• Demonstration of chemical and pyrotechnic dart lethality against common SZ and beach zone mines (BZ) • Demonstrate effectiveness of continuous rod warhead against light and medium beach obstacles

Sea Mining	**FY00**	**FY01**	**FY02 (1,200)**
Initiate	• Demonstration of mine network concept • Field tests of guidance sensors and signal processing for Distributed Autonomous Detection System (DADS) weapon • Development of command and control hardware/software for minefield control	• Field test of command and control of DADS weapon	
Continue	• Development of guidance sensors	• Demonstration of mine network concept • Development of command and control hardware/software for minefield control	• Development of command and control hardware/software for minefield control • Field test of command and control of DADS weapon
Complete	• Development of hardware/software to demonstrate feasibility of DADS weapon concept	• Field tests of guidance sensors and signal processing for DADS weapon	• Analysis/documentation of guidance sensors and signal processing field tests
Special Warfare/ EOD	**FY00**	**FY01**	**FY02 (10,400)**

Initiate	• Development of deployable virtual environment based training aid and tactical decision aid • Design of Shallow Water Imaging Polarimeter (SHRIMP) EOD • Development of robotic actuators and manipulators based on artificial muscle materials • Development of SAS for small autonomous search vehicles	• Investigate technology options for heating system for Swimmer Deliver Vehicle (SDV) EOD • Development of technologies to remotely jam or disable electronic safed armed fused devices.	• Development of hyperspectral polarometer prototype
Continue	• Development of life support technologies • Development of Buried minehunting dual frequency sonar • Development of Unmanned underwater vehicle (UUV) technologies to support VSW reconnaissance missions EOD • Development of diver portable high frequency acoustic imaging sonar	• Development of life support equipment technologies • UUV technologies to support VSW reconnaissance missions • Development of virtual environment based training aid and tactical decision aids for Navy Special Warfare missions • Development of SAS for small autonomous search vehicles EOD • Development of robotic manipulators and actuators based on artificial muscle materials • Development of coordinated behavior and mission execution by UUVs	• Development of life support equipment technologies • UUV technologies to support VSW reconnaissance missions • Development of virtual environment based training aid and tactical decision aids for NSW missions
Complete			

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

	• Feasibility assessment of hyperspectral imaging polorimeter technology • Fabricated test bed for catalyst free CO2 scrubber EOD • Transitioned diode pumped laser to Environmental Security Technology Certification Program (ESTCP)	• Field tests and evaluation of buried minehunting sonar • Transition underwater photo curable adhesive technology to PMS-EOD	• Field tests of synthetic aperture sonar integrated on a UUV • Field tests of SHRIMP sensor EOD • Field tests of diver portable high frequency imaging sonar

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	
Adjustments from FY 2001 President's Budget:			
PE Restructure			57,675
NWCF Rates Adjustment			-4
Non Pay Inflation Adjustment			68
Program Adjustment			-71
FY 2002 PRESBUDG Submission	**	**	57,668

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PE 0602315N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602131M (Marine Corps Applied Research)
(U) PE 0602236N (Warfighter Sustainment Applied Research)
(U) PE 0602747N (Undersea Warfare Applied Research)
(U) PE 0602435N (Ocean Warfighting Environment Applied Research)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Applied Research

(U) PE 0603502N (Surface and Shallow Water Mine Countermeasures)
(U) PE 0603654N (Joint Service EOD Development)
(U) PE 0603782N (Mine and Expeditionary Warfare Advanced Research)
(U) PE 0604654N (Joint Service EOD Development)
(U) PE 0603640M (Marine Corps Advanced Technology Demo)

(U) NON NAVY RELATED RDT&E:
(U) PE 0602712A (Countermine Systems)
(U) PE 0603606A (Landmine WF and Barrier Advanced Technology)
(U) PE 1160401BB (Special Operation Technology Development)
(U) PE 1160402BB (Special Operation Advanced Technology Development)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602805N
PROGRAM ELEMENT TITLE: Dual Use Science & Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Dual Use Science & Technology	7,638	12,452	10,000

(U) Mission Description and Budget Item Justification: The mission of the Dual Use Science and Technology (DUS&T) Program is to prototype and demonstrate new approaches for leveraging commercial research, technology, products, and processes for military benefit. These new approaches to working with industry, many of which were prototyped at DARPA, must become common throughout the Navy in order to take full advantage of the technological dynamism of the commercial sector. While acquisition reform has helped clear the path, and experience has shown leveraging can work; it has also shown that leveraging is still unfamiliar and not widely adopted. The challenge is to spread leveraging of the commercial sector into the Navy and make it a normal way of doing business throughout the entire acquisition spectrum. Specifically, DUS&T encourages the Navy to leverage commercial research and development to improve the performance, cost and/or readiness of military systems. Under this effort, the Navy solicits, evaluates, ranks, and nominates dual use S&T projects for Dual Use S&T funds. Each project is 50% cost shared with industry. 25% is cost shared with the Navy project funds and Dual Use S&T provides the remaining 25%. All projects are awarded using either Cooperative Agreements or Other Transactions. This is essentially learning by doing approach to Dual Use S&T in the Navy, with Dual Use S&T funds providing an incentive.

JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under APPLIED RESEARCH because it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602805N
PROGRAM ELEMENT TITLE: Dual Use Science & Technology

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

* PEBB=Power Electronic Building Blocks; VHDL=very high-speed integrated circuit hardware description language; PZT=lead zirconate titanate; IIS=Intelligent Inference Systems; MMC=Metal Matrix Composite; IR=Infrared; PCS=Power Conversion System; NSSN=Navy's New Attack Submarine; ADLFP=Air Deployable Low Frequency Projector; CAD=Computer Aided Design

	FY00 ($7,638)	FY01 ($12,137)	FY02 ($10,000)
Initiate	• A System for Distributed Registration for Mobile Augmented Reality in Urban Environment • Linear Wide-Band Vacuum Electronic Power Amplifier • Multi-Frequency Design Codes for Linear High Power Amplifiers • High Power Silicon Carbide Transmitter • Affordable Modular Digital Receiver • K/KA-Band Phased Array Antennas for Mobile Platforms • Low Defect Density GaN Substrates from GaN Boules • Band Pass Modulators • Phased Array Weather Radar Technology • Active Control of Combustion Processes • High Rate Fiber Placement for Affordable Composite	• ONR issued a call to Navy activities in October 2000 for FY 2002 topics to be included in a single Joint Army, Navy, and Air Force solicitation to industry for dual use S&T proposals. Selected topics will address Navy needs identified in the Science and Technology Requirements Guide and Navy projects will be expected to provide at least 25% of the total proposed effort with industry providing at least 50%. • 500kW Integrated Fuel Processor • Dual Use of Energy Transduction Materials • Processing of Biased *PZT Material for Use in High Power Sonar Transducers and High Strain Actuators • Design Optimization and Methodology for Stern Flaps	• Agreements for FY 2002 will be awarded in October 2001. Topic areas solicited on which these agreements competed include: Advanced Propulsion, Power and Fuel Efficiency Technology.

	Structures • Friction Stir Welding Technology Commercialization for High Strength Structural Alloys • Scaled-Up Production of Nanstructured Ceramic Powders for Thermal Spray Coating of Military & Commercial Parts • Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Dynamically Reconfigurable and Scalable Distributed Shipboard Automation System for Improved Sustainability and Survivability • Thermal Barrier Coatings for Molybdenum Refractory Alloys • Compact Lightweight Heat Exchanger for Turbine Thermal Management • Cost-Effective Fabrication Processes for Advanced Superalloy Disks • High Power Density Integrated Motor-Propulsors and Electric Machines • *IIS Bio-Bots • Simulation Based Intelligent Tutoring for Maintenance • Reconfigurable Control and Fault Identification System	• Hydraulic Systems Replacement Using Magnetostrictive Technology in the 50,000 Pound Linear Thrust Range • NAVAIR Technology Commercialization Initiative to transfer Navy developed technology to the commercial sector. • Initiate fuel cell research utilizing deep sea methane hydrates as a in-situ fuel source.	

	• *MMC Reinforced Magnetic Thrust Disk • Enhanched Bearing Materials • Turbine Engine Propulsion • Nickel-Metal Hydride Aircraft Battery • High Impact, Supply-Base Special Processes Identification • Teaching Factory for Advanced Turbine Engine Welding and Inspection Processes		
Continue	• Qualification of Ausform finishing Process for the Manufacturing of Aerospace Gearing • Advanced Hull Forms • Condition Based Monitoring • Active Control of Radiated Noise • Enhanced Thermographic Inspection • Reduced Cost Manufacturing for BLISKS • Wideband Tactical Communications • *IR Array Technology • Amplifier Development • Very High Power *PEBB Demonstration • Advanced Propulsion	• Active Control of Radiated Noise • Wear/Corrosion/Erosion/Fouling Resistant Coatings and Applications • Enhanced Thermographic Inspection • Reduced Cost Manufacturing for BLISKS • Wideband Tactical Communications • *IR Array Technology • Amplifier Development • A System for Distributed Registration for Mobile Augmented Reality in Urban Environment Algorithm • Linear Wide-Band Vacuum Electronic Power Amplifier	• Qualification of Ausform Finishing Process for the Manufacturing of Aerospace Gearing • Advanced Hull Forms • Very High Power *PEBB Demonstration • A System for Distributed Registration for Mobile Augmented Reality in Urban Environment • Linear Wide-Band Vacuum Electronic Power Amplifier • Multi-Frequency Design Codes for Linear High Power Amplifiers • High Power Silicon Carbide Transmitter • Affordable Modular Digital Receiver • Low Defect Density GaN Substrates from GaN Boules

	Technology-Hydrogen Dense Fuels Stabilized Aluminum Hydride or Alane • Wear/Corrosion/Erosion/Fouling Resistant Coatings and Application Methods • Quantum Devices and Ultra-High Frequency Digital Signal Processing • Affordable Unattended and Distributed Sensor Technology • Advanced High Speed Vessels for the Littoral • Uncooled *IR Imaging Array • Piezo-Electronic Microwave Power Components • Resin Transfer Molding for High Temperature Applications • Artificially Intelligent Tutoring for Advanced Distributed Learning	• Multi-Frequency Design Codes for Linear High Power Amplifiers • High Power Silicon Carbide Transmitter • Affordable Modular Digital Receiver • Low Defect Density GaN Substrates from GaN Boules • Band Pass Modulators • Active Control of Combustion Processes • High Rate Fiber Placement for Affordable Composite Structures • Friction Stir Welding Technology Commercialization for High Strength Structural Alloys • Scaled-up Production of Nanostructured Ceramic Powders for Thermal Spray Coating • Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Dynamically Reconfigurable and Scalable Distributed Shipboard Automation System for Improved Sustainability and Survivability • Thermal Barrier Coatings for Molybdenum Refractory Alloys	from GaN Boules • Band Pass Modulators • Active Control of Combustion Processes • Magnetostrictive Actuators for Marine Propeller Pitch and Flow Control • Dynamically Reconfigurable and Scalable Distributed Shipboard Automation System for Improved Sustainability and Survivability • Thermal Barrier Coatings for Molybdenum Refractory Alloys • Cost-Effective Fabrication Processes for Advanced Superalloy Disks • High Power Density Integrated Motor-Propulsors and Electric Machines • *IIS Bio-Bots • Reconfigurable Control and Fault Indentification System • *MMC Reinforced Magnetic Thrust Disk • Enhanced Bearing Materials • Nickel-Metal Hydride Aircraft Battery • Advanced Propulsion Technology-Hydrogen Dense Fuels Stabilized Aluminum Hydride or Alane • Fuel Cells

		• Cost-Effective Fabrication Processes for Advanced Superalloy Disks • High Power Density Integrated Motor-Propulsors and Electric Machines • *IIS Bio-Bots • Reconfigurable Control and Fault Identification System • *MMC Reinforced Magnetic Thrust Disk • Enhanced Bearing Materials • Turbine Engine Propulsion • Nickel-Metal Hydride Aircraft Battery • High Impact, Supply-Base Special Processes Identification • Qualification of Ausform finishing Process for the Manufacturing of Aerospace Gearing • Advanced Hull Forms • Very High Power *PEBB Demonstration • Advanced Propulsion Technology-Hydrogen Dense Fuels Stabilized Aluminum Hydride or Alane	
Complete	• *PCS – power quality equipment that can be used as a dynamic	• Quantum Devices and Ultra-High Frequency Digital Signal	• High Rate Fiber Placement for Affordable Composite Structures

	voltage regulator source with ride through fault capability. The inverter phase leg of the *PCS has applications in propulsion drive systems • Introduction of compact DC/DC Isolation into the NAVY DC Zonal type architecture as part of the Integrated Power System program • *CAD-Driven Laser Forming Process under consideration for wing component on F/A-18 E/F • Nanostructured coatings approved as replacement for • hard chrome on a series of submarine components • GEDAE™ a multi-processor software development tool used on Navy's *NSSN acoustic search processing string, Tactical Environmental Digital Signal Processor, *ADLFP, and Air Force's Rivet Joint. • Complete design of a database for an OC-48c Asynchronous Transfer Mode Segmentation and Reassembly engine. From this effort two sub-items are available. The first is an Application Specific Integrated Circuit design that is being fabricated by National Security	Processing • Condition Based Maintenance • Affordable Unattended and Distributed Sensor Technology • Advanced High Speed Vessels for the Littoral • Uncooled *IR Imaging Array • Piezo-Electronic Microwave Power Components • Resin Transfer Molding for High Temperature Applications • Artificially Intelligent Tutoring for Advanced Distributed Learning • K/KA-Band Phased Array Antennas for Mobile Platforms • Phased Array Weather Radar Technology • Compact Lightweight Heat Exchanger for Turbine Thermal Management • Simulation Based Intelligent Tutoring for Maintenance • Teaching Factory for Advanced Turbine Engine Welding and Inspection Processes	• Friction Stir Welding Technology Commercialization for High Strength Structural Alloys • Scaled-up Production of Nanostructured Ceramic Powders for Thermal Spray Coating • Compact Lightweight Heat Exchanger for Turbine Thermal Management • Turbine Engine Propulsion • High Impact, Supply-Base Special Processes Identification • Active Control of Radiated Noise • Enhanced Thermographic Inspection • Reduced Cost Manufacturing for BLISKS • Wideband Tactical Communications • *IR Array Technology • Amplifier Development

	Agency using its 0.5 micron Complimentary Metal Oxide Semiconductor line. The second is a set of *VHDL code synthesizable to Field Programmable Gate Array. The *VHDL code has been tested and used by Naval Research Laboratories staff, and will be used in the Gigabit ATM Network Adapter project. • Demonstrated the feasibility of replacing aging and/or obsolescent processors with a verifiable hardware device that can execute both legacy and new higher order language software in real-time, deterministic systems.		
SBIR	FY00	FY01 ($315K)	FY02
		• Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.	

* PEBB=Power Electronic Building Blocks; VHDL=very high-speed integrated circuit hardware description language; PZT=lead zirconate titanate; IIS=Intelligent Inference Systems; MMC=Metal Matrix Composite; IR=Infrared; PCS=Power Conversion System; NSSN=Navy’s New Attack Submarine; ADLFP=Air Deployable Low Frequency Projector; CAD=Computer Aided Design

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602805N
PROGRAM ELEMENT TITLE: Dual Use Science & Technology

(U) PROGRAM CHANGE SUMMARY FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 PRESBUDG	9,945	10,067	10,218
Adjustments from FY 2001 President's Budget:			
Congressional Plus-ups		2,500	
Revised Economic Assumption	-39	-115	
SBIR	-245		
Execution Adjustment	-2,023		
Program Adjustment			-218
FY 2002 PRESBUDG Submission	7,638	12,452	10,000

(U) Schedule: Not Applicable.
(U) Technical: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s S&T program contributes to this effort.

(U) This program adheres to Tri-Service Dual Use Science and Technology Program

(U) RELATED RDT&E:
(U) PE 0602805F (Air Force's Dual Use Science and Technology Program)
(U) PE 0602805F (Air Force's Dual Use Science and Technology Program)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603114N
PROGRAM ELEMENT TITLE: Power Projection Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2911 Power Projection Advanced Technology	**	**	76,410

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0603238N, 0603792N and 0603217N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

This program includes RDT&E,N funds to develop and demonstrate advanced technologies for naval weapon systems, including Electric Warship and Directed Energy, which provide enhanced lethality and enable new capabilities for locating, identifying and killing high-value, short-dwell military ground and undersea targets, and suppression of enemy defenses. These technologies will include those that minimize exposure of naval personnel to lethal fire (autonomous vehicles), reduce the total ownership cost of systems, and provide responsive/cost effective high speed sealift.

In support of this overall mission the following specific areas are included:

The specific mission of Time Critical Strike integrates surveillance, indications and warnings, target identification, targeting, fire order generation and dissemination, engagement and kill mechanisms, and damage assessment processes to address critical mobile targets, urban targets, short dwell targets and deeply buried targets. Time Critical Strike must address time sensitive targets in complex urban areas over crowded skies shared with civilian commercial and neutral country aircraft. A common, shared picture is required to enable distributed collaborative planning. Unmanned combat air vehicles will be investigated to effectively and affordably prosecute Strike and surveillance missions. The fusion contained within this picture should include all source data (raw as well as processed from organic, theater, and

national sensors). The approach must be responsive in that it can quickly process and disseminate organic data from platforms. Additionally, it must be unambiguous–for instance, uncertainty in a track should be properly

portrayed to the users. Intelligence processing, execution speed, command decisions, and accuracy of strike are in constant tension.

The autonomous operations program aims to enhance the mission capability of Naval forces by developing technologies that will dramatically increase the autonomy, performance, and affordability of Naval organic unmanned vehicle systems. These efforts are focused in four areas: Unmanned Ground Vehicles (UGV) which focuses on the increasing utility of UGV systems to Marine Corps units in all environments but specifically in urban and littoral terrain; Unmanned Air Vehicles (UAV) which includes intelligent reasoning for autonomy, technologies to enhance “see and avoid” capabilities, object identification, vehicle awareness, and vehicle and mission management; Unmanned Undersea Vehicles (UUV) which will demonstrate the technical feasibility for a UUV system to effectively search, detect, track and trail undersea threats while maintaining a robust communications link to enable appropriate command, control and transmission of collected data; and UAV Propulsion: which will develop propulsion and power technologies unique to Naval UAVs operating on surface combatants. The project is related to on-going projects such as the Integrated High Performance Turbine Engine Technology program.

In addition specific technology efforts are associated with affordability, reduction of total ownership costs for power projection systems, and cost effective high speed sealift.

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

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEMONSTRATION BUDGET ACTIVITY because it encompasses design, development, simulation, or experimental testing of prototype hardware to validate technological feasibility and utility, and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603114N PROJECT NUMBER: R2911
PROGRAM ELEMENT TITLE: Power Projection Advanced Technology PROJECT TITLE: Power Projection Advanced Technology

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

Time Critical Strike	FY00	FY01	FY02 $50,610
Initiate			▪ Naval-Unmanned Combat Air Vehicle (UCAV-N) Phase II: Development of UCAV-N advanced technology demonstrator system • UCAV-N Phase II: Refine System Plans and Designs initially developed in 6.2 program. Conduct sub-system development and test leading to prototype demonstration ▪ Real Time Execution Decision Support System (REDS): Develop software methods for collaborative planning, options generation, and mission target folder generation

Initiate			▪ Analysis of seeker alternatives and mission need assessment for a next generation mid-range, ship launched, precision strike weapon ▪ Low Cost Terminal Seeker Trade study of seeker, processor, and weapon interface in accordance with concept study and performance requirements ▪ Image Analysis Survey and develop methods for target exploitation in image and video streams ▪ Develop chemical and mechanical processes for low cost Fiber Optic Gyroscope inertial measurement unit fabrication ▪ Integration studies of an advanced dual mode anti-radiation missile seeker incorporating a balljoint gimbals into a ramjet-powered missile airframe for a flight test demonstration of seeker Anti-Radiation Missiles effectiveness at high speed ▪ Hyper-spectral Imaging System : Develop rugged, high through-put

			Infra-Red Spectrometer, optical train analysis, select position/pointing system reference, and enhance detect algorithms for real time processor
Continue	▪ High speed, gun launched, barrage round projectile demonstration program, gun launch of high velocity, unguided flight test vehicle to range (>40nmi) and preliminary lethal mechanism tests supporting Marine Corps Volume of Fire Requirements	▪ High speed, gun launched, barrage round projectile demonstration program, high-g testing of critical electronic guidance components and structural components. Analysis/simulation of projectile system lethality in support of Marine Corps Volume of Fire Requirements	
Complete			▪ Complete flight test demonstration of a high speed gun launched barrage round to measure flight time and distance, guidance package accuracy, and fleechette lethality

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603114N PROJECT NUMBER: R2911
PROGRAM ELEMENT TITLE: Power Projection Advanced Technology PROJECT TITLE: Power Projection Advanced Technology

Autonomous Vehicles	FY00	FY01	FY02 $17,700
Initiate			▪ Develop self-awareness sensors to enable adaptation and independent action for detection (threats, terrain), display, and decision ▪ Design definition and risk reduction for intelligent vehicle self-management and fault tolerance targeting concepts ▪ Design and develop advanced propulsion system for reliable UAV systems ▪ Design and develop mobility UGV testbed for platform, sensor, and command & control sub-systems ▪ Integrate and Demonstrate UUV technologies supporting Maritime Intelligence, Surveillance, Reconnaissance missions ▪ Demonstration of reconfigurable network technology for multiple mobile UUV and stationary nodes in shallow water

Initiate			▪ UUV-Development of acoustic and Radio Frequency communications for mobile and stationary nodes ▪ UUV-Development of low rate, long endurance power sources and precision navigation methods for undersea vehicles
Continue	▪ ADVANCED LINEAR MOTOR TECHNOLOGY Advanced Technology Demonstration to demonstrate the use of a linear motor for shipboard recovery of naval aircraft	▪ ADVANCED LINEAR MOTOR TECHNOLOGY-Develop demonstration system design and conduct critical component testing	

Complete			▪ ADVANCED LINEAR MOTOR TECHNOLOGY ATD-Complete fabrication of demonstration system. Demonstrate single sided portion of linear motor recovery system w/simulated aircraft recovery loading
Total Ownership Costs	FY00	FY01	FY02 $8,100
Initiate		▪ Finalize reconfigurable rotor blade system requirements and conduct concept trades ▪ Initiate development of a prototype ¼-scale Shaped Memory Alloy actuator	• Evaluation / assessment of High Speed Sealift Vehicle.
Continue	• Develop and flight demo enhanced air platform	• Develop and flight demo enhanced air platform	▪ Develop and flight demo enhanced air platform operational

	operational capability	operational capability	capability ▪ Design and build of a ¼-scale model actuator and blade assembly continue with manual lock for reconfigurable rotor blade program to enhance the affordability and mission effectiveness of tilt-rotor and rotary wing aircraft. Conduct preliminary bench test.
Complete			▪ Reconfigurable rotor blade system requirements and concept trade studies

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603114N PROJECT NUMBER: R2911
PROGRAM ELEMENT TITLE: Power Projection Advanced Technology PROJECT TITLE: Power Projection Advanced Technology

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Adjustments from FY 2001 President's Budget:			
Program Adjustment			+9,918
PE Restructure			66,504
Non-Pay Adjustment			+97
NWCF Adjustment			-109
FY 2002 President's Submission	**	**	76,410

**The Science and Technology PEs were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0603238N, 0603792N and 0603217N

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable
(U) Schedule: Not Applicable

(U) OTHER PROGRAM FUNDING SUMMARY:

(U) NAVY RELATED RDT&E:
(U) 0602114N Power Projection Applied Research
(U) 0603236N Warfighter Sustainment Advanced Technology
(U) 0602435N Ocean and Atmospheric Technology
(U) 0603782N Mine and Expeditionary Warfare Technology

(U) NON NAVY RELATED RDT&E:
(U) Not Applicable

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603114N PROJECT NUMBER: R2911
PROGRAM ELEMENT TITLE: Power Projection Advanced Technology PROJECT TITLE: Power Projection Advanced Technology

(U) SCHEDULE PROFILE: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
Force Protection Advanced Technology			
R2192	**	**	85,297

** The Science and Technology Program Element (PE) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603238N, 0603270N, 0603508N, 0603792N, and 0603217N.

MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Includes RDT&E funds to develop and demonstrate advanced technologies that support platform self protection and theatre wide and missile defense of naval platforms and forces. The new capabilities include the areas of all-weather, day/night protection of naval platforms and forces against all weapon threats, counterstealth and countermeasures. These new capabilities also include affordable technologies for platform structural systems as well as platform systems, sub-systems and components and aircraft vectoring technologies. Demonstrated capabilities support the ability to prevent or control platform damage while preserving operational capability.

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

JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY

PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	**	**	-
Adjustments from FY 2001 President's Budget:			
PE Restructure			37,219
NWCF Adjustment			21
Non Pay Inflation Adjustment			3
Minor Adjustment			-46
Additional Program Adjustment			48,100
FY 02 PRESBUDG Submission	**	**	85,297

** The Science and Technology Program Element (PE) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603238N, 0603270N, 0603508N, 0603792N, and 0603217N.

Schedule: Not Applicable.

Technical: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY
PROJECT NUMBER: R2192
PROJECT TITLE: Force Protection Advanced Technology

PROGRAM ACCOMPLISHMENTS AND PLANS:

Surface Ship & Submarine Hull, Mechanical & Electrical (HM&E)	**FY00**	**FY01**	**FY02** **$60,344**
Initiate	• Reconfigurable Engineering Plant • Superconducting (SC) and Permanent Magnet (PM) Propulsion Motors		• Dynamic Magazine Protection • Passive Magazine Protection • Advanced Damage Countermeasures • Near Field Deamping • Coastal Area Protection System • Electric warship technologies, including directed energy • Ship technology demonstrator platform
Continue	• Damage Control Automation to Reduce Manning (DCARM) • Quiet Electric Drive • Ship Service Fuel Cell • Power Electronic Building Blocks • Advanced Machinery Support System	• Damage Control Automation to Reduce Manning (DCARM) • Quiet Electric Drive • Ship Service Fuel Cell • Advanced Machinery Support System • Reconfigurable Engineering Plant • SC and PM Propulsion Motors	• Advanced Machinery Support System • Reconfigurable Engineering Plant • Ship Service Fuel Cell • Quiet Electric Drive • SC and PM Propulsion Motors

Complete	• Advanced Machinery Support System - ER Truss Assessment - Project M Large Scale Demo	• Advanced Machinery Support System - Truss Shock Demo • Power Electronic Building Blocks	• Damage Control Automation to Reduce Manning (DCARM) • Advanced Machinery Support System - Coating Demo

Sensors & Associated Processing	**FY00**	**FY01**	**FY02 $16,077**
Initiate	• Multifunction Infrared Distributed Aperture System (MIDAS) Maritime Technology Demonstration (MTD). Objective is to demonstrate a passive infrared sensor system to provide pilots and other platform operators with visual quality spherical tactical situational awareness. • Ship Infrared Search & Track (IRST) Sensor	• Affordable Ground Based Radar	• Missile Warning System (MWS) • Shipboard Electro-optic (EO)/Infrared (IR) Closed loop Self Protection • EO/IR Self Protection for Small Ground Vehicles • Submarine & Surface Platform Self Protection Classified Project • Develop Quantum Cascade and Diode Pump Solid State Lasers for EO/IR Self Protection
Continue		• MIDAS-Maritime Technology Demonstration (MTD) • Ship Based IRST Sensor	• Affordable Ground Based Radar • Ship Based IRST Sensor
			• MIDAS-MTD: Assemble flight

Complete			demonstration system and conduct flight demonstration.

Missile Defense	**FY00**	**FY01**	**FY02 $7,679**
Initiate			• Development of affordable sensor system elements which can be used ashore against air threats targeted at Marine Corps units or Critical assets ashore protected by Naval Forces. • Development of affordable elements of airborne and shipboard multi-spectral sensor and combat systems for the purpose of early detect through engage functions over-the-horizon from firing ships.

			• Develop a demonstration system for Threat prioritization and weapon assignment in a multi-mission environment. • Affordable and highly effective interceptor components which can be integrated into variants of surface-to-air interceptors currently envisioned.
Continue	• Develop & flight demo enhanced air platform operational capability	• Develop & flight demo enhanced air platform operational capability	• Develop & flight demo enhanced air platform operational capability

Underwater Platform Self Defense	**FY00**	**FY01**	**FY02** **$1,197**
Continue	• Anti-torpedo Torpedo Trip Wire System	• Anti-torpedo Torpedo Trip Wire System	• Anti-torpedo Torpedo Trip Wire System

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY

PROJECT NUMBER: R2192
PROJECT TITLE: Force Protection Advanced Technology

OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
- PE 0601153N (Defense Research Sciences)
- PE 0602123N (Force Protection Applied Research)
- PE 0603561N (Advanced Submarine Systems Development)
- PE 0603563N (Ship Concept Advanced Design)
- PE 0603573N (Advanced Surface Machinery Systems)
- PE 0603609N (Conventional Munitions)
- PE 0603755N (Ship Self Defense)
- PE 0603790N (NATO Research and Development)
- PE 0603792N (Advanced Technology Transition)
- PE 0603794N (C3 Advanced Technology)
- PE 0603800N (Joint Advanced Strike Technology Program)
- PE 0604270N (EW Development)
- PE 0604366N (Standard Missile Improvements)
- PE 0604558N (New Design SSN Development)
- PE 0604561N (SSN-21 Development)

NON-NAVY RELATED RDT&E:
- PE 0602201F (Aerospace flight Dynamics)
- PE 0602203F (Aerospace Propulsion)
- PE 0602204F (Aerospace Avionics)
- PE 0602270F (Electronic Combat Technology)
- PE 0603202F (Aerospace Propulsion Subsystems Integration)
- PE 0603245F (Advanced Flight Technology Integration)
- PE 0603205F (Flight Vehicle Technology)
- PE 0603216F (Aerospace Propulsion and Power Technology)
- PE 0603270F (Electronic Combat Technology)
- PE 0603401F (Advanced Spacecraft Technology)
- PE 0603601F (Conventional Weapons Technology)
- PE 0603726F (C3I Subsystem Integration)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603123N
PROGRAM ELEMENT TITLE: FORCE PROTECTION ADVANCED TECHNOLOGY

PROJECT NUMBER: R2192
PROJECT TITLE: Force Protection Advanced Technology

PE 0604770F (Joint Surveillance/Target Attack Radar Systems (JSTARS)
PE 0602270A (Electronic Warfare Technology)
PE 0603270A (Electronic Warfare Technology)
PE 0603772A (Advanced Tactical Computer Science and Sensor Technology)
PE 0604866C (Patriot Risk Reduction Mitigation)

SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603235N
PROGRAM ELEMENT TITLE: Common Picture Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2919 Common Picture Advanced Technology	**	**	48,583

**The Science and Technology (S&T) Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PEs 0603707N and 0603747N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE includes funds for advanced technology development, test and evaluation of a dynamic distributed common picture based on leading edge technologies that will improve situational awareness across all Command echelons from the Commander in Chief (CINC) to tactical units afloat and warfighters ashore. This effort will demonstrate a capability for building and maintaining a seamless secure, common operational and tactical picture of the total battlespace, thereby providing Naval Forces a capability for self-synchronization, increased speed of command, and optimized resource allocations. The Common Picture Program is supportive of the following Future Naval Capabilities (FNCs): Information Distribution; Decision Support System; Missile Defense; Littoral Anti Submarine Warfare (ASW); and Platform Protection. Advanced technologies to be developed, tested and demonstrated include: communication protocols and networks for secure data link operation; information networks for cooperative target tracking; information and knowledge management; tailored information, exploitation, extraction and distribution; communication security and information assurance technologies; decision support tools for use in network-centric, collaborative environments; multi-source integration for composite combat identification (ID) and target tracking; small platform situational awareness and protection; cross-platform data fusion for formulating a common tactical/environmental picture in support of littoral ASW operations; space based systems and navigational technologies that reduce the Global Positioning System’s (GPS) vulnerability

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603235N
PROGRAM ELEMENT TITLE: Common Picture Advanced Technology

validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603235N PROGRAM ELEMENT TITLE:

PROJECT NUMBER: R2919
PROJECT TITLE: Common Picture Advanced Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:
Supports the FNC in the area of Information Distribution. The emphasis is on the development of technologies supporting secure heterogeneous wireless communication networks for data (e.g. voice, multi-media) links and interconnecting air, ship, submarine and land platforms. Technology will be developed to demonstrate; (1) secure dynamic entry onto and exit from distributed user communication nodes without having to pre-plan the event in a tactical data link network environment such as Link-16; (2) Communications to support networking of unmanned sensors; (3) Architectures, Network security, and Network Resource Management in support of Networking with Coaltion forces; (4) Integrated network architecture that employ existing tactical data for exchange of information with multiple legacy tactical communications systems; (5) secure robust protocols for efficient networked group communications; (6) network management techniques for effectively allocating bandwidth and computational resources across the tactical and theatre levels in support of information technology needs for network centric operations; (7) ability to rapidly analyze and validate network information system security according to the common criteria.

Secure Networked Information Systems	**FY00**	**FY01**	**FY02 ($2,483)**
Initiate			• Tactical Data Link Dynamic Networking • Multi-national Virtual Operational Network • Secure group network protocols • Adaptive network centric systems

Communication Security - Classified Program

Communication Security	**FY00**	**FY01**	**FY02 ($15,000)**

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603235N PROGRAM ELEMENT TITLE:

PROJECT NUMBER: R2919
PROJECT TITLE: Common Picture Advanced Technology

Initiate			• Classified Program

Supports the FNC in the area of Decision Support. The emphasis is on developing information and knowledge management capabilities and decision aids to build and maintain a timely operational/tactical picture of the total battlespace across all Command echelons from the CINC to tactical units afloat as well as warfighter ashore. Technology developments and demonstrations include: Knowledge based operations with intuitive visualization for Command Center operations; multi-source integration; situational assessment decision aids that reduces operator workload and optimizes resource allocation; interactive distributed planning, plan monitoring and re-planning; collaborative technologies to support distributed operations.

Decision Support System	FY00	FY01	FY02 ($11,000)
Initiate	• Commander in Chief (CINC 21)	• Environment Visualization (EVIS)	• Marine to CINC Intelligent Cueing and Triggers • Handheld Common Operational Picture (COP) • Multi-Modal Workstation/Workload Management • Knowledge Visualization Wall • Intelligence, Surveillance, Reconnaissance & Targeting Prototype Enhancements

Continue	• Virtual Information Center Technology for Open-Source Requirements (VICTOR) • Decision Support Systems for Coalition Operations (DSSCO) • Aircrew Decision Support Systems (ADSS)	• VICTOR • DSSCO • ADSS • CINC 21	• EVIS • Collaborative Technology (CT)for Course of Action Analysis (COA) • VICTOR • DSSCO • ADSS • COA-Interactive Decision Support (IDS) Plan/Monitor/Re-planning System • CINC 21

Supports the FNC in the area of Missile Defense. The emphasis is on developing multi-source sensor integration for cooperative target tracking, improved combat ID and extending engagement of air targets near point of origin by using all-source data to formulate a common operational and tactical picture of the battlespace. Technologies that will be developed and demonstrated include; fusion algorithms to create and display a single integrated air picture common to all users; signal processing and target discrimination algorithms for surveillance assets; overland fire control quality tracking of cruise and ballistic missiles; target intercept integration and tracking, Combat ID techniques; and fusion of all source information.

Surface/Aero Space Surveillance Multi Source Integration & Combat ID	**FY00**	**FY01**	**FY02 ($7,500)**
Initiate			• Platform Level Multi Source Integration • Theater Wide Multi-Source

			Integration • Combat Identification For Air Defense • Affordable Ground Based Radar

Supports the FNC in the area of Littoral Anti-Submarine Warfare (ASW). The emphasis is on developing both a common ASW tactical and environmental picture to improve detecting, tracking, and classifying neutral subsurface platforms. Technologies that will be developed and demonstrated include; cross platform data fusion, common sensor performance predictions across platforms, and captured sensor performance uncertainty.

Integrated ASW	**FY00**	**FY01**	**FY02 ($4,600)**
Initiate		• Demonstration of Intra-Platform Data Fusion between Radar and Sonar on Surface Ship and Sonobuoys from Marine Patrol Aircraft (MPA) during Vinson Battle-Group (BG) Deployment • Demonstration of Cross Platform Data Fusion between Surface Ship and MPA in transiting BG and Area Clearance Scenarios.	• Development of Algorithms for Intra Platform Sensor Performance Prediction and Real Time Inter Platform Sharing of Sensor Performance Predictions • Demonstration of Intra Platform Data Fusion between Radar and Sonobuoys on MPA • Demonstration of Cross Platform Data Fusion between Surface Ships and MPA using Multistatic Active Mode
Continue	• Development of Intra and Inter Platform Data Fusion Algorithms • Development of Operational	• Development of Intra and Inter Platform Data Fusion Algorithms • Development of Operational	• Development of Intra and Inter Platform Data Fusion Algorithms • Development of Operational

	Guidelines for Platforms engaged in Cross Platform Data Fusion • Collection of Data for Algorithm Development	Guidelines for Platforms engaged in Cross Platform Data fusion • Collection of Data for Algorithm Development	Guidelines for Platforms engaged in Cross Platform Data Fusion • Collection of Data for Algorithm Development
Complete		• Demonstration of Intra-Platform Data Fusion between Radar and Sonar on Surface Ship and Sonobuoys from Marine Patrol Aircraft (MPA) during VINSON Battle-Group (BG) deployment • Demonstration of Cross Platform Data Fusion between Surface Ship and MPA in transiting BG and Area Clearance Scenarios.	• Demonstration of Intra Platform Data Fusion between Radar and Sonobuoys on MPA • Demonstration of Cross Platform Data Fusion between Surface Ships and MPA using Multistatic Active Mode

Supports the FNC in Platform Protection. The emphasis is on developing a compact small platform situational awareness capability that is particularity suited for man-portable smaller ships, submarines, and surveillance aircraft. The system will employ miniature millimeter-wave integrated circuit (MMIC) devices and a new antenna to form an extremely compact, low volume and light weight system that provides very accurate hemispheric direction finding and a self-protection capability against threat missile weapon systems.

Platform Awareness & Protection	**FY00**	**FY01**	**FY02 ($1,000)**
Initiate			• Advanced Prototype Compact Small Platform Situational Awareness • Laboratory Demonstration of Circular-Disposed Interferometer

			with MMIC Receiver

Supports the FNCs association with Common Picture Advanced Technology in the area of GPS and Navigation Technology. The emphasis is on three areas: (a) Integration of the GPS and EPLRS/Link-16 (GEL) for developing GPS and Navigation. This effort draws upon the capabilities presently available in the fleet that use Link 16/Joint Tactical Informaiton Distribution System (JTIDS) and Enhanced Position Location Reporting System (EPLRS). This approach locates elements in the battle group through radio signal time-of-flight. Over all, the Relative Navigation approach draws upon a wide range of Navigation and precision clock capabilities available in the Navy Battlegroup and extends their availability through existing communications links. (b) Relative Navigation efforts: These efforts draw upon the capabilities presently available in the fleet that use Link 16/JTIDS and EPLRS system. This approach locates elements in the battle group through radio signal time-of-flight. Over-all, the Relative Navigation approach draws upon a wide range of Navigation and precision clock capabilities available in the Navy Battle group and extends their availability through available communications links. (c) Alternatives to Global Positioning System (GPS) and to Relative Navigation: This category draws upon wide–ranging physical principles and phenomena. Gravity gradient measurements, and images of the earth formed through the natural emissivity of bodies.

GPS and Navigation Technology	**FY00**	**FY01**	**FY02 ($5,000)**
Continue	• GPS/Navigation Systems Integration (NSI) • Relative Navigation Concept • Non-GPS Navigation Technology	• GPS/NSI • Relative Navigation Concept • Non-GPS Navigation Technology	• GPS/NSI • Relative Navigation Concept • Non-GPS Navigation Technology

The Extending the Littoral Battlespace (ELB) effort responds to the top level military need to rapidly deploy a Naval Expeditionary Task Force with an embarked Marine Air Ground Task Force (MAGTF) as part of a larger Joint Task Force to any region of the world’s littorals and conduct military operations from a sea vase across the spectrum of conflict to implement national military strategy. Forces employed ashore will be light, agile, distributed and disaggregated and capable of optimizing remote fires, to effectively deter aggression, halt attacks and secure critical areas as a

precursor to a much larger force. Forces will be empowered by unprecedented situation understanding via a robust information infrastructure that is fully coupled to a decision/planning/execution system on a shared battlespace network (sea/land). The objective is to demonstrate an enhanced integrated command and control/fires and targeting capability to enable rapid employment, maneuver, and fires to support joint dispersed unit operations in an extended littoral battlespace.

Extended Littoral Battlespace	FY00	FY01	FY02 ($1,000)
Initiate			• Transition technologies, hardware, and software to user for further military utility • Demonstration/post demonstration analysis for evaluation the system concept and assessing its military utility. • Residual support of equipment fielded with Amphibious Ready Group/Marine Expeditionary Unit (ARG/MEU) and deployment dependant on accomplishment in FY01

- Marine Mammals: Decision aids, planning tools and technologies are being developed to aid the decisionmaker in mission planning for minimal environmental impact, with particular regard to marine protected species and marine protected areas. The network centric toolkit is designed to operate seamlessly with existing and emerging common tactical displays, databases, and data integration tools. The effort includes establishing software, hardware and

communications standards to access models and databases residing both inside and outside Department of Defense, and to present them to common tactical picture hardware/software assets.

Marine Mammals	FY00	FY01	FY02($1,000)
Initiate			• Visualization of information with Levels of Uncertainty • Develop Environmental Risk Criteria for use with displays of underwater acoustics • Common Tactical Picture access to Navy Living Marine Resources Information System (LMRIS - NavOceanO)

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
Program Adjustments			48,359
NWCF Adjustment			179
Inflation Adjustment			45
FY 2002 Presbudg Submission	6,089*	9055*	48,583

**The Science and Technology (S&T) Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2001 was funded in PEs 0603707N and 0603747N.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603235N PROGRAM ELEMENT TITLE: PROJECT NUMBER: R2919 PROJECT TITLE: Common Picture Advanced Technology

(U) CHANGE SUMMARY EXPLANATION

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Science)
(U) PE 0602235N (Common Picture Applied Research)
(U) PE 0602114N (Power Projection Applied Research)
(U) PE 0602271N (RF Systems Applied Research)

(U) NON-NAVY RELATED RDT&E:

(U) SCHEDULE PROFILE: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603236N
PROGRAM ELEMENT TITLE: Warfighter Sustainment Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2915 Warfighter Sustainment Advanced Technology	**	**	57,685

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0603217N, 0603707N, 0603712N and 0603792N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE supports: a) the Integrated Warfare Architecture (IWAR) Support Areas for Manpower and Personnel, Training, and Readiness; b) the IWAR Mission Areas; c) the Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff; and d) the Future Naval Capabilities (FNC) for Capable Manpower, Total Ownership Cost Reduction, Expeditionary Logistics, and Warfighter Protection. It develops technologies that enable the Navy to recruit, select, classify, assign and manage its people; to train effectively and affordably in classroom settings, in simulated environments and while deployed; to effect human systems integration into weapon systems. Other technologies developed in this PE enable reduced operating costs through life-extension of legacy systems, increased efficiency of future propulsion systems and improved diagnostic tools.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603236N PROGRAM ELEMENT TITLE: Warfighter Sustainment Advanced Technology

PROJECT NUMBER: R2915 PROJECT TITLE: Warfighter Sustainment Advanced Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) MANPOWER AND PERSONNEL DEVELOPMENT: This project provides Navy personnel system managers with the ability to attract and retain the right people and to place them in jobs that best use their skills, training, and experience. Fleet readiness can be enhanced and personnel costs reduced via such technologies as modeling and simulation, mathematical optimization, advanced testing, statistical forecasting, information visualization, data warehousing, date cleansing, web-based knowledge management, and human performance measurement.

MANPOWER & PERSONNEL DEVELOPMENT	FY00	FY01	FY02-$3,145
Initiate	• Enlisted Manpower and Personnel Integrated Planning System (EMPIPS) • Optimizing Personnel Classification; Combating Attrition Through Job Satisfaction (RIDE) • Skill Assessment, Training, Evaluation and Assistance for Navy Recruiters (STEAR) • Manpower Implications of Advertising to Target Markets (TAMI) • Training Continuum and Readiness Modeling (TCARM)	• Navy Compensation Decision Support System	• Integrated Whole Person Assessment to reduce unwanted attrition and increase career satisfaction, retention, and fleet readiness • Integrated Sailor/Marine Career Management System to place the right person in the right job with the correct training in a timely fashion • Integrated Personnel Situation Monitoring, Analysis, and Response Technologies to enable personnel managers to overcome emerging personnel critical skill shortages, assess alternative personnel policies, and maximize personnel readiness
Continue	• Comprehensive Officer Force Management Environment (COFME)	• COFME • EMPIPS • RIDE • STEAR • TCARM	• Navy Compensation Decision Support System • RIDE

Complete	• Enlisted Strategic Planning and Assessment (ESPA) • Distribution 2000 Prototype (D2K)	• TAMI	• COFME • EMPIPS • RIDE • STEAR • TCARM

(U) TRAINING SYSTEMS: This project improves mission effectiveness and safety by applying both simulation and instructional technology to the design of affordable education and training methods and systems. The project develops and evaluates systems to improve basic through advanced individual and team training, skill maintenance, and mission rehearsal capability. It improves training efficiency and cost-effectiveness by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the logistics, development, delivery, evaluation, and execution of training.

TRAINING SYSTEMS	**FY00**	**FY01**	**FY02-$19,192**
Initiate	• Synthetic Cognition for Operations Team Training (SCOTT)		• Prototype Authoring Capabilities for Developing Pedagogically Sound Advanced Distributed and Distance Learning • Objective-Based On-the-Job Training and Maintenance Support for Individuals and Teams: 1) transfer of expertise through improved mentoring activity, enhanced embedded scenario-based distributed team training; 2) improved maintenance training; and 3) support using advanced intelligent tutoring systems, diagnostic sensor data and interactive electronic technical manuals • Prototype Virtual Technology/Environments for realistic Landing Craft Air Cushion (LCAC) and Advanced

			Amphibious Assault Vehicle (AAAV) simulators for coordination among crew for driving and fighting vehicles to maintain and enhance combat readiness
Continue	• Deployable Sonar Operator Training (DSOT) • Conning Officer Virtual Environment (COVE) • Tactical Readiness Instruction (TRIADS) • Computer Simulation Based Training System with Intelligent Tutoring Components (CSITS) • Intelligent Exercise Planning and Control Agents (IEPCA) • Transportable Strike/Assault Rehearsal (TSTARS) • Damage Control Assessment & Intelligent Tudor	• SCOTT • DSOT	• DSOT • SCOTT
Complete		• CSITS • COVE • Tactical Decision Making (TDM) • TSTARS	

(U) HUMAN SYSTEMS INTEGRATION (HSI): This project supports the design of affordable warfighter-centered systems, organizations and jobs by applying knowledge of human capabilities, limitations and needs. Project focus will be on selection/training criteria and validation and the development of engineering support tools to enable human-centered design.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603236N PROGRAM ELEMENT TITLE: Warfighter Sustainment Advanced Technology

PROJECT NUMBER: R2915 PROJECT TITLE: Warfighter Sustainment Advanced Technology

HUMAN SYSTEMS INTEGRATION	FY00	FY01	FY02-$434
Initiate			• Development of a Prototype Advanced Land Attack Console Employing Human-Centric Design Principles
Continue	• Ship Manpower Analysis and Requirements Tool (SMART) • Advanced Alerting (ADAL) • Display and User Enhancement Technology for Systems (DUETS) • Sonar Workstation (SW)	•	
Complete		• SW • SMART • ADAL • DUETS	

(U) INTEGRATED HIGH PERFORMANCE TURBINE ENGINE TECHNOLOGY (IHPTET): This project covers the Navy's share of the demonstrator engine efforts under the Department of Defense (DoD)/National Aeronautics and Space Administration (NASA)/Industry IHPTET program, ensuring that Navy unique design and operational requirements are met. The program funds three demonstrator engine classes. Each engine class has specific performance goals that are divided into multiple phases. Phase II is currently progressing to the engine demonstration phase. The Phase III concepts were developed and have been initiated. The phase goals of each engine class are listed as follows and are referenced to a 1987 baseline (additional affordability goals have been developed for fighter/attack and turboprop/shaft classes):

- (U) Fighter/attack (Joint Technology Demonstrator Engine (JTDE)):
  - Phase II - 1997: +60% thrust/weight (Fn/Wt), +200^{o}F combustor inlet temperature (CIT), +600^{o} F turbine inlet temperature (TIT), -20% acquisition cost, -20% maintenance cost, -30% fuel burn.
  - Phase III - 2005: +100% Fn/Wt, +400^{o}F CIT, +900^{o} F TIT, -35% acquisition cost, -35% maintenance cost, -40% fuel burn.

- (U) Turboprop/shaft (Joint Turbine Advanced Gas Generator (JTAGG)):
  - Phase II - 1997: +80% shaft horsepower/weight (SHP/Wt), -30% specific fuel consumption (SFC), +600°F TIT, -20% acquisition cost, -20% maintenance cost.
  - Phase III - 2003: +120% SHP/Wt, -40% SFC, +1000°F TIT, -35% acquisition cost, -35% maintenance cost.
- (U) Missile/expendable engines (Joint Expendable Turbine Engine Concepts (JETEC)):
  - Phase II - 1997: +70% Fn/Wt, -30% SFC, +1200°F CIT, +900 °F TIT, and -45% Cost.
  - Phase III - 2003: +100% thrust/airflow (Fn/Wa), -40% SFC, +1400 °F CIT, +1400°F TIT, -60% Cost.

- (U) Each engine company (Allison Advanced Development Company (AADC) (IN), Honeywell International Engines and Systems (HES) (formerly AlliedSignal Engines) (AZ), General Electric (GE) (OH & MA), Pratt & Whitney (P&W) (CT & FL), Teledyne Continental Motors Engine Division (formerly Teledyne Ryan Aeronautical) (OH) and Williams International (WI) (MI)) attempts to utilize at least two engine builds or demonstrator tests within each Phase to demonstrate the performance goals.

IHPTET	FY00	FY01	FY02-$10,409
Initiate	• Phase III JETEC (AADC)	• Phase III JTDE (P&W) Goal Demo	
Continue	• Phase III JTDE (P&W) Interim • Phase III JTDE (GE/AADC) • Phase II JTDE (GE/AADC) • Phase II JTAGG (HES) • Phase III JTAGG (GE/HES) • Phase II JETEC (AADC) • Phase III JETEC (WI) • Phase III JETEC (HES)	• Phase III JTDE (GE/AADC) • Phase II JTDE (GE/AADC) • Phase III JTAGG (GE/HES) • Phase II JETEC (AADC) • Phase III JETEC (WI) • Phase III JETEC (HES) • Phase III JETEC (AADC)	• Phase III JTDE (P&W) Goal Demo • Phase III JTDE (GE/AADC) • Phase II JTAGG (HES) • Phase III JTAGG (GE/HES) • Phase III JETEC (WI) • Phase III JETEC (HES) • Phase III JETEC (AADC)
Complete	• Phase II JTDE (P&W) • Phase II JETEC (WI) • Phase II JTAGG (HES) Initial Build • Phase II JETEC (AADC) Initial Build	• Phase II JTAGG (HES) • Phase III JTDE (P&W) Interim Build	• Phase II JETEC (AADC) Goal Demo • Phase II JTDE (GE/AADC) Goal Demo

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603236N PROGRAM ELEMENT TITLE: Warfighter Sustainment Advanced Technology PROJECT NUMBER: R2915 PROJECT TITLE: Warfighter Sustainment Advanced Technology

(U) CORROSION CONTROL: This effort includes an integrated approach for the control of the effects of external and internal corrosion in airframes. The work develops advanced, cost effective prevention and lifecycle management technologies. This is particularly significant to life extension for the aging fleet.

AIRFRAME CORROSION	FY00	FY01	FY02-$3,144
Initiate			• Single Coat Systems for Ship Tanks • Airframe Corrosion • Modular Hybrid Pier

(U) SMART SYSTEMS: This project develops flight qualified smart wire system hardware and performs a flight demonstration. Smart wiring embeds diagnostic and prognostic technologies into aircraft wiring systems to manage wiring system health. The goals of smart wiring are (1) reduce wiring maintenance man-hours by 20%, (2) reduce wiring induced mission aborts and non-mission capable hours by 20%, and (3) reduce in-flight electrical fires and subsequent loss of aircraft by 80%.

SMART WIRING	FY00	FY01	FY02-$2,494
Initiate			• Develop updated requirements document for smart wiring system • Award and execute contract to develop safety-of-flight qualified hardware for smart wiring system • Bench and Engine Test the Total Oil Monitoring System

(U) EXPEDITIONARY LOGISTICS: This project represents the 6.3 investment strategy supporting the Expeditionary Logistics FNC. The FNC is broken into three enabling capabilities covering distribution, Command and Control, and readiness. Work areas encompass surface replenishment and activities within ship to shore material distribution. Additionally, Command and Control of ground logistics is addressed including decision support and battlefield sensor arrays. This program supports the technology maturation, demonstration and transition line.

EXPEDITIONARY LOGISTICS	FY00	FY01	FY02-$16,265
Initiate		• Create decision support technologies for Log C2 Course of Action (COA) generation • FY02-07 Program Planning for surface distribution including development of metrics, exit criteria and technology risk management	• Shipboard strike up/down for carriers and logistics ships • Underway replenishment including station keeping and load control technologies • Log battlefield sensor arrays • Operational Logistics modeling and simulation
Continue			• Ground Logistics Command and Control with situational awareness and course of action tools

(U) ADVANCED SHIPBOARD CRANE MOTION SYSTEM Advanced Technology Demonstration (ATD): The Advanced Shipboard Crane Motion System ATD will demonstrate a crane control system that combines recent advances in nonlinear control system technologies with existing strategic Auxiliary Crane Ship electro-hydraulic cranes. The control scheme will control load pendulation through sea state three by applying nonlinear control algorithms, appropriate to the ship motion environment, to the shipboard crane control system and the crane operator commands. This technology will extend the capability for ship to lighterage transfer of expeditionary warfare logistics to at least 300 containers per day in sea state three.

ADVANCED SHIPBOARD CRANE MOTION SYSTEM ATD	FY00	FY01	FY02-$2,602
Initiate	• Advanced Shipboard Crane Motion Control System ATD. Objective is to demonstrate a pendulation control system for shipboard cranes that will permit ship-to-shore transfer of logistics through sea state three. Completed modeling and		

	simulation-based design evaluations.		
Continue		• Advanced Shipboard Crane Motion Control System ATD. Complete procurement/ fabrication of sensor and control package. Install crane simulator/trainer for military operator training. Conduct demonstration of test ship roll simulation system.	
Complete			• Advanced Shipboard Crane Motion Control System ATD – Pendulation control system demonstrated at pierside, at anchor, and at sea during military exercise.

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			00
Appropriated Value			
Adjustments from FY 2001 President's Budget			
PE Restructure			57,712
NMCI Reimbursable Adjustment			+77
NWCF Rate Adjustment			-108
Non-Pay Inflation			+75
Minor Adjustment			-71
FY 2002 President's Budget Submission	**	**	57,685

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0603217N, 0603707N, 0603712N and 0603792N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603236N PROJECT NUMBER: R2915
PROGRAM ELEMENT TITLE: Warfighter Sustainment Advanced Technology PROJECT TITLE: Warfighter Sustainment Advanced Technology

(U) OTHER PROGRAM FUNDING SUMMARY:

(U) NAVY RELATED RDT&E:

(U) PE 0601153N Defense Research Sciences
(U) PE 0602123N Force Protection Applied Research
(U) PE 0602236N Warfighter Sustainment Applied Research
(U) PE 0604703N Personnel, Training, Simulation, and Human Factors

(U) NON NAVY RELATED RDT&E:

(U) PE 0601102A Defense Research Sciences
(U) PE 0602211A Aviation Technology
(U) PE 0603003A Aviation Advanced Technology
(U) PE 0603007A Manpower, Personnel and Training Advanced Technology
(U) PE 0601102F Defense Research Sciences
(U) PE 0602203F Aerospace Propulsion
(U) PE 0603202F Aerospace Propulsion Subsystems Integration
(U) PE 0603216F Aerospace Propulsion and Power Technology
(U) PE 0603227F Personnel, Training and Simulation Technology

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT:0603271N
PROGRAM ELEMENT TITLE: RF Systems Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2913 RF Systems Advanced Technology			
TOTAL	**	**	76,876

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PEs 0603270N, 0603238N, 0603792N, and 0603794N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The RF Systems Advanced Technology Program addresses Radio Frequency (RF) technology in Surface(including Electric Warship)/Aerospace Surveillance Sensors and systems, Electronic Combat Sensors and Systems, RF Radio Communications Systems, and Multi-Function (integrated surveillance/electronic combat/communications) RF Systems. The program emphasizes near to mid-term technology transition opportunities by developing and demonstrating advanced RF Systems technologies including Advanced Signal Processing Technologies that enable Future Naval Capabilities in Time Critical Strike, Missile Defense and Directed Energy, Platform Protection, and Information Distribution. RF Surveillance Technology developments emphasize advanced sensors and sensor systems for continuous high volume theater wide air and surface surveillance, battle group surveillance, real time reconnaissance and ship defense. Major technology goals include long-range target detection, discrimination, target identification and fire control quality target tracking in adverse weather, background clutter and electronic countermeasure environments. RF Electronic Combat Technology developments emphasize passive sensors and active and passive RF countermeasure systems which exploit and counter a broad range of electromagnetic threats. Program focus is on maintaining near perfect real-time knowledge of the enemy and of the electronic order of battle; countering the threat of cruise missiles to deployed naval forces; and precision identification and location of threat emitters. This also includes the development of threat warning and self-protection technology for tactical aircraft under the TADIRCM program. Radio Communications Technology developments address critical naval communications technology deficiencies and needs that are not addressed by the commercial technology sector. The program emphasis is on high-bandwidth, reliable interoperable communications at all levels of command and on technology to enable rapid and reliable utilization of government and commercial telecommunication assets worldwide. Multi-Function RF Technology emphasizes development, demonstration and transition of wideband, high performance RF

apertures and front ends optimized to Navy-unique needs for: improved antenna aperture performance and efficiency; reduced radar cross section and significant reduction in the numbers of apertures required to provide RF Surveillance, RF Electronic Combat and RF Radio Communications functions on Navy Surface Combatants. Advanced RF Systems Technology developments directly support the Department Of Defense Joint Warfighter Science and Technology Plan and the Defense Technology Area Plans. Projects within this program element have attributes that focus on enhancing the affordability of warfighting systems.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT:0603271N PROJECT NUMBER: R2913
PROGRAM ELEMENT TITLE: RF Systems Advanced Technology PROJECT TITLE: RF Systems Advanced Technology

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) **Surface/Aerospace Surveillance RF Technology** The Surface/Aerospace Surveillance RF Technology thrust develops and demonstrates advanced RF surveillance sensor and sensor processing technologies and systems for transition into new and existing naval platforms. Technology program focus is on providing the Navy with high performance affordable surveillance systems that are responsive to identified naval needs for real time situational awareness, long range target detection, discrimination, identification, and tracking/targeting of air and surface threats in all operating conditions. Major drivers include sensor performance in complex target, electronic countermeasures (ECM), and adverse environmental conditions including littoral operations. Programs include: Advanced Airborne Early Warning (AEW) Radar system technology including Ultra-High-Frequency (UHF) Electronically Steered Array (UESA) development and demonstration for the Navy’s E-2C carrier based surveillance aircraft; Affordable Precision Surveillance and Targeting Radar for air-surface surveillance and targeting support aircraft; and highly mobile ground based multifunction radar for the Marine Corps.

Surface/Aerospace Surveillance RF Technology	**FY00**	**FY01**	**FY02 ($16,302)**
Initiate	• Ultra-High-Frequency (UHF) Electronically Steered Array	• Development of a Pod configured Airborne, All-Weather, Autonomous Precision Surveillance and	• Flyable UESA Antenna Development for Missile Defense Future Naval Capability • S-Band Array T/R Module

	(UESA) Advanced Technology Demonstration • System Development Initiated • Advanced Signal Processing Technology	Targeting (PS&T) Radar System	
Continue	• Define and develop capability required for threat warning and self protection of tactical aircraft (TADIRCM).	• Ultra-High Frequency (UHF) Electronically Steered Array (UESA) Advanced Technology Demonstration System Development • Advanced Signal Processing Technology	• PS&T Radar System Design and Development including X-Band Antenna Array and algorithms for Time Critical Strike Targeting. • • Advanced Signal Processing Technology
Complete			• Mountain Top UESA Advanced Technology Demonstration • Live fire testing and risk reduction of self protection and threat warning system for tactical aircraft (TADIRCM)

2. (U) **Radio Communications RF Technology:** The Radio Communications RF Technology Thrust develops and demonstrates new RF communication sub-system and system technologies for integration into naval air, surface, sub-surface and ground platforms. The program focuses on RF communications technologies and systems that provide new enabling capability for network-centric operations including high-bandwidth connectivity for mobile platforms/forces and interoperability with coalition/allied forces. Technologies pursued in this thrust are specific to naval operations and platforms and as such

are not addressed by the other services or the commercial sector. Advanced radio communications system technologies developed in this program element provide reliable, and enduring high data rate, two way radio communications between naval operational forces and all levels of command in all operating conditions and environments including electronic countermeasures.

Radio Communications RF Technology	**FY00**	**FY01**	**FY02 ($32,856)**
Initiate	• Multi-Element Buoyant Cable (MBCA) Advanced Technology Demonstration initiated	• X/Ku-Band Physical Layer (Open Systems interconnect (OSI) Reference Model for X/Ku-Band RF Communications Link)	• K/Ka/Q-Band Physical Layer OSI Reference Model for K/Ka/Q-Band RF Communications Link • S/C Band Phased Array Technology • Littoral Mobile Wireless Networking
Continue	• Very High Frequency (VHF)/UHF/L-Band Physical Layer development continued	• VHF/UHF/L-Band Physical Layer OSI Reference Model for VHF/UHF/L Band RF Communications Link • Multi-Element Buoyant Cable (MBCA) Advanced Technology Demonstration • Multi-National Virtual Operation Capability	• X/Ku-Band Physical Layer OSI Reference Model for X/Ku-Band RF Communications Link • VHF/UHF/L-Band Physical Layer • Multi-National Virtual Operation Capability
Complete			• MBCA Advanced Technology Demonstration

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT:0603271N PROGRAM ELEMENT TITLE: RF Systems Advanced Technology PROJECT NUMBER: R2913 PROJECT TITLE: RF Systems Advanced Technology

3. (U) **Multi-Function RF Technology:** Multi-Function RF Apertures and Systems are needed to enable the integration of critical mission functions of Radar, Electronic Warfare and Communications into a common set of RF apertures that operate efficiently over a broad spectral bandwidth. Significant reductions in the numbers of antennas required to support platform level RF Surveillance, RF Electronic Combat and RF Radio Communications functions are needed to improve combat system performance, reduce life cycle costs, and to reduce platform electromagnetic signatures resulting in significant increases in warfighting effectiveness and survivability.

Multi-Function RF Technology	FY00	FY01	FY02 ($27,718)
Initiate	• Initiated Advanced Multifunction Radio Frequency (AMRF) High Band Transmitter		• Test Bed Integration and Preliminary Testing
Continue	• AMRF High Band Receiver Development • AMRF Resource Allocation Manager Development • Beam forming and signal generator development	• High Band Multifunction Receiver System Advanced Technology Demonstration • AMRF High Band Transmitter development • Preliminary Build of System Resource Allocation Manager • Initial Test of Beam Steering/Control and signal generator sub-systems • Test and Characterization of Low Band Transmit Array Output power	• Integration and Demonstration of High Band Multi-Function Receiver System for AMRFS • Integrate Beam former & Signal Generator with High Band AMRFS Subsystems • Construction and testing of V1 Testbed Receiver and Digital Beamformer • Conduct Low Band Transmit Array Isolation Measurements at Field Site
Complete			

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT:0603271N PROJECT NUMBER: R2913
PROGRAM ELEMENT TITLE: RF Systems Advanced Technology PROJECT TITLE: RF Systems Advanced Technology

			• Design and Develop Software Architecture (Resource Allocation Manager and Realtime Network)

B. (U) PROGRAM CHANGE SUMMARY:

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			
PE Restructure			69,773
Program Adjustment			+1,914
Inflation Adjustment			+112
Additional Program Adjustment			+5000
NWCF Adjustment			+77
FY 2002 PRESBUDG Submission	**	**	76,876

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0603270N, 0603238N, 0603792N, and 0603794N.

(U) CHANGE SUMMARY EXPLANATION

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT:0603271N PROJECT NUMBER: R2913
PROGRAM ELEMENT TITLE: RF Systems Advanced Technology PROJECT TITLE: RF Systems Advanced Technology

(U) NAVY RELATED RDT&E:
- (U) PE 0601152N (In-House Laboratory Independent Research)
- (U) PE 0601153N (Defense Research Science)
- (U) PE 0602271N (RF Systems Applied Research)
- (U) PE 0602114N (Power Projection Applied Research)
- (U) PE 0603114N (Power Projection Advanced Technology)
- (U) PE 0602123N (Force Protection Applied Research)
- (U) PE 0603123N (Force Protection Advanced Technology)
- (U) PE 0602235N (Common Picture Applied Research)
- (U) PE 0603235N (Common Picture Advanced Technology)
- (U) PE 0603729N (Warfighter Protection Advanced Technology)
- (U) PE 0603236N (Warfighter Sustainment Advanced Technology)

(U) NON-NAVY RELATED RDT&E:
- (U) PE 0602702F (Command, Control and Communications)
- (U) PE 0602204F (Aerospace Aviation)
- (U) PE 0602782A (Command, Control and Communications (C^3) Technology)
- (U) PE 0602705A (Electronics and Electronic Devices)
- (U) PE 0602270A (Electronic Warfare Technology)
- (U) PE 0602270F (Electronic Warfare Technology)
- (U) PE 0603270A (Electronic Warfare Technology)
- (U) PE 0603270F (Electronic Combat Technology)

(U) SCHEDULE PROFILE: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 002 ESTIMATE
C2297 Marine Corps Warfighting Lab-Core	44,838	36,390	33,085
C2296 Remote Precision Gun Aiming Platform	0	991	0
R2362 Extending the Littoral Battlespace	10,575	9,435	956
R2223 Marine Corps ATD	11,019	12,385	17,269
R2295 C3RP	0	1,486	0
TOTAL	66,432	60,687	51,310

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: As the land warfare component of Naval Expeditionary Forces, the Marine Corps has unique and technologically stressing requirements resulting from its amphibious mission, Marine Air-Ground Task Force (MAGTF) organizational structure, reliance on maneuver, logistic sustainability, and intensive tempo of operations in diverse environments. Critical Marine Corps requirements being addressed in this program element (PE) are: Maneuver, Firepower, Command and Control, Logistics, and Training and Education. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment. Multiple transitions into the Demonstration/Validation phase are planned, as well as fieldable prototyping to reduce risk in Engineering and Manufacturing Development. Joint service efforts are in line with Defense Technology Objectives and Joint Warfighting Objectives (JWOs). In addition, Marine Corps Warfighting Experimentation in conceptual operational assessment of emerging technologies is funded. This PE also provides Extended Littoral Battlespace efforts in the area of command, control, communications, computers and intelligence, and fires and targeting. Efforts focus on connectivity between MAGTF and Fleet organizations and naval sea-based fire support. Specifically, this PE supports the following capabilities: promptly engaging regional forces in decisive combat on a global basis; responding to all other contingencies and missions in the full spectrum of combat operations (high, mid and low intensity) in Military

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

Operations in Urban Terrain, and in operations other than war, and warfighting experimentation. By providing the technologies to enable these capabilities, this PE primarily supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. This PE supports all of the Marine Corps mission areas.
Due to the number of efforts in this PE, the programs described are representative of the work included in this PE.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	68,565	54,749	49,837
Adjustments from FY 2001 President's Budget:			
SBIR/STTR Transfer	-1,371		
Congressional Plus-ups		+6,500	
NWCF Rate Adjustments			-46
Inflation Adjustment	-265	-562	+67
Execution Adjustments	-497		
PE Rebalance			-4,548
Program Adjustment			+6,000
FY 2002 President's Submission	66,432	60,687	51,310

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstration

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
C2297 Marine Corps Warfighting Lab	44,838	36,390	33,085

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Marine Corps Warfighting Laboratory (MCWL) is the centerpiece experimental test bed for the operational enhancement of the Marine Corps. Using the Special Purpose Marine Air-Ground Task Force (Experimental) (SPMAGTF(X)) as its “test bed” organization, MCWL demonstrates the usefulness and necessity of integrating new technological developments and advanced concepts into the Operational Forces of the Marine Corps. MCWL focuses on developing and field testing future operational and technological concepts and serves as the focal point for the enhancement/refinement of future warfighting capabilities. The organizational thrust is to provide an institutional mechanism for continuously generating new ideas for warfighting capabilities. Concepts of operation “Sea Dragon” are validated by means of various Warfighting Experiments.

(U) Sea Dragon is a process of experimentation, which is designed as an ongoing mechanism to insure the relevance of Marine forces in the face of change. Sea Dragon encompasses inquiries into multiple technology and warfighting areas, including: Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR); Fires; Medical, Biological, Chemical, and Non-Lethal Technologies; Expeditionary Logistics; and Advanced Training and Education Techniques.

(U) MCWL develops tactics, techniques, and procedures (TTPs) and evaluates advanced technologies that create or enhance future warfighting capabilities, and integrates them into the Marine Corps Combat Development System. MCWL also provides all the efforts for the Marine Corps Combat Development Command (MCCDC) Wargaming in support of Combat Development System and Experimentation.

(U) Using experimental operational forces, beginning with the SPMAGTF(X) as the forward element of a future Naval Expeditionary Force (NEF), MCWL conducts a number of Advanced Warfighting Experiments (AWEs) supported by several Limited Objective Experiments (LOEs), Limited Technology Assessments (LTAs), Wargames, and Studies. LOEs, LTAs, and AWEs examine discrete variables in as much isolation as can be achieved. Technologies used in LTAs are gathered for

use in larger LOEs while LOEs are building blocks from which resulting AWEs are constructed. Detailed descriptions are provided below.

1) An AWE is defined as a larger scale operational experiment where advanced warfighting capabilities and enabling technologies are evaluated to determine the military utility, operational effectiveness, and operational suitability in as realistic an environment as possible. These AWEs examine an operational concept that envisions a greatly expanded, lethal, fluid, chaotic, and more opportunistic battlefield within a maneuver warfare approach. An AWE answers experimental issues under conditions most closely approximating war using the Advanced Warfighting Concept under examination. It further serves as a venue for integrating all warfighting functions for the purpose of integrated experimentation. All experimentation conducted during a phase builds toward the AWE.

2) LOEs are considerably smaller in scope than AWEs and focus on a discrete set of closely related experiment objectives. These experimental forces will be highly trained, technologically infused, highly lethal, and intellectually prepared to fight in this chaotic and opportunistic environment. LOEs are designed to answer questions that, if left unanswered, would have a significant adverse impact on the successful execution of experimental operations in the related AWE.

3) LTAs are oriented on the performance characteristics of specific technologies and equipment to assess their usefulness by means of analysis or experimentation. MCWL conducts LTAs in cases where the performance characteristics of developing technology are insufficiently documented to conduct operational planning necessary for experimentation. MCWL plans and conducts LTAs to effectively incorporate a technology into follow-on experiments.

4) A Wargame is a broad discipline manifested in a range of activities from a few individuals conducting Action-Reaction-Counteraction drills to a significant commitment from Operating Forces Staff or SPMAGTF(X) Command Element (CE) to execute a Command Post Exercise (CPX) supported by extensive modeling and simulation (M&S). A Wargame is integral to MCWL’s experimental process and precedes the execution of each LOE/AWE to refine the LOE/AWE Experimentation Plan.

5) A Study is a low-cost (relative to operational experimentation) technique designed to result in broader or deeper research into an Experimental Issue. MCWL undertakes a study when a literature search reveals that existing studies are inadequate to support experiment objectives and synthesis is required and is focused on one or a few closely

related Experiment Issues. A Study can contribute to any stage of the Innovation and Experimentation Process, but is most useful during experiment planning.

(U) Under the guidance of the Experimental Campaign Plan (ECP) (formerly known as Five Year Experimentation Plan (FYEP)), MCWL's prior accomplishments and current plans include seven AWE "build-up" phases culminating in actual AWE execution:

1) Hunter Warrior: (March 1996 through April 1997) Experimented with advanced operational concepts and technologies on an extended and dispersed battlefield, in open and mountainous terrain at the mid-intensity operational level.

2) Urban Warrior: (April 1997 through June 1999) Focused on developing new TTPs; and supporting technologies for operations in urban, close terrain, and near urban littoral areas.

3) Joint Contingency Force (JCF) (also known as Millennium Dragon): (October 1999 through September 2000) Designed to identify, study, and improve new concepts and tactics for the Marine Corps under the auspices of the Operational Maneuver from the Sea (OMFTS) concept. In support of these concept-based experiments, new enabling technologies are being developed, tested, and evaluated for operational use in a combat environment.

4) Capable Warrior: (June 1999 through FY 2001) Uses lessons learned in Hunter Warrior and Urban Warrior to integrate the full capability of a Marine Air-Ground Task Force (MAGTF) with naval units operating at the numbered fleet level of a Joint Task Force from the sea. Develops initial TTPs for an OMFTS force.

5) Coalition Warrior (FY 2001 through FY 2003) Focuses on the integration of 21st century sea-based technologies into coalition warfare; which begins to examine the challenges of Marine Expeditionary Force (MEF) level OMFTS implementation.

6) Millennium Warrior (FY 2003 through FY 2004) focuses on executing an appropriate alignment of OMFTS capability improvements as the maritime (naval) portion of Joint Vision (JV) 2010.

7) Cyber Warrior (FY 2004 through FY 2006) focuses on asymmetrical experimentation against OMFTS with emphasis on advanced Non-Lethal Weapons, Biological, and Nano and Micro Technologies.

8) Ultimate Warrior (FY 2006 through FY 2008) focuses on Marine Corps after Next experimentation with emphasis on Future Family of Fighting Vehicles, Biological, and Nano and Micro Technologies.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2297
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstration PROJECT TITLE: MCWL

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

MCWL	FY00 $44,838	FY01 $35,837	FY02 $33,085
Initiate	MCWL Operations (Support): • Initiated Intergovernmental Personnel Act (IPA) Assignment Agreements which provide technical and managerial support to the Marine Corps in matters relating to: development and integration of new Marine Corps Technologies, Tactics, Techniques, and Procedures (TTTPs) in order to provide future Marine Corps capabilities in the areas of Doctrine, Organization, Training and Education, Equipment, and Support (DOTES); and development of stratagems and actions in order to provide future Marine Corps technological capabilities in all areas of Marine Aviation and Ground Combat, and Marine Combat Service Support (CSS). • Began preliminary Coalition Warrior Experimentation Planning and technology investigations.	C4I: • Initiate pre-planning to support the Coalition Warrior AWE. • Evaluate the effectiveness of commercially available (off-the-shelf) technology for providing wireless connectivity from Marine squads into IMMACCS. • Investigate alternatives to IMMACCS/ECOC.	MCWL Operations (Support): • Initiate Millennium Warrior Experimentation Planning and technology investigations.

	Command, Control, Communications, Computers, and Intelligence (C4I): • Initiated experimental planning and C4ISR development to support the Capable Warrior AWE. • Developed additional capability for the IMMACCS Agent Engine using adaptive algorithms. • Initiated advanced command and control investigations and experiments for sea based fire support. • Initiated Multi-Path, Beyond Line of Sight Communications Technology (MUBLCOM) and voice translation investigations. Drones, Aviation, Sensors, and Vehicles: • Initiated the Vehicle Demonstrations program (Congressional Enhancement) by purchasing eight Interim Fast Attack Vehicles (IFAVs) (a commercial, lightweight, highly mobile platform designed to serve primarily as a weapons platform). Two of each of the following IFAV variants were purchased in support of		

	evaluation/experimentation efforts: Command and Control (C2), Heavy Weapons Carrier, Utility/Personnel Carrier, and Mobile Counter-Fire System (MCFS). Conducted arduous operational experimentation of each vehicle variant both with active Marine Forces and within the MCWL's conceptual experimental framework. • Initiated UAV small payload development for the Dragon Warrior (low cost, small tactical vertical takeoff and landing (VTOL) drone) focusing on reconnaissance, surveillance, and target acquisition (RSTA) capabilities. • Initiated Unmanned Ground Vehicle (UGV) payload development investigations focusing primarily on RSTA capabilities. • Initiated investigations into the development of a "Micro" (miniature) UAV and UGV. • Initiated development of a class of large population,		

	autonomous robots capable of collecting and reporting on battlefield intelligence. • Initiated preliminary investigations into the development or adaptation of an airborne vehicle platform that can remain aloft indefinitely to facilitate Over the Horizon (OTH) communications to support nearly all aspects of OMFTS. Fires and Targeting: • Established an Advanced Lightweight Grenade Launcher (ALGL) (light weight, portable 40 millimeter (mm) machine gun which rapidly fires grenades) experimentation program (Congressional Enhancement) to determine the applicability and capabilities of an ALGL for use by forward afloat MAGTFs and organic components thereof to include: MEUs, Force and Division Reconnaissance, and United States Marine Corps (USMC) Small Boat Teams. Integrated and subsequently experimented with the ALGL on a Fast Attack Vehicle (FAV), a		

	multi-purpose wheeled vehicle designed to be internally transported by the MV-22 Osprey. • Initiated experimentation with development of small precise munitions. • Initiated rapid target system exploration/demonstration/development as a technical means of ensuring that the target selected by the ground observer is in fact the same one the pilot is intending to attack by providing a video image of the target to the pilot, the terminal controller, and the individual tasked with coordinating fires. • Developed a Combined Arms Coordination Simulation that would use computerized decision support tools to rapidly de-conflict the paths of friendly airborne objects in the battlespace. This technology investigation has the capability to increase responsiveness of supporting fires while reducing the		

	possibility of fratricide. Seabasing, Logistics, Combat Service Support (CSS), and Combat in Cities (including Training and Education): • Developed and integrated the CSS tools/systems/equipment that will make up the “Marine of 2020”. • Invested in all types of simulation to allow required OMFTS warfighting capabilities to be tested. • Investigated development of a system that tracks personnel involved in a Non-combatant Evacuation Operations, to include personal data (i.e., name, family background, medical and administrative data, etc). • Initiated Project Tun Tavern efforts by purchasing commercially available equipment and software to automate two Recruiting Sub-Stations (RSSs) for experimental testing. Project Tun Tavern aims to provide an integrated tool for the Marine		

	Corps Recruiter to process interactive recruiting information, incorporate Information Technology (IT) into the recruiting environment, and demonstrate advanced warfighting concepts to prospective Marines. Chemical/Biological (Chem/Bio), Medical, Analysis, and Non-Lethals: • Conducted Human Physical Performance in MOUT studies by developing a physiologically-based conditioning program to enhance physical performance and prevent injuries for Marine infantry in MOUT; and investigated mechanical means of lowering body temperature to alleviate effects of exhaustion. • Defined the scope, nature, technical utilities, and TTPs that support domestic and international responses to the human and material casualties of a weapon of mass destruction (WMD) deployment. • Initiated Project Atlanta (also		

	known as Southern Response) (Congressional Earmark) efforts. Project Atlanta is a program designed to define command and control (C2) with respect to Local, State, and Federal Agencies. It develops concepts of operation (CONOPS) and Standard Operating Procedures (SOPs) for Local, State and Federal Agency collaboration and develops test capability for affordable sensors. It also integrates sensor technologies with response teams, C2, and CONOPS with regards to domestic terrorist scenarios.		
Continue	MCWL Operations (Support): • Continued Strategic Planning through the location, development, and evaluation of advanced warfighting operational and organizational concepts and related enabling technologies • Synthesized results and lessons learned into proposed TTPs for the Marine Corps. • Expanded research; planning;	MCWL Operations (Support): • Continue Strategic Planning through the location, development, and evaluation of advanced warfighting operational and organizational concepts and related enabling technologies. • Synthesize results and lessons learned into proposed TTPs for the Marine Corps. • Continue research; planning;	MCWL Operations (Support): • Continue Strategic Planning through the location, development, and evaluation of advanced warfighting operational and organizational concepts and related enabling technologies. • Synthesize results and lessons learned into proposed TTPs for the Marine Corps. • Continue research; planning; modeling and simulation, concept,

	modeling and simulation, concept, and wargame development; preparation; execution; and analysis and assessment to extend exploration of critical components. This included investigations into Operations Other Than War (OOTW). • Continued Capable Warrior Experimentation Planning and technology investigations. • Provided for Marine Forces (Atlantic and Pacific) Battle Laboratories to conduct experimentation to include MEF (Pacific) Battle Laboratory Scientific Advisor and 24th Marine Expeditionary Unit (MEU) and 13th MEU operations. C4I: • Continued to develop information processing and to further integrate capabilities into the Integrated Marine Multi-Agent Command and Control System (IMMACCS) and the Experimental Command and Control (ECOC) facility. • Continued to develop enhanced	modeling and simulation, concept, and wargame development; preparation; execution; and analysis and assessment to extend exploration of critical components. This includes investigations into OOTW. • Continue IPA Assignment Agreements which provide technical and managerial support to the Marine Corps in matters relating to: development and integration of new Marine Corps TTTPs in order to provide future Marine Corps capabilities in the areas of DOTES; and development of stratagems and actions in order to provide future Marine Corps technological capabilities in all areas of Marine Aviation and Ground Combat, and Marine CSS. • Expand Coalition Warrior Experimentation Planning and technology investigations. • Continue to provide for Marine Forces (Atlantic and Pacific) Battle Laboratories to conduct	and wargame development; preparation; execution; and analysis and assessment to extend exploration of critical components. This includes investigations into OOTW. • Continue IPA Assignment Agreements that provide technical and managerial support to the Marine Corps. • Continue Coalition Warrior Experimentation Planning and technology investigations. • Continue to provide for Marine Forces (Atlantic and Pacific) Battle Laboratories to conduct experimentation. C4I: • Continue experimental planning and C4ISR development to support the Capable Warrior AWE and pre-planning to support the Coalition Warrior AWE. • Continue to develop information processing and to further integrate capabilities into the IMMACCS and the ECOC facility. • Continue to develop enhanced capability for Shared Net and BVT efforts.

	capability for Shared Net and Battlefield Visualization Tool (BVT) efforts. • Continued to investigate commercially available (off-the-shelf) technology for providing wireless connectivity from Marine squads into IMMACCS. • Continued to conduct and investigate red teaming concepts and technologies. Drones, Aviation, Sensors, and Vehicles: • Expanded investigations/ experimentation in aviation technologies, which could lead to increasing accuracy and effectiveness of Close Air Support missions plus reduce the possibility of fratricide. • Continued aviation experimentation in the urban environment. • Continued aviation based simulation/instrumentation efforts. • Continued search for new and emerging technologies. Fires and Targeting:	experimentation. C4I: • Continue experimental planning and C4ISR development to support the Capable Warrior AWE. • Continue to develop information processing and to further integrate capabilities into the IMMACCS and the ECOC facility. • Continue to develop enhanced capability for Shared Net and BVT efforts. • Continue to develop/expand capability for the IMMACCS Agent Engine. • Conduct experiments and evaluates the performance of advanced command and control investigations and experiments for sea based fire support. • Continue/expand MUBLCOM and voice translation efforts. • Continue to conduct and investigate red teaming concepts and technologies. Drones, Aviation, Sensors, and Vehicles: • Continue small payload development for Dragon Warrior	• Continue to develop/expand capability for the IMMACCS Agent Engine. • Continue to conduct experiments and evaluate the performance of advanced command and control investigations and experiments for sea based fire support. • Continue to evaluate the effectiveness of commercially available (off-the-shelf) technology for providing wireless connectivity from Marine squads into IMMACCS. • Continue/expand MUBLCOM and voice translation efforts. • Continue investigations into alternatives to IMMACCS/ECOC. • Continue to conduct and investigate red teaming concepts and technologies. Drones, Aviation, Sensors, and Vehicles: • Continue small payload development for Dragon Warrior UAV. • Continue UGV payload and micro UAV/UGV payload development efforts. • Continue development of a class

	• Continued development of Mobile Counter Fires System (automated fires system). • Continued development of a precision-targeting device that includes a laser rangefinder that will provide ground forces with accurate target acquisition. • Expanded investigation/ development of thermal weapons capabilities/technologies, to include night-sight/hands-free communications. • Identified, purchased, and experimented with technologies/concepts to enhance the effectiveness of the warfighter. • Continued to investigate emerging fires and targeting technologies. Seabasing, Logistics, CSS, and Combat in Cities (including Training and Education): • Continued to search for, evaluate, and perform enhanced seabased logistics support and seabasing analysis. • Continued rapid prototype	UAV. • Continue/expand UGV payload and micro UAV/UGV payload development efforts. • Continue/expand development of a class of large population, autonomous robots capable of collecting and reporting on battlefield intelligence. • Continue investigations/ experimentation in aviation technologies that could lead to increasing accuracy and effectiveness of Close Air Support missions and also reduce the possibility of fratricide. • Continue aviation experimentation in the urban environment and aviation based simulation/instrumentation efforts. • Continue to search for new and emerging technologies. Fires and Targeting: • Continue development of a precision-targeting device that includes a laser rangefinder that will provide ground forces with accurate target	of large population, autonomous robots capable of collecting and reporting on battlefield intelligence. • Continue investigations/experimentation in aviation technologies that could lead to increasing accuracy and effectiveness of Close Air Support missions and also reduce the possibility of fratricide. • Continue aviation experimentation in the urban environment and aviation based simulation/instrumentation efforts. • Continue to search for new and emerging technologies. Fires and Targeting: • Continue development of a precision targeting device that includes a laser rangefinder. • Continue experimentation with / development of small precise munitions. • Continue rapid target system exploration/demonstration/development. • Continue Combined Arms Coordination Simulation efforts.

	development, demonstration, and transition of logistics information resources technologies for deployable Expeditionary Combat Services Support Operations Center (CSSOC) applications. • Continued system concept modeling/simulation support for decision support and technology plan development for Joint Expeditionary Forces. • Continued integrating clothing and equipment that will enhance Marines' survivability, specifically to support Project Metropolis (a definitive multi-year experiment designated to create a system of realistic warfighting that will allow Marines to shoot, move, and communicate as they accomplish missions during Military Operations in Urban Terrain (MOUT)). • Continued to experiment with electronic markers. • Continued to leverage ongoing work in the Day/Night Small Unit Target Acquisition and	acquisition. • Continue experimentation with / development of small precise munitions. • Continue rapid target system exploration/demonstration/development. • Continue Combined Arms Coordination Simulation efforts. • Continue thermal weapons technology search/developmental efforts. • Continue to identify, purchase, and experiment with technologies/concepts to enhance the effectiveness of the warfighter. • Continue to investigate emerging fires and targeting technologies. Seabasing, Logistics, CSS, and Combat in Cities (including Training and Education): • Continue to develop and integrate the CSS tools/systems/equipment that will make up the "Marine of 2020". • Continue to invest in all types	• Continue thermal weapons technology search/developmental efforts. • Continue to identify, purchase, and experiment with technologies/concepts to enhance the effectiveness of the warfighter. • Continue to investigate emerging fires and targeting technologies. Seabasing, Logistics, CSS, and Combat in Cities (including Training and Education): • Continue to develop and integrate the CSS tools/systems/equipment that will make up the "Marine of 2020". • Continue to invest in all types of simulation to allow required OMFTS warfighting capabilities to be tested. • Continue to search for, evaluate, and perform seabased logistics support and seabasing analysis. • Continue investigation/development of a system that tracks personnel involved in a Non-combatant

	Small Unit Logistics fields. • Continued to evaluate CSS for emerging and developing weapons as they apply to operational concepts of logistics support and sustainment for various non-standard scenarios. • Continued to investigate existing and emerging training enhancements and simulation equipment and devices. • Continued to search for and evaluate emerging commercially available technologies that could significantly improve efforts in this area. Chem/Bio, Medical, Analysis, and Non-Lethals: • Continued to support instrumentation capability that provides battlespace instrumentation for experimentation. • Continued efforts to improve upon the automated data collection system. • Continued to provide overall systems engineering and integration support for ongoing experimentation.	of simulation to allow required OMFTS warfighting capabilities to be tested. • Continue to search for, evaluate, and perform seabased logistics support and seabasing analysis. • Continue investigation/development of a system that tracks personnel involved in a Non-combatant Evacuation Operations. • Continue rapid prototype development, demonstration, and transition of logistics information resources technologies. • Continue system concept modeling/simulation support for decision support and technology plan development for Joint Expeditionary Forces. • Continue to investigate and incorporate automated information technologies for asset tracking, interactive, condition based maintenance support, and sensored logistics information feeds. • Continue integrating clothing	Evacuation Operations. • Continue rapid prototype development, demonstration, and transition of logistics information resources technologies. • Continue system concept modeling/simulation support for decision support and technology plan development for Joint Expeditionary Forces. • Continue to investigate and incorporate automated information technologies for asset tracking, interactive, condition based maintenance support, and sensored logistics information feeds. • Continue integrating clothing and equipment that will enhance Marines' survivability. • Continue MOUT experimentation efforts. • Continue to experiment with electronic markers. • Continue to leverage ongoing work in the Day/Night Small Unit Target Acquisition and Small Unit Logistics fields. • Continue to evaluate CSS for emerging and developing weapons

	• Continued to provide overall analysis and reporting of experimentation efforts. • Continued to seek Non-Lethal technologies that can affect an opponent's infrastructure without necessarily destroying it. • Continued to investigate the use of Non-Lethal technologies to deter, delay, deny, disrupt, and destroy opponents or their material. PROJECT ALBERT (Congressional Enhancement): • Project Albert is designed to develop new tools to capture emergent behavior in synthetic environments that over time will lead to more effective maneuver warriors. Continued developing data, concepts, and tools of 21st Century Operations Analysis especially in the areas of non-linear and asymmetric warfare. The Project Albert goal is to generate data to support warfighting hypotheses with emphasis on questions relating	and equipment that will enhance Marines' survivability. • Continue Project Metropolis experimentation efforts. • Continue to experiment with electronic markers. • Continue to leverage ongoing work in the Day/Night Small Unit Target Acquisition and Small Unit Logistics fields. • Continue to evaluate CSS for emerging and developing weapons as they apply to operational concepts of logistics support and sustainment for various non-standard scenarios. • Continue investigations into existing and emerging training enhancements and simulation equipment and devices. • Continue Project Tun Tavern efforts by conducting a second LTA/LOE that both builds on the FY 2000 efforts and initiates development and integration of selected C4I concepts into the recruiting environment. • Continue to search for and to evaluate emerging commercially available technologies that	as they apply to operational concepts of logistics support and sustainment for various non-standard scenarios. • Continue investigations into existing and emerging training enhancements and simulation equipment and devices. • Continue Project Tun Tavern efforts. • Continue to search for and to evaluate emerging commercially available technologies that could significantly improve efforts in this area. Chem/Bio, Medical, Analysis, and Non-Lethals: • Expand medical investigations, including investigations into the chemical/biological arena. • Continue to define the scope, nature, technical utilities, and TTPs that support domestic and international responses to the human and material casualties of a WMD deployment. • Continue to support instrumentation capability that provides battlespace

	to urban warfare.	could significantly improve efforts in this area. Chem/Bio, Medical, Analysis, and Non-Lethals: • Continue medical investigations, including investigations into the chemical/biological arena. • Continue to define the scope, nature, technical utilities, and TTPs that support domestic and international responses to the human and material casualties of a WMD deployment. • Continue to support instrumentation capability that provides battlespace instrumentation for experimentation. • Continue efforts to improve upon the automated data collection system. • Continue to provide overall systems engineering and integration support for ongoing experimentation. • Continue to provide overall analysis and reporting of experimentation efforts. • Continue to seek Non-Lethal	instrumentation for experimentation. • Continue efforts to improve upon the automated data collection system. • Continue to provide overall systems engineering and integration support for ongoing experimentation. • Continue to provide overall analysis and reporting of experimentation efforts. • Continue to seek Non-Lethal technologies that can affect an opponent's infrastructure without necessarily destroying it. • Continue to investigate the use of Non-Lethal technologies to deter, delay, deny, disrupt, and destroy opponents or their material.

		technologies that can affect an opponent's infrastructure without necessarily destroying it. • Continue to investigate the use of Non-Lethal technologies to deter, delay, deny, disrupt, and destroy opponents or their material.	
Complete	MCWL Operations (Support): • Completed Millennium Dragon Experimentation Planning and technology investigations. C4I: • Incorporated lessons learned from the Urban Warrior AWE into ongoing development efforts and the LOEs scheduled for FY 2000. • Developed enhancements for information management systems to provide the Common Tactical Picture at all levels (squad leader to Commander) of the MAGTF. Drones, Aviation, Sensors, and Vehicles: • Conducted Broad Area Unmanned Responsive Resupply Operations (BURRO) (helicopter / Unmanned	MCWL Operations (Support): • Complete Capable Warrior Experimentation Planning and technology investigations. C4I: • Incorporate lessons learned from Millennium Dragon into ongoing technical development efforts and conduct LOEs planned for the build up to the Capable Warrior AWE. • Evaluate performance of information management systems to provide the Common Tactical Picture at all levels (squad leader to Commander) of the MAGTF. Fires and Targeting: • Complete development of Mobile Counter Fires System.	C4I: • Incorporate lessons learned from Capable Warrior into ongoing technical development efforts and conduct LOEs planned for the build up to the Coalition Warrior AWE.

	Aerial Vehicle (UAV) capable of carrying heavy loads) Phase III efforts (Congressional Enhancement), which included landing zone (manned and unmanned) UAV interface considerations, automated cargo acquisition on land and sea, and increased cargo load carrying capacity of the unmanned vehicle. Upgraded Urban Targeting Range. Fires and Targeting: • Completed development of the experimental prototype Dragon Fire (Unattended) Mortar System. Seabasing, Logistics, CSS, and Combat in Cities (including Training and Education): • Completed development of the Rapid Request Tracking System (RRTS). • Investigated and incorporated automated information technologies for asset tracking, interactive, condition based maintenance support, and sensored logistics information feeds.		

	• Developed expeditionary bulk liquids technology to support a total distribution concept. • Expanded Combat Decision Range (CDR) efforts to include Platoon/Squad Level training elements. • Developed and implemented components of a prototype at Field Grade Officer's Course in support of MCWL experimentation efforts.		
SBIR	FY00	FY01 $553	FY02
		• Portion of FY01 extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 328	

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes indirectly to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0602131M (Marine Corps Landing Force Technology), Project R3001, Marine Corps Landing Force Technology
(U) PE 0603640M (Marine Corps Advanced Technology Demonstrations), Project R2223, Advanced Technology Demonstrations
(U) PE 0603640M (Marine Corps Advanced Technology Demonstrations), Project C2362, Extended Littoral Battlespace, Advanced Concept Technology Demonstration

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: C2297
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstration PROJECT TITLE: MCWL

(U) PE 0305204M (Marine Corps Tactical UAV), Project C2672, Marine Corps Close Range Tactical UAV (Dragon Warrior)

(U) NON-NAVY RELATED RDT&E: Not applicable.

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE					
R2362 Extending the Littoral Battlespace	10,575	9,435	956	0	0	0	0	0

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: : The Extending the Littoral Battlespace (ELB) Advanced Concept Technology Demonstration (ACTD) effort responds to the top level military need to rapidly deploy a Naval Expeditionary Task Force with an embarked Marine Air Ground Task Force (MAGTF) as part of a larger Joint Task Force to any region of the world’s littorals and conduct military operations from a sea base across the spectrum of conflict to implement national military strategy. Forces employed ashore will be light, agile, distributed and dis-aggregated and capable of optimizing remote fires, to effectively deter aggression, halt attacks and secure critical areas as a precursor to a much larger force. Forces will be empowered by unprecedented situational awareness via a robust information infrastructure that is fully coupled to a decision/planning/execution system on a shared battlespace network (sea/land). The objective of the ACTD is to demonstrate an enhanced integrated command and control/fires and targeting capability to enable rapid employment, maneuver, and fires to support joint dispersed unit operations in an extended littoral battlespace. A Major Systems Demonstration (MSDI) was completed FY99 and a second one (MSDII) is planned for FY 2001. The ELB ACTD was approved by Deputy Under Secretary of Defense (Acquisition and Technology) (DUSD (AT)) on 16 January 1997.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

PROJECT NUMBER: R2362 PROJECT TITLE: Extending the Littoral Battlespace

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

EXTENDING THE LITTORAL BATTLESPACE	FY00 $10,575	FY01 $9,021	FY02 $956
Initiate	• Enabling technologies efforts to incorporate and integrate emerging state- of –the shelf technologies • Selection, purchase, and installation of next generation, fires and targeting for second demonstration • Full database and object interoperability between emerging and legacy systems • Engineering, technical, and operational assessments to define system demonstration scenarios	• Select, provide, and support transition sets from MSDII to user for further military utility and operator assessment • Demonstration of C4ISR system of systems in a realistic combat scenario utilizing operational forces	• Transition technologies, hardware, and software to user for further military utility

Continue	• Planning and augmenting the Command, Control, Communications, Computers, Intelligence, Intelligence, Surveillance and Reconnaissance (C4ISR) system design for MSDII in FY 2001 • Demonstration/post demonstration analysis for evaluation the system concept and assessing its military utility • Planning for MSDII • Pre-demonstration activities to include systems installation, integration, tests, software verification and validation, ship installation, operator training, system scenario tests	• Demonstration/post demonstration analysis for evaluation the system concept and assessing its military utility • Planning for and conducting MSDII • Pre-demonstration activities to include systems installation, integration, tests, software verification and validation, ship installation, operator training, system scenario tests	• Demonstration/post demonstration analysis for evaluation the system concept and assessing its military utility • Residual support of equipment fielded with Amphibious Ready Group/Marine Expeditionary Unit (ARG/MEU) and deployment dependant on accomplishment in FY01
Complete	• Systems Integration Tests and Full Systems Tests • Determined, provided and supported transition sets of MSDI technology	• Systems Integration Tests, Full Systems Tests, and MSDII • Determine, provide and support transition sets of Full Systems Test (FST) and MSDII technology	• Systems Integration Tests, Full Systems Tests, and MSDII • Determine, provide and support transition sets of FST and MSDII technology
SBIR	FY00	FY01 $207	FY02

		• Portion of FY01 extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 328	

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations PROJECT NUMBER: R2362 PROJECT TITLE: Extending the Littoral Battlespace

(U) PROGRAM CHANGE SUMMARY: See Program change total summary for P.E.

(U) OTHER PROGRAM FUNDING SUMMARY: Not applicable

(U) NAVY RELATED RDT&E:
- (U) PE 0601152N (In-House Laboratory Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0204163N (Fleet Communications)
- (U) PE 0602782N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
- (U) PE 0602235N (Common Picture Applied Research)
- (U) PE 0206623M (Marine Corps Ground/Supporting Arms Systems)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0603612M (Marine Corps Mine/Countermeasures Systems)
- (U) PE 0603635M (Marine Crops Ground Combat/Support System)
- (U) PE 0206313M (Marine Air Ground Task Force Command/Control/Communications/Computers & Intelligence)

(U) NON-NAVY RELATED RDT&E:
- (U) PE 0603004A (Weapons and Munitions Advanced Technology)
- (U) PE 0603005A (Combat Vehicle and Automotive Advanced Technology)
- (U) PE 0603606A (Landmine Warfare and Barrier Advanced Technology)
- (U) PE 0603607A (Joint Service Small Arms Programs)
- (U) PE 0603619A (Landmine Warfare and Barrier Advanced Demonstrations)
- (U) PE 0603772A (Battlefield Force Integration)
- (U) PE 0604710A (Night Vision Systems - Engineering Development)
- (U) PE 0604808A (Landmine Warfare and Barrier Engineering Development)
- (U) PE 0602301E (Computing Systems and Communications Technology)
- (U) PE 0602702E (Tactical Technology) Technology Demonstrations (ATDs)
- (U) PE 0603226E (Experimental Evaluation of Major Innovative Technologies)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2223 Marine Corps ATD	11,019	12,385	17,269

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: As the land warfare component of Naval Expeditionary Forces power projection, the Marine Corps has unique and technologically stressing requirements resulting from its amphibious mission; Marine Air-Ground Task Force (MAGTF) organizational structure; and reliance on maneuver, logistic sustainability, and intensive tempo of operations in diverse environments. Critical Marine Corps requirements/imperatives being addressed in this program element (PE) are: Maneuver, Firepower, Communications Command and Control, Logistics, and Training and Education. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment. Multiple transitions into the Demonstration/Validation phase are planned, as well as fieldable prototyping to reduce risk in Engineering and Manufacturing Development. Joint service efforts are in line with Defense Technology Objectives and Joint Warfighting Objectives (JWOs). Efforts focus on connectivity between MAGTF and Fleet organizations and naval sea-based fire support. Specifically, this PE supports the following capabilities: promptly engaging regional forces in decisive combat on a global basis; responding to all other contingencies and missions in the full spectrum of combat operations (high, mid and low intensity) in Military Operations in Urban Terrain (MOUT), and in operations other than war; and warfighting experimentation. By providing the technologies to enable these capabilities, this PE primarily supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. This PE supports all of the Marine Corps.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROJECT NUMBER: R2223
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations PROJECT TITLE: Marine Corps ATD

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

MANEUVER	FY00 $4,187	FY01 $4,814	FY02 $940
Initiate	• Autonomous amphibious vehicle tech demonstrator (AAV P-7)		• Light vehicle mobility & survivability demonstrations
Continue	• Reconnaissance Surveillance and Targeting Vehicle (RST-V) • Hybrid-electric drive • MV-22 compatibility • Signature management	• Reconnaissance Surveillance and Targeting Vehicle (RST-V) • Mobility testing • Survivability testing	• Reconnaissance Surveillance and Targeting Vehicle (RST-V) • Field testing / experimentation • RST & C4I testing
Complete		• Autonomous amphibious vehicle tech demonstrator (AAV P-7)	

FIREPOWER	FY00 $2,975	FY01 $1,981	FY02 $6,600
Initiate			• Advanced airbursting munitions demonstration • Integrated Infantry Combat System firepower development • Loitering Electronic Warfare Killer…

Continue	• Objective Crew Served Weapon Development with Joint Service Small Arms Program • Complementary Low Altitude Weapons system (CLAWS)	• Objective Crew Served Weapon Development with Joint Service Small Arms Program	• Objective Crew Served Weapon Development with Joint Service Small Arms Program
Complete		• Transition CLAWS to MARCORSYSCOM Program Manager	

COMMAND AND CONTROL	FY00 $1,542	FY01 $1,612	FY02 $2,200
Initiate	• Ultra wide-band networking technologies preliminary and critical design reviews • Prototype gyrocompass for improved azimuth determination-Enhanced Target Acquisition and Location System (ETALS)	• Initiate basic Commandand Control(C2) testbed for user prototyping requirements generation on prospective commercial and emerging C4I technologies.	• Intell Advanced Technology Development: Initiate tactical jammer effort. • Intell Advanced Technology Development; Initiate Mobile Direction Finding Advanced Technology Development for insertion into Team Portable Collection System program. •
Complete	• Assessment of interferometric technologies for azimuth determination ETALS	• Ultra wide-band system integration, and prototype hardware delivery • Develop prototype gyrocompass for ETALS: Transition to Time Critical Strike Future Naval	• Communications Advanced Technology Development: Ultra wide-band, demonstration.

		Capability.	

LOGISTICS	FY00 $993	FY01 $2,477	FY02 $2,529
Initiate		• Emerging packaging concepts.	• Packaging materials to reduce tare weight.
Continue	• Focussed on advanced concept technology demonstration for small unit logistics command and control Advanced Concept Technology Demonstration (ACTD), emphasizing decision support and improved logistics situational awareness at the tactical level. • Modeled future systems to enable logistics functions to be conducted in an Operational Maneuver from the sea (OMFTS) environment. These future systems will be from a result of the demonstration of the Tactical Logistics Distribution System (TLoaDS), which was used by Marine Corps Combat Development Command Studies and Analysis (MCCDC) Studies and Analysis (S&A) in Mission Area Analysis studies. • Demonstrated a concept of	• Focus on advanced concept technology demonstration for small unit logistics command and control Advanced Concept Technology Demonstration (ACTD), emphasizing decision support and improved logistics situational awareness at the tactical level. • Demonstrated a concept of operations and coordinated the field demonstration of both Onboard Vehicle/Refueler Communication (OVRC) and Fuel Automated Quantity Sensor (FAQS) during one of the designated assessment exercises held in FY 01. A Naval focus for fuel information aggregation will be emphasized, providing the commander critical fuel awareness across a distributed battlefield. Additionally, this task will	• Emerging packaging concepts. • Demonstrate a concept of operations and coordinated the field demonstration of both Onboard Vehicle/Refueler Communication (OVRC) and Fuel Automated Quantity Sensor (FAQS) during one of the designated assessment exercises held in FY 01. A Naval focus for fuel information aggregation will be emphasized, providing the commander critical fuel awareness across a distributed battlefield. Additionally, this task will provide variable rate flow pumps to enable Marines to fuel different types of vehicles at their optimum rate(i.e. M1A1 takes on fuel at a much higher rate than a HMMWV). • Continue residual management plan for Small Unit Logistics (SUL) Advanced Concept Technology

	operations and coordinated the field demonstration of both Onboard Vehicle/Refueler Communication (OVRC) and Fuel Automated Quantity Sensor (FAQS) during one of the designated assessment exercises held in FY 00. A Naval focus for fuel information aggregation will be emphasized, providing the commander critical fuel awareness across a distributed battlefield. Additionally, this task will provide variable rate flow pumps to enable Marines to fuel different types of vehicles at their optimum rate (i.e. M1A1 takes on fuel at a much higher rate than a High Mobility Multipurpose Wheeled Vehicle (HMMWV)).	provide variable rate flow pumps to enable Marines to fuel different types of vehicles at their optimum rate (i.e. M1A1 takes on fuel at a much higher rate than a HMMWV).	Demonstration (ACTD).
Complete		• Future systems enabling logistics functions to be conducted in an OMFTS environment will be developed, tested, and demonstrated. These future systems will be from a result of the demonstration of	

		the Tactical Logistics Distribution System (TLoaDS)model, which was used by MCCDC S&A in Mission Area Analysis studies. • Demonstrate SUL ACTD in Exercise Desert Knight, December 00.	

TRAINING AND EDUCATION	FY00 $1,322	FY01 $1,238	FY02 $0
Initiate	• Weapon & human tracking technology assessments • Advance Amphibious Assault Vehicle (AAAV) Non-Acquisition Category Program Decision Document (NAPDD) • Memorandum of Agreement (MOA) with Army (STRICOM) for technology leverage/sharing	• AAAV Amphibious Vehicle Training and Maintenance support technology investigation • Investigation on visual displays for embedded training • Improve Computer Generated Forces behavior/representation • Combat Vehicle Appended Trainer (CVAT) visual displays support • Virtual Technology Environment (VIRTE) transition plan	

Continue	• Locomotion Consortium meetings (Office of Naval Research (ONR), Naval Research Laboratory (NRL), Army Research Institution (ARI), Army Research Laboratory (ARL), Naval Air Warfare Center Training Systems Division (NAWCTSD), Contractors, & Academia) • Demonstrated Small Unit (Infantry) and Combat Vehicle technology demonstrators at several conferences (i.e. Society of Automobile Engineers (SAE), Modern Day Marine, Inter-service/Industry Training, Simulation Education Conference (I/ITSEC)) • Weapon & human tracking technology assessments	• Development of prototype in support of combat vehicles (AAAV & Landing Craft Air Cushion (LCAC)) • Improve infantry Computer Generated Forces and transition technology into combat vehicles • Investigate visual displays in support of AAAV deployable maintenance and training concepts to support embedded training capabilities • Locomotion Consortium meetings (ONR, NRL, ARI, ARL, NAWCTSD, Contractors, & Academia)	
Complete	• Weapon & human tracking assessments and report • Transition technology to ISMT-E program (computer assessment) • Transition technology to CVAT program (visual displays)	• Transition technologies to VIRTE • VIRTE Transition Plan approved	
SBIR	FY00	FY01 $263	FY02

		• Portion of FY01 extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 328	

Littoral Combat and Power Projection Future Naval Capability	FY00	FY01	FY02 $5,000
Initiate			• Initiate Littoral combat Future Naval Capability to provide combatant commanders with scalable, interoperable, combined arms marine Air Ground Task Forces; Naval Expeditionary Forces ready to fight and prevail, and shape the national security environment. Development efforts will optimize the Marine Corps' operating

			forces, support and sustainment base, and its unique capabilities to respond to the complex spectrum of crises and conflicts.

(U) PROGRAM CHANGE SUMMARY: See Program change total summary for P.E.

(U) OTHER PROGRAM FUNDING SUMMARY: Not applicable

(U) NAVY RELATED RDT&E:
- (U) PE 0601152N (In-House Laboratory Independent Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0204163N (Fleet Communications)
- (U) PE 0602782N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0603555N (Undersea Superiority Technology Demonstrations)
- (U) PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
- (U) PE 0603235N (Common Picture Advanced Technology)
- (U) PE 0206623M (Marine Corps Ground/Supporting Arms Systems)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0603612M (Marine Corps Mine/Countermeasures Systems)
- (U) PE 0603635M (Marine Crops Ground Combat/Support System)
- (U) PE 0206313M (Marine Air Ground Task Force Command/Control/Communications/Computers & Intelligence)

(U) NON-NAVY RELATED RDT&E:
- (U) PE 0603004A (Weapons and Munitions Advanced Technology)
- (U) PE 0603005A (Combat Vehicle and Automotive Advanced Technology)
- (U) PE 0603606A (Landmine Warfare and Barrier Advanced Technology)
- (U) PE 0603607A (Joint Service Small Arms Programs)
- (U) PE 0603619A (Landmine Warfare and Barrier Advanced Demonstrations)
- (U) PE 0603772A (Battlefield Force Integration)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology Demonstrations

PROJECT NUMBER: R2223
PROJECT TITLE: Marine Corps ATD

(U) PE 0604710A (Night Vision Systems - Engineering Development)
(U) PE 0604808A (Landmine Warfare and Barrier Engineering Development)
(U) PE 0602301E (Computing Systems and Communications Technology)
(U) PE 0602702E (Tactical Technology) Technology Demonstrations (ATDs)
(U) PE 0603226E (Experimental Evaluation of Major Innovative Technologies)

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2497 Joint Experimentation	42,300	51,033	118,802						CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Commander in Chief, U.S. Joint Forces Command (CINCUSJFCOM) is chartered by the Secretary of Defense as the Department of Defense Executive Agent for joint concept development and experimentation (JCDE). CINCUSJFCOM's mission is to develop and implement an aggressive program of experimentation that fosters innovation and rapid fielding of new concepts and capabilities. This effort will enable U.S. armed forces to achieve and maintain Full Spectrum Dominance as envisioned in the Chairman, Joint Chiefs of Staff (CJCS) Joint Vision 2020 (JV 2020). The Charter establishes U.S. Joint Forces Command (USJFCOM) as the focal point for all joint concept development and experimentation activities. This program element (PE) directly supports that initiative by providing funding to continue activities focused on the development, analysis and experimentation of new joint operational concepts which are key to addressing future military challenges. This effort results in empirically based recommendations for change to joint doctrine, organization, training, material, leadership, personnel, and facilities (DOTMLPF).

(U) Recommended changes resulting from this experimentation activity will be forwarded CJCS and the Joint Requirements Oversight Committee (JROC) for implementation. The individual Military Services and United States Special Operations Command (USSOCOM) retain primary responsibility to develop concepts and conduct experimentation within their core competencies, to include their respoective land, air and space, sea, expeditionary and special operations roles. USJFCOM serves as the joint force integrator. The Assistant Secretary of Defense for Strategy and Threat Reduction (ASD(S&TR)) monitors USJFCOM's joint concept experimentation on behalf of the Secretary of Defense. ASD(S&TR), working with the Defense Resources Board (DRB) acting in its Revolution in Military Affairs (RMA) oversight role, conducts reviews of CINCUSJFCOM experimentation activities.

(U) The Joint Experimentation Campaign Plan for FY 2001 focuses on high priority tasks assigned to USJFCOM through the Defense Planning Guidance (DPG) and CJCS Instructions on Joint Concept Development and Experimentation. The DPG and CJCS instructions direct USJFCOM to continue development and refinement of the Rapid Decisive Operations (RDO) concept. RDO is the overarching, integrating concept and is supported by eight functional concepts. These functional concepts are Attack Operations Against Critical Mobile Targets (AOACMT) Common Relevant Operational Picture (CROP), Adaptive Joint Command and Control (AJC2), Joint Interactive Planning (JIP), Focused Logistics: Enabling Early Decisive Operations (FLEEDO), Information Operations (IO), Assured Access (AA) (formerly Forcible Entry Operations (FEO), and

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

Strategic Deployment (SD). Two new joint operational concepts are also under development. These are joint, Intelligence, Surveillance and Reconnaissance (JISR) and Effects Based Operations (EBO). Development of these new concepts is based on lessons learned from completed FY00 joint experimentation activities.

(U) During FY 2000, USJFCOM conducted the first of a series of biennial Millennium/Olympic Challenge (MC/OC) major joint integrating experiments (to be staged in even years). These experiments will address the challenges of Rapid Decisive Operations. Millennium Challenge 2000 is the U.S. Armed Forces first large scale, joint warfighting concept experiment. Scheduled in August and September 2000, it is designed to assess proposed, future joint warfighting concepts by integrating into a single exercise experimentation activities from all the Military Services and USJFCOM. MC 00 integrated the Army's Joint Contingency Advanced Warfighting Experiment (JCF-AWE); Navy's Fleet Battle Experiment - Hotel (FBE H), Air Force's Joint Expeditionary Field Experiment (JEFX), and the Marine Corps' Millennium Dragon (MD) experimentation activities. MC 00 is a prototype for future service and joint experiments. USJFCOM achieved two major objectives during MC 00. These were to provide an overarching joint context for the Services' major experiments and to leverage these Service activities as well as selected joint exercises in order to examine three specific operational issues related to RDO: Joint Deployment Process Improvement, Precision Engagement and Information Superiority/Command and Control. CJCS envisions MC 00 as the model for multi-service collaboration, synchronization and interoperability. The MC/OC series of exercises will be the foundation for joint experimentation activities in FY 2002, 2004 and 2006. Millennium 2002 (MC 02) will assess the ability of a coherent, interoperable joint force to conduct a rapid, decisive joint strike operation in the 2004-2007 time period. Olympic Challenge 2004 (OC 04) will evaluate a similar operation in the 2010-2015 timeframe. The FY2001 Senate Armed Services Committee Report specifically directed the Secretary of Defense to plan in Fiscal Year 2001 and conduct in Fiscal Year 2002, a joint field experiment focused on exploring the most critical war fighting challenges that will confront U.S. joint military forces at the operational level of war. It further directed that this experiment incorporate elements of all the military services and Special Operations forces. This activity would include elements representative of each military service and U.S. Special Operations Command's future force concepts, e.g., Air Force Expeditionary Aerospace Force, Army medium weight brigades, and the Navy/Marine Corps' Forward From the Sea, Operational Maneuver From the Sea visions. The MC/OC series of joint experiments will provide the joint context for examining how well these individual service concepts work together to provide joint military capabilities at the operational level of war.

(U) Beginning in FY 2001, USJFCOM will conduct a series of annual Unified Vision (UV) experiments that provide context for refinement of RDO and its supporting functional concepts. Unified Vision 2001 will serve as the preliminary concept and experiment event that supports MC 02. Unified Vision events in odd years will support the even year MC/OC major joint integrating experiments. Unified Vision experiments in even years will support development of future integrating concepts, leading toward the UV and MC/OC experiments three and four years later. Unified Vision experiments will also provide a venue to develop and establish the joint operational environment as a context for USJFCOM participation in the Military Services' future wargames.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) The CJCS Joint Experimentation Campaign Plan 01 Guidance directed exploration of revolutionary concepts and advanced technologies that have potential to significantly alter the conduct of military operations. These include autonomous operations; nano-technologies, biocentric operations, non-kinetic engagement technologies and space based capabilities. Additionally, USJFCOM has CJCS direction to work closely with the science and technology community in developing warfighting capabilities.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, and experimental testing or prototype hardware. It is also necessary to validate technological feasibility and concept of operations to reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) PROGRAM ACCOMPLISHMENTS AND PLANS: Rapid **Decisive Operations.** This concept describes how a joint force commander can determine and employ the right balance of air, sea, land, space and electromagnetic spectrum capabilities. It is the integrating concept for future joint experimentation activities and is supported by the other functional concepts described in this paper. A series of sequential wargames and field exercises will be used to develop and assess this concept

Rapid Decisive Operations (RDO)	**FY00 $6,550**	**FY01 $15,582**	**FY02 $10,750**
Initiate	• Analytical wargame series Conduct first wargame Conduct wargame technical rehearsal Developed computer models • Integrate Entropy based wargaming models into scheduled wargaming events • Conduct evaluations of alternative operational concepts of force employment • Provide lessons learned and results to support development of FY01 and FY02 joint experiments	• Unified Vision 2001 experiment in preparation for Millennium Challenge 2002 • Leverage Northern Edge 2001 teaming event	• Unified Vision 2002 experiment in preparation for Millennium Challenge/Olympic Challenge experiments in 2004 and 2006 • Millennium Challenge 2002

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

Continue	• Concept white paper under development • Technology focus: ➢ Elements of Information and Intelligence ➢ Fully Networked, Sensor Systems ➢ Non-Kinetic Effects ➢ Non-Lethal Weapons ➢ Command and Control (C2) ➢ Unmanned Air Vehicle (UAV) Employment ➢ Mobile Offshore Base ➢ Intrusive Information Operations ➢ Bar Coding ➢ Global Positioning Satellite (GPS) tracking ➢ Comprehensive Data Bases ➢ Predictive modeling ➢ Wide bandwidth and Broad User Selections ➢ Portable, Wireless, Ruggeddized Reliable Hardware Systems	• Continue to develop the integrating concept for Rapid Decisive Operations • Leverage Navy Fleet Battle Experiment India • Leverage Marine Capable Warrior • Leverage U.S. Pacific Command (PACOM) Joint Mission Force • Technology focus: ➢ Elements of Information and Intelligence ➢ Fully Networked, Sensor Systems ➢ Non-Kinetic Effects ➢ Non-Lethal Weapons ➢ C2 ➢ UAV Employment ➢ Mobile Offshore Base ➢ Intrusive Information Operations ➢ Other technologies as previously listed	• Leverage three Navy Fleet Battle Experiments (Juliet, Kilo, Lima) • Leverage Marine Capable Warrior • Leverage PACOM Joint Mission Force • Leverage U.S. European Command (EUCOM) exercise Matador 02 • Leverage U.S. Air Force Joint Expeditionary Field Experiment (JEFX) 02 • Leverage Army Advanced Warfighting Experiment • Technology focus: ➢ Elements of Information and Intelligence ➢ Fully Networked, Sensor Systems ➢ Non-Kinetic Effects ➢ Non-Lethal Weapons ➢ C2 ➢ UAV Employment ➢ Mobile Offshore Base ➢ Intrusive Information Operations ➢ Other technologies as previously listed
Complete	• Baseline Collective Assessment (BCA) published • RDO Analytical Wargame • Millennium Challenge 2000	• Concept White paper published • Doctrine, Organization, Training, Material, Leadership, Personnel, and Facilities (DOTMLPF) recommendations completed for forwarding to Chairman, Joint Chiefs of Staff (CJCS)	• Refined concept white paper published • DOTMLPF recommendations forwarded to CJCS • Concept reports and papers published.

		• Concept reports and white papers published	

(U) **Attack Operations Against Critical Mobile Targets.** A functional concept supportive of Rapid Decisive Operations. It includes the immediate identification and continuous, accurate tracking of critical mobile and time sensitive targets, and subsequent engagement with precise, retargetable and immediately responsive weapons and offensive information operations

Attack Operations Against Critical Mobile Targets (AOACMT)	**FY00 $5,165**	**FY01 $1,197**	**FY02 $7,350**
Initiate	• Experimentation and Exercise sequence including: Exercise Unified Vision 00 Exercise Attack Operations 00 Supporting seminars • Joint Test & Evaluation Program in Joint Suppression of Enemy Air Defenses • Fleet Battle Experiments F & G • Experimentation and research on Detect and Decide components of Attack Operations	• Attack Operations Against Critical Mobile Targets (AO 01) • Unified Vision 2001 experiment in preparation for Millennium Challenge 2002 • Decision Making Ability of Software Agents Limited Objective Experiment (LOE)	• Experimentation and research on Decide and Deliver components of Attack Operations • Unified Vision 2002 experiment in preparation for Millennium Challenge/Olympic Challenge experiments in 2004 and 2006. • Millennium Challenge 2002
Continue	• Investigation into the Joint Critical Mobile Target Cell composition, structure, and processes • Technology focus: ➢ Intelligence, Surveillance and Reconnaissance (ISR) Sensor Fusion ➢ Automatic Target Recognition	• Experimentation and research on Detect and Decide components of Attack Operations • Leverage Army Forces Command's (FORSCOM) Roving Sands 01 • Leverage PACOM/USFK's (U.S. Forces Korea) Ulchi Focus Lens • Technology focus: ➢ ISR Sensor Fusion	• Leverage Roving Sands 02 • Leverage PACOM/USFK's Ulchi Focus Lens • Technology focus: ➢ ISR Sensor Fusion ➢ Automatic Target Recognition ➢ Automated Intel Preparation of the Battlefield

	➢ Automated Intel Preparation of the Battlefield ➢ Attack Operations Enhanced Decision Aids ➢ Air Platforms ➢ Enhanced Decision Aids ➢ Faster precision weapon delivery systems ➢ Alternate attack systems	➢ Automatic Target Recognition ➢ Automated Intel Preparation of the Battlefield ➢ Attack Operations Enhanced Decision Aids ➢ Air Platforms ➢ Enhanced Decision Aids ➢ Faster precision weapon delivery systems ➢ Alternate attack systems	➢ Attack Operations Enhanced Decision Aids ➢ Air Platforms ➢ Enhanced Decision Aids ➢ Faster precision weapon delivery systems ➢ Alternate attack systems
Complete	• Concept white paper published • BCA published • Initial Adversary Vulnerability Assessment (IAVA) published • Attack Ops 00 Human in the Loop (HITL) Virtual Simulation Experiment • Millennium Challenge 2000	• Attack Ops 01 HITL Virtual Simulation Experiment • Refined white paper published • Unified Vision 2001 • DOTMLPF recommendations produced and forwarded to CJCS • Concept Reports and papers published	• Refine concept white paper published • Unified Vision 2002 HITL Virtual Simulation Experiment • DOTMLPF recommendations produced and forwarded to CJCS • Concept Reports and papers published • Millennium Challenge 2002

(U) Information Superiority: Includes four function concepts: Common Relevant Operational Picture, Joint Interactive Planning, Adaptive Joint Command and Control and Information Operations. Together these concepts work to provide a Joint Force Commander with a superior picture of both national and coalition forces and seek to deny or disrupt information, which is critical to the enemy's concept of operations and mission

Information Superiority (IS)	**FY00 $3,550**	**FY01 $5,584**	**FY02 $5,411**
Initiate	• Common Relevant Operational Picture (CROP) Initiated seminar/workshop series (CROP) Commence Information superiority wargame (CROP)	• Unified Vision in preparation for Millennium Challenge 2002 • Collaboration Decision Environment (CDEX01-1) • Command Post Experiment 2001 Workshop	• Unified Vision Experiment in preparation for Millennium Challenge/Olympic Challenge experiments in 2004 and 2006 • Millennium Challenge 2002

	Integrate wargame/seminar results into Millennium Challenge 00 Global Wargame at Naval War College • Joint Interactive Planning (JIP) Joint Interactive Planning Workshop & Seminars Participate in Rapid Decisive Operations and Attack Ops Experiments Army Joint Command Post Exercise Participation in Millennium Challenge 00 Participation in Navy Fleet Battle Experiment Golf • Adaptive Joint Command and Control (AJC2). Begin Force Application Seminars, Workshop and wargame Participate in JFCOM Information Superiority Wargame Participate in Deployment and Sustainment seminars, workshops and wargame Millennium Challenge 00 JFCOM Joint Command Post Exercise • Information Operations (IO). Participate in Air Force	Workshop • Command Post Experiment 2001 Workshop II (CDEX01-2) • Web of the Future Limited Objective Experiment (LOE) • Decision Making Ability of Software Agents LOE	• Two Command Post Experiment LOEs

	Global Engagement Wargame Information Superiority workshops, seminars and wargame Joint Warrior Information Demonstration (JWID) 00 with USSPACECOM Global Wargame 00 at Naval War College JFCOM Evident Surprise Information Operations Wargame • IS Integrated Concept Team (ICT) • CROP LOE • AJC2 LOE • JIP LOE		
Continue	• Concept white paper coordination for JIP and AJC2 • BCA planned for IO • Technology focus: ➢ Collaborative Information Environment ➢ Decision Support ➢ Battlespace Awareness ➢ Information Assurance	• Leverage All Service Combat Identification Evaluation Team (ASCIET) (All Service Combat Identification Program) • Technology focus: ➢ Collaborative Information Environment ➢ Decision Support ➢ Battlespace Awareness ➢ Information Assurance	• Technology focus: ➢ Collaborative Information Environment ➢ Decision Support ➢ Battlespace Awareness ➢ Information Assurance
Complete	• Concept white paper published for CROP • BCA published for CROP, JIP, and AJC2 • Millennium Challenge 2000	• BCA for IO published • Concept white papers for JIP and AJC2 published • Unified Vision 2001 • Workshops and LOEs	• Concept white paper for IO published • Unified Vision 2002 • Millennium Challenge 2002 • Workshops and LOEs

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) **Focused Logistics Enabling Early Decisive Operations**. Integrates advanced technologies with logistics management to effectively support early force deployment and continued force employment

Focused Logistics: Enabling Early Decisive Operations (FLEEDO)	**FY00 $1,115**	**FY01 $100**	**FY02 $3,350**
Initiate	• Participation in: Exercise Foal Eagle Exercise Bright Star Deployment and Sustainment workshops Joint Logistics Information Study Technology Symposium Millennium Challenge 00 Deployment and Sustainment wargame Reduced Logistics Footprint Study • Information Collection and Decision Support Tools concept • Deployment/Forward Presence Planning and Execution concept • Agile Sustainment and Delivery concept • Joint Theater Logistics Management concept	• Unified Vision 2001 experiment in preparation for Millennium Challenge 2002 • Joint Reception, Staging, Onward Movement and Integration/Joint Theater Logistics Management (JRSOI/JTLM) Seminar • Concept Workshop • Focused Logistics Wargame (FLOW) • Focused Logistics Limited Objective Experiment (LOE)	• Unified Vision 2002 in preparation for Millennium Challenge/Olympic Challenge 2004 and 2006 • Millennium Challenge 2002 • Focused Logistics Wargame (FLOW) • Focused Logistics Limited Objective Experiment (LOE) • Concept Workshop

Continue	• BCA planned • Technology focus: ➢ Logistics Asset Visibility ➢ Collaborative and Automated Logistics Planning Toolset ➢ Cognitive Logistics Support and Decision Aids ➢ Advancements in Transportation Assets ➢ Precision Guided Munitions ➢ Alternate Fuels and Power Sources	• Information Collection and Decision Support Tools concept • Deployment/Forward Presence Planning and Execution concept • Agile Sustainment and Delivery concept • Joint Theater Logistics Management concept • Leverage Army's Force Projection/Sustainment Wargame • Leverage PACOM's Force Deployment/Sustainment Reception, Staging, Onward Movement and Integration (RSOI) Wargame • Technology focus: ➢ Logistics Asset Visibility ➢ Collaborative and Automated Logistics Planning Toolset ➢ Cognitive Logistics Support and Decision Aids ➢ Advancements in Transportation Assets ➢ Precision Guided Munitions ➢ Alternate Fuels and Power Sources	• Technology focus: ➢ Logistics Asset Visibility ➢ Collaborative and Automated Logistics Planning Toolset ➢ Cognitive Logistics Support and Decision Aids ➢ Advancements in Transportation Assets ➢ Precision Guided Munitions ➢ Alternate Fuels and Power Sources
Complete	• Concept white paper published • Base Case Assessment Published • Millennium Challenge 2000	• Refined concept for FLEEDO published • Unified Vision 2001 • Workshops and LOEs	• Refined concept for FLEEDO published • Unified Vision 2002 • Millennium Challnege 2002 • Workshops and LOEs

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) **Assured Access (formerly Forcible Entry Operations).** Examines how a Joint Force Commander can rapidly deploy and penetrate an adversary's territory to conduct further operations.

Assured Access	**FY00 $250**	**FY01 $100**	**FY02 $3,110**
Initiate	• Draft concept white paper • Baseline Case Assessment • Conduct initial seminar • Participation in Millennium Challenge 00	• Assured Access concept development • Unified Vison 2001 experiment in preparation for Millennium Challenge 2oo2	• Refined Assured Access concept development • Unified Vision 2002 in preparation for Millennium Challenge/Olympic Challenge 2004 and 2006
Continue	• BCA planned • Concept white paper under development		
Complete		• BCA published • Concept white paper published • Unified Vision 2001	• Refined Assured Access concept development • Unified Vision 2002 in preparation for Millennium Challenge/Olympic Challenge 2004 and 2006

(U) **Strategic Deployment**. Provide significantly improved strategic deployment forces capable of projecting joint forces by sea, land and air, along with sustainment for these forces, across strategic distances in order to support Rapid Decisive Operations.

Strategic Deployment (SD)	**FY00 $450**	**FY01 $100**	**FY02 $8,350**
Initiate	• Focused Logistics Wargame (FLOW 99) • Baseline Collection Assessment	• Unified Vision 2001 experiment in preparation for Millennium Challenge 2002	• Unified Vision 2002 in preparation for Millennium Challenge/Olympic Challenge 2004

	• Mobility Requirements Study 05 • Strategic Deployment Concept White Paper • Strategic Deployment Wargame • Millennium Challenge 00	• Joint Reception, Staging, and Onward Movement and Integration/Joint Theater Logistics Management (JRSOI/JTLM) Seminar • Focused Logistics Wargame (FLOW) • Focused Logistics Limited Objective Experiment (LOE)	and 2006 • Millennium Challenge 2002 • Focused Logistics Wargame (FLOW) • Focused Logistics Limited Objective Experiment (LOE)
Continue	• Baseline Collective Assessment (BCA) planned • Concept white paper coordination	• Information Collection and Decision Support Tools concept • Deployment/Forward Presence Planning and Execution concept • Agile Sustainment and Delivery concept • Joint Theater Logistics Concept • Leverage Army's Force Projection /Sustainment Wargame • Leverage PACOM's Force Deployment/Sustainment Reception, Staging, Onward Movement and Integration (RSOI) Wargame • Technology focus: ➢ Logistics Asset Visibility ➢ Collaborative and Automated Logistics Planning Toolset ➢ Cognitive Logistics Support and Decision Aids ➢ Advancements in Transportation Assets	• Technology focus: ➢ Logistics Asset Visibility ➢ Collaborative and Automated Logistics Planning Toolset ➢ Cognitive Logistics Support and Decision Aids ➢ Advancements in Transportation Assets ➢ Precision Guided Munitions ➢ Alternate Fuels and Power Sources

		➢ Precision Guided Munitions ➢ Alternate Fuels and Power Sources	
Complete	• Stand up Integrated Concept Team	• Baseline Capability Assessment (BCA) published • Concept white paper for Strategic Deployment published • Unified Vision 2001 • Workshops and LOEs	• Refined Concept white paper for Strategic Deployment published • Unified Vision 2002 • Millennium Challenge 2002 • Workshops and LOEs

(U) **Millennium Challenge**. Is a coordinated joint experimentation JFCOM exercise involving participation by all the Military Services battle laboratories and concept development organizations. This exercise will permit integration of the overarching Rapid Decisive Operations (RDO) supporting concepts with future warfighting concepts being developed by each of the services.

Millennium Challenge Major Joint Experiment	**FY00 $22,300**	**FY01 $25,250**	**FY02 $58,647**
Initiate	• Army's Joint Contingency Advanced Warfighting Experiment (JCF-AWE) • Navy Fleet Battle Experiment – Hotel (FBE-H) • Air Force's Joint Expeditionary Field Experiment (JEFX) • Marine's Millennium Dragon (MD) Experiment provide venue for the joint exercise	• Unified Vision 2001 experiment in preparation for Millennium Challenge (MC) 2002	• MC 2002 is a major field experiment in Rapid Decisive Operation, using 2004-2007 forces to conduct decisive joint strike operations. MC 2002 will be used to validate the potential of various government-owned training ranges to support major joint experiments. • Unified Vision 2002 experiment in preparation for Millennium/Olympic Challenge experiments in 2004 and 2006

Continue	• Concept development for Precision Engagement, Joint Deployment, and Information Superiority	• Concept development for Precision Engagement, Joint Deployment, and Information Superiority • Refinement of RDO concept and supporting functional concepts	• Concept development for Precision Engagement, Joint Deployment, and Information Superiority • Refinement of RDO concept and supporting functional concepts
Complete	• Millennium Challenge 2000	• Unified Vision 2001	• Millennium Challenge 2002 • Unified Vision 2002

(U) Advanced Concept Technology Demonstrations (ACTDs). Programs listed below are OSD sponsored ACTDs, which are under the sponsorship of JFCOM. They are being coordinated and integrated into joint warfighting experimentation concepts.

Advance Concept Technology Demonstrations (ACTD)	**FY00 $120**	**FY01 $120**	**FY02 $250**
Initiate	• Link16/Variable Message Format (VMF) Interface Rosetta Technology		
Continue	• Multi-Link Antenna System (MLAS) • Content Based Information Security (CBIS) • Joint Theater Logistics (JTL) • Force Medical Protection (FMP)	• Link16/Variable Message Format (VMF) Interface Rosetta Technology • MLAS • CBIS • JTL • FMP • TMDI	• MLAS • CBIS • JTL • FMP • TMDI • HAE UAV • JMLS

	(FMP) • Theater Missile Defense Interoperability (TMDI) • High Altitude Endurance Unmanned Aerial Vehicle (HAE UAV) • Joint Modular Lighter System (JMLS) • Integrated Collection Management (ICM) • Navigation Warfare (NAVWAR)	• HAE UAV • JMLS • ICM • NAVWAR	• ICM
Complete	• Joint Logistics (JL) • Battlefield Awareness and Data Dissemination (BADD) complete and in final report coordination	• Link16 ACTD to concepts	• Link16 ACTD to concepts

(U) **Limited Objective Experiments**. Short term experiments supporting specific, tightly focused future warfighting concepts.

Limited Objective Experiments (LOEs)	**FY00 $2,000**	**FY01 $1,500**	**FY02 $12,792**
Initiate	• Non-Kinetic Technologies (NKT), • Unified Vision (UV) 00 Attack Operations Against Critical Mobile Targets Theater Missile Defense Joint Suppression of Enemy Air Defenses	• Non-Kinetic technologies (NKT) integrated in to exercise Unified Endeavor 01-03 • Unified Vision 2001 experiment in preparation for Millennium Challenge(MC 2002	• Unified Vision 2002 experiment in preparation for Millennium/Olympic Challenge (OPC) experiments in 2004 and 2006

Complete	• Non-Kinetic Technologies (NKT) • Unified Vision 2000 • Information Superiority LOEs	• Non-Kinetic Technologies (NKT) • Information Superiority LOEs • Focused Logistics LOE	• Non-Kinetic Technologies (NKT) • Information Superiority LOEs • Focused Logistics LOE

(U) **Innovation and Transformation (Futures).** Activities to evaluate the military potential of emerging technologies in the 2020-2030 timeframe.

Innovation and Transformation (Futures)	**FY00 $500**	**FY01 $500**	**FY02 $5,600**
Initiate	• Bio-mimetics, nano-technology, and compact power • Autonomous/automated decision-making and joint command and control, enhancing human performance, learning and training, space-based capabilities in support of joint operations. • Innovation and Transformation Workshops • Industry Day Program	• United States Marine Corps (USMC) Project Ellis: Homeland Defense Working Group • Space-Based Support for Joint Operations Seminar • USMC Project Ellis: Alternate Fueled Vehicles Workshop • Preventing Strategic and Operational Surprise • USMC Project Ellis: Sea-Based Logistics Working Group	• Same level of effort, conducting seminars and quarterly workshops on topics listed in FY00 and 02
Continue		• Leverage United States Air Force (USAF's) Future Capabilities Wargame • Leverage Navy's Global Wargame • Leverage USMC's Warrior Wargame • Leverage Army's Transformation Wargame	• Leverage USAF's Future Capabilities Wargame • Leverage Navy's Global Wargame • Leverage USMC's Warrior Wargame • Leverage Army's Transformation Wargame

		Wargame • Leverage Science and Technology (S&T)	• Leverage S&T
Complete	• Innovation and Transformation Center established • Information and Transformation Workshops • Industry Day Program		

(U) **Integration with other CINC, Services and DoD Agencies**

Integrate CINCs/Services/Agencies (C/S/As)	**FY00 $150**	**FY01 $500**	**FY02 $2,192**
Initiate			
Continue	• Stand Off Precision Air Drop, • Non-lethal, Non-kinetic Capabilities • UAVs, • Force Protection • C2 Centers, • Global Positioning Systems (GPS) • Mobility, Warfighter Forces, Deployability Issues • Communications	• European Command (EUCOM) partnership in National Alliance Treaty Organization (NATO) Concept Development and Experimentation (CDE) process • Southern Command (SOCOM) Joint Experimentation Office partnership • PACOM Joint Mission Force Concept development • SOUTHCOM Disaster Relief and Humanitarian Assistance proposal • U.S. Space Command (SPACECOM) Computer Network Defense work	• Engagement with agencies and organizations outside DoD accomplished primarily through the S&T community. The S&T Division focuses on identifying individuals, forums, and products key to affect change in the DoD S&T communities. Some of the key organizations actively engaged are Office of Secretary of Defense (OSD), Director, Defense Research and Engineering (DDR&E), Deputy Under Secretary of Defense (DUSD), Assistant Secretary of Defense (ASD), Joint Chiefs of Staff (JCS)

	Infrastructure in Support of Command, Control, Communications, Computer (C4) and Intelligence, Surveillance and Reconnaissance (C4ISR) • Coalition Issues • Theater Early Warning Multi-Spectral Imagery, Concept of Operations (CONOPs) for Secure and Aerial Port of Debarkation (APOD)/Base in an Expeditionary Area of Responsibility (AOR).	Computer Network Defense work • U.S. Strategic Command (STRATCOM) C2 Modernization and Integration Lab partnership • U.S. Transportation Command (TRANSCOM) involvement in Joint Deployment Process Initiative in Millennium Challenge • S&T academic Workshop • ACTD Management Board • Industry Day Conference • Technology Area Review and Assessment Panels Conference • Summer Science Board Studies WorkingGroup/Seminar	(ASD), Joint Chiefs of Staff (JCS), Defense Advanced Research Project Agency (DARPA), Service Research Laboratories, Science Advisory Boards, Chief Scientists, and Service and Commander in Chief (CINC) Experimentation offices. The Defense Science and Technology Board receives particular focus.
Complete	• Alliance of All Service Battle Laboratories (AASBL) • PACOM Joint Mission Force Concept test in RDO Analytical Wargame	• Workshops and Seminars	• Workshops and Seminars

(U) Multi-national and Coalition Concept Development

Multi-national Concept Development and Experimentation (MN CDE)	**FY00 $150**	**FY01 $500**	**FY02 $1,000**
Initiate	• Theater Engagement Plans • Multi-national Information Sharing Integrated Concept Team (ICT)	• Multi-national Experimentation Forum 2001 Seminar • NATO Concept Development and Teaming Event (Germany) • NATO Concept and	• Multi-national Experimentation Forum 2002 Seminar • Partnership with future coalition nations: e.g. Norway. United Kingdom, France, Argentina,

	• Multi-national Logistics ICT • NATO Concept Development and Experimentation Integrated Event Team (IET) in support of Allied Command Atlantic	Experimentation Teaming Event (Albania) • APTX 2001 Teaming Event	Singapore
Continue	• Partnership with Foreign Liaison Officers (FLOs) NATO member states, Australia, Japan, South Korea, Argentina, Singapore, and the Gulf Cooperation Council states.	• Theater Engagement Plans • Support to Services Multi-national Experimentation efforts • NATO Concept Development and Experimentation effort in support of Allied Command Atlantic (ACLANT)	• Memorandum of Understanding with the Governments of Australia, United Kingdom and Canada
Complete	• International Experimentation Branch created	• Concept Report and Paper	• Concept Report and paper

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	43,498	49,506	53,660
Appropriated Value:			
Adjustments from FY 2000 President's Budget:			
SBIR/STTR Transfer	-1,028		
Congressional Adjustments	-170	-361	
Congressional Plus-Up		+2,000	
NWCF Adjustment			-38
Non-Pay Adjustment			+146
Gov't Wide Rescission		-112	
Adjustment to Program (MC02)			65,142
FY 2002 President's Submission	42,300	51,033	85,502

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:

- (U) 0601152N In-house Lab Independent Research
- (U) 0601153N Defense Research Sciences
- (U) 0602114N Power Projection Applied Research
- (U) 0602123N Force Protection Applied Research
- (U) 0602131M MC Landing Forces Tech
- (U) 0602235N Common Picture Applied Research
- (U) 0602236N Warfighter Sustainment Applied Research
- (U) 0602271N RF Systems Applied Research
- (U) 0602435N Ocean Warfighting Environment Applied Research
- (U) 0602747N Undersea Warfare Applied Research
- (U) 0602782N Mine & Expeditionary Warfare Applied Research
- (U) 0603114N Power Projection Advanced Technology

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603727N
PROGRAM ELEMENT TITLE: Joint Experimentation

- (U) 0603123N Force Protection Advanced Technology
- (U) 0603235N Common Picture Advanced Technology
- (U) 0603236N Warfighter Sustainment Advanced Technology
- (U) 0603271N RF Systems Advanced Technology
- (U) 0603640M Marine Corps Advanced Technology
- (U) 0603729N Warfighter Protection Advanced Technology
- (U) 0603747N Undersea Warfare Advanced Technology
- (U) 0603758N Naval Warfighting Experiments and Demo
- (U) 0603782N Mine & Expeditionary Warfare Advanced Technology
- (U) 0603750D Advanced Concept Technology Demonstration
- (U) 0603727D Joint Warfighting

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603729N
PROGRAM ELEMENT TITLE: Warfighter Protection Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2914 Warfighter Protection Advanced Technology	**	**	17,678

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PE 0603706N and PE 0603707N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports the development and demonstration of advanced technologies for improved warfighter protection medical equipment, techniques, technologies and systems. These technologies enhance Navy and Marine Corps capabilities in Casualty Care and Management, Casualty Prevention, and maintenance of a Healthy and Fit Force. The goal of Casualty Care and Management is to maximize the continuum of care with lifesaving interventions as far forward as possible in an increasingly lethal battlespace with reduced infrastructure and logistics. Casualty Prevention includes enhancing warfighter situation awareness and countering threats from disease, battle and non-battle injuries. Healthy and Fit Force efforts preserve health and enhance fitness of ready forces against physical and psychological threats through the continuum of peace and war.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of guidelines and prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to operational use or transition to an acquisition program, industry, or clinical trials.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603729N PROGRAM ELEMENT TITLE: Warfighter Protection Advanced Technology

PROJECT NUMBER: R2914 PROJECT TITLE: Warfighter Protection Advanced Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Casualty Care and Management	FY00	FY01	FY02-$9,192
Initiate	• Novel resuscitation fluids: ketone additive • Low volume resuscitation fluids: comparison of all FDA-approved hypertonic crystalloids in hemorrhage • Low volume resuscitation fluids: evaluation of new FDA-approved low-volume colloid fluid • Intranasal ketamine for pain control • Ultrasound intra-operative cautery • Casualty management coordination system	• Hemostatic dressing with microbicidal agent • Pelvic clamp for hemostasis	• Portable injectable water system: man-carried system • High intensity focused ultrasound technology for hemorrhage location and hemostasis • Hand-held portable ultrasound diagnostic imager evaluation in trauma • Novel analgesics to reduce pain
Continue	• Novel oxygen carrying blood substitutes: pegylated liposome-encapsulated synthetic hemoglobin; freeze-dried red cells • Portable injectable water shipboard system • Novel resuscitation fluids: gas diffusion enhancer • Freeze-dried platelets • Hollow-fiber frozen red cell glycerolization/deglyceroli-zation system (demo) • FDA-approval algal polymer	• Novel resuscitation fluids: ketone additive • Low volume resuscitation fluids: comparison of all FDA-approved hypertonic crystalloids in hemorrhage • Low volume resuscitation fluids: evaluation of new FDA-approved low-volume colloid fluid • Intranasal ketamine for pain control • Ultrasound intra-operative cautery	• Novel resuscitation fluids: ketone additive • Low volume resuscitation fluids: comparison of all FDA-approved hypertonic crystalloids in hemorrhage • Low volume resuscitation fluids: evaluation of new FDA-approved low-volume colloid fluid • Intranasal ketamine for pain control • Casualty management coordination system • Novel oxygen carrying blood

	hemostatic field dressing	• Casualty management coordination system • Novel oxygen carrying blood hsubstitutes: pegylated liposome-encapsulated synthetic hemoglobin; freeze-dried red cells • Portable injectable water shipboard system • Novel resuscitation fluids: gas diffusion • Hollow-fiber frozen red cell glycerolization/deglyceroli-zation system enhancement	substitutes: pegylated liposome-encapsulated synthetic hemoglobin; freeze-dried red cells • Hemostatic dressing with microbicidal agent • Pelvic clamp for hemostasis • Low-volume resuscitation fluids: gas diffusion enhancer
Complete	• Extended shelf-life liquid red cells • FDA approval for algal polymer hemostatic field dressing • Hand-held portable ultrasound diagnostic imager (transition)	• Freeze-dried platelets (move to Army funding) • FDA-approved algal polymer hemostatic field dressing (transition)	• Ultrasound intra-operative cautery – demonstration • Portable injectable water shipboard system – transition • Hollow-fiber frozen red cell glycerolization/deglyceroli-zation system (transition)

Casualty Prevention	**FY00**	**FY01**	**FY02-$7,955**
Initiate	• Assess pharmacological interventions for decompression sickness/oxygen toxicity	• Body armor biodynamics • Evaluate laser technology and laser injury impact on operational performance • Assess Gz-tolerance in repeated high/Gz conditions • Investigate impact of thermal stress on operational performance • Enhanced maintenance of spatial	• Agile laser eye protection • Helicopter Aircrew Integrated Life Support systems • Advanced multi-purpose diving system • Salivary tests for disease diagnosis • Advanced personal environmental control system

		orientation • Smart uniform with embedded physiological sensors	
Continue	• Laser event recorder • Guidelines for low frequency acoustic effects on human divers • Develop criteria to evaluate new-technology-sensor-based devices • Validate new methods for neurotoxicant testing • Validate radiofrequency (RF) induced current model in shipboard environment	• Laser event recorder	• Body armor biodynamics • Evaluate laser technology and laser injury impact on operational performance • Assess Gz-tolerance in repeated high/Gz cxonditions • Investigate impact of thermal stress on operational performance • Enhanced maintenance of spatial orientation • Smart uniform with embedded physiological sensors
Complete	• Model for early stages of smoke inhalation injury	• Assess pharmacological interventions for decompression sickness/oxygen toxicity • Guidelines for low frequency acoustic effects on human divers (transition) • Develop criteria to evaluate new-technology-sensor-based devices • Validate new methods for neurotoxicant testing • Validate RF induced current model in shipboard environment	• Laser event recorder (demonstration)

Healthy and Fit Force	**FY00**	**FY01**	**FY02-$531**
Initiate	• Investigate the application of acoustic technology for	• Assessment and prevention of noise-induced hearing loss	• Anthropometry for human factors in cockpit design

	hearing protection • Assess vibration characteristics and resonance frequencies in waterborne low frequency sound	using antioxidants	• Injury prevention/fitness optimization
Continue	• Tuned materials for hearing protection • Occupational fitness for injury reduction	• Assess vibration characteristics and resonance frequencies in waterborne low frequency sound • Tuned materials for hearing protection • Occupational fitness for injury reduction	• Assessment and prevention of noise-induced hearing loss using antioxidants • Occupational fitness for injury reduction
Complete	• Evaluate neck and back strain in E2C aviators • Develop standards for use of photorefractive keratectomy (PRK) procedures on aviators	• Investigate the application of acoustic technology for hearing protection	• Tuned materials for hearing protection (demonstration)

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Appropriated Value			
Adjustments from FY 2001 President's Budget			
PE Restructure			17,700
NWCF Rate Adjustment			-3
Non-Pay Inflation			+3
Minor Adjustments			-22
FY 2002 President's Budget Submission	**	**	17,678

**The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 and 2001 was funded in PEs 0603706N and 0603707N.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603729N PROGRAM ELEMENT TITLE: Warfighter Protection Advanced Technology

PROJECT NUMBER: R2914 PROJECT TITLE: Warfighter Protection Advanced Technology

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY:

(U) NAVY RELATED RDT&E:
- (U) PE 0602235N Common Picture Applied Research
- (U) PE 0602236N Warfighter Sustainment Applied Research
- (U) PE 0603236N Warfighter Sustainment Advanced Technology
- (U) PE 0604771N Medical Development

(U) NON-NAVY RELATED RDT&E:
- (U) PE 0602716A Human Factors Engineering Technology
- (U) PE 0602785A Manpower, Personnel and Training Technology
- (U) PE 0602787A Medical Technology
- (U) PE 0603002A Medical Advanced Technology
- (U) PE 0602202F Human Effectiveness Applied Research
- (U) PE 0603231F Crew Systems and Personnel Protection Technology

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE
ADVANCED TECHNOLOGY

-(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
X1933 Air Anti-submarine Warfare	10,625	11,619	0
R2142 Undersea Warfare Concepts	32,114	35,197	0
R2267 USW Weapons Advanced Technology	11,865	10,945	0
R2485 Terfenol-D	1,931	0	0
R2844 Magnetrestrictive Transduction	0	2,477	0
R2845 Prototype Multi-Function Radar	0	2,972	0
R2846 Low Frequency Broadband Acoustic Airgun Source	0	2,972	0
R2916/Undersea Warfare Advanced Technology	**	**	56,303
TOTAL	56,535	66,182	56,303

** The Science & Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2002 was funded in PEs 0603238N and 0603747N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) JUSTIFICATION FOR BUDGET ACTIVITY: All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this Program Element (PE). In countering the proliferation of quiet diesel submarines to third world countries and Russia’s continued heavy investment in submarine technology, work within this PE provides an enabling capability for power projection and force sustainability. This approach protects the country’s capital investment in surveillance, submarine, surface ship and air Anti-Submarine Warfare (ASW) assets both by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in three to five years. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previously developed in 6.1 and

6.2, or developed and suggested by industry, academia, or military research laboratories/agencies. These technology options include advanced research in the following areas:

- Improving reliable undersea target detection and tracking to enable on-command application of precision offensive military force. Programs include undersea sensors and arrays to provide robust shallow water (SW) surveillance and reconnaissance, and to detect undersea threats to the surface battleforce.
- Dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs include advanced sensors and arrays for both improved ASW surveillance and enhanced battleforce self-defense, ASW data fusion for better tactical control, and low frequency active sonar and rapidly deployable surveillance systems for covert/non-covert indication and warning.
- Improving reliable undersea target detection and tracking, thus enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of the Littoral ASW (LASW) Future Naval Capability (FNC).
- Improving undersea weapons effectiveness while reducing overall costs through improvements to current systems as well as the development of new weapons concepts. The goal of Undersea Weaponry is to produce cost effective, quick reaction intelligent weapons incorporating broadband processing with battlegroup connectivity, intelligent countermeasures, hard kill torpedo defense, improved littoral operation, and weapon flexibility. Several S&T challenges must be addressed including cluttered operating environments, multipath acoustic propagation, low/no doppler targets, detonation physics, high density power sources, and fusing/safety/arming mechanics. The technology developed under this project will be transitioned to the acquisition community for incorporation into existing platforms. For a complete picture of these efforts, see also PE 0602747N. These efforts support the LASW (ASW), Autonomous Operations, and Platform Protection FNC.

(U) While the program addresses technical issues associated with a broad range of high interest operational areas, the emphasis is on SW environments.

(U) The Navy S&T program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE
ADVANCED TECHNOLOGY

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	59,625	58,296	60,311
Adjustments from FY 2001 President's Budget:			
Execution Adjustment	-1,845		
SBIR/STTR Adjustment	-1,011		
Program Restructure			-3,980
NWCF Adjustments			-102
DOD Pay Inflation			+74
Congressional Plus-Ups		8,500	
Congressional Recission	-234	-614	
FY 2002 PRESIDENT'S Submission	56,535	66,182	56,303

The Science & Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & FY 2002 was funded in PEs 0603238N and 0603747N.

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2916/Undersea Warfare Advanced Technology	**	**	56,303	40,677	40,755	39,560	46,390	50,648	CONT.	CONT.

** Due to the Science and Technology (S & T) Program Element (PE) restructuring in FY 2002, funding levels are unavailable, however, the work described in FY 2000 & FY 2001 was funded in PE 0603747N, projects R2142, R2267, and X1933.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

(U) JUSTIFICATION FOR BUDGET ACTIVITY: All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this project. In countering the proliferation of quiet diesel submarines to third world countries and Russia's continued heavy investment in submarine technology, work within this project provides an enabling capability for power projection and force sustainability. This approach protects the country's capital investment in surveillance, submarine, surface ship and air Anti-Submarine Warfare (ASW) assets both by exploring those high risk/high payoff technologies that promise to provide capabilities of exceptionally high military value in three to five years. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previously developed in 6.1 and 6.2, or developed and suggested by industry, academia, or military research laboratories/agencies. These technology options include advanced research in the following areas:

- Improving reliable undersea target detection and tracking to enable on-command application of precision offensive military force. Programs include undersea sensors and arrays to provide robust shallow water (SW) surveillance and reconnaissance, and to detect undersea threats to the surface battleforce.
- Dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs include advanced sensors and arrays for both improved ASW surveillance and enhanced

- battleforce self-defense, ASW data fusion for better tactical control, and low frequency active sonar and rapidly deployable surveillance systems for covert/non-covert indication and warning.
- Improving reliable undersea target detection and tracking, thus enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of the Littoral ASW (LASW) Future Naval Capability (FNC).
- Improving undersea weapons effectiveness while reducing overall costs through improvements to current systems as well as the development of new weapons concepts. The goal of Undersea Weaponry is to produce cost effective, quick reaction intelligent weapons incorporating broadband processing with battlegroup connectivity, intelligent countermeasures, hard kill torpedo defense, improved littoral operation, and weapon flexibility. Several S&T challenges must be addressed including cluttered operating environments, multipath acoustic propagation, low/no doppler targets, detonation physics, high density power sources, and fusing/safety/arming mechanics. The technology developed under this project will be transitioned to the acquisition community for incorporation into existing platforms. For a complete picture of these efforts, see also PE 0602747N. These efforts support the LASW (ASW), Autonomous Operations, and Platform Protection FNC.

(U) While the program addresses technical issues associated with a broad range of high interest operational areas, the emphasis is on SW environments.

(U) The Navy S&T program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: R2916
PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Wide Area Surveillance	FY00	FY01	FY02—$13,189
Initiate	• Development of a prototype Lead Zirconate Titanate (PZT) slotted cylinder element • Development of a PZT X-Spring Tonpilz broadband source • Development of a lightweight power amplifier as an enabling technology for acoustic sources • Sea testing of non-acoustic systems against shallow targets in littoral waters • Advanced development of a rapidly deployable, shallow water, autonomous distributed system (DADS). Integrate acoustic communication, acoustic and non-acoustic sensors, signal processing, data fusion and control technologies		• Automated active multi-static classification algorithm • Compact Deployable Multistatic Active Receiver (Super-ADAR) • Development of Compact Deployable LFA sources • Advanced development and test of Deployable LFA Multistatic technologies • Conduct at-sea tests of multiple offboard source prototypes

Continue	• Development and demonstration of "A"-size, PZT-driven, slotted cylinder sources for Air Deployed Low Frequency Projector (ADLFP) application • Development of the hybrid Terfenol-D/PZT Tonpilz broadband array segment • Single element development of an improved PZT slotted cylinder shell technology • Ultra-light Array technology development	• Development of lightweight power amplifier technology for acoustic sources • Demonstration of the hybrid Terfenol-D/PZT Tonpilz • Demonstration of improved slotted cylinder shell technology • Design/construction/testing of DADS in preparation for FY03 barrier demonstration • Development and demonstration of High Frequency Broadband Array Technologies	• Construction/testing of the Deployable Shallow Water Deployable System (DADS) in preparation for FY03 barrier demonstration
Complete		• Development and demonstration of a prototype PZT slotted cylinder transducer mini-array to address LLFA requirements • Demonstration of improved slotted cylinder shell technology • Development of "A" size slotted cylinder source elements/array design to support NAVAIR PMA 264 requirements for the ADLFP program • Delivery of a prototype lightweight power amplifier for acoustic sources	

Battlegroup ASW Defense	FY00	FY01	FY02—$31,387
Initiate	• C2 Cavitation autodetector • LWSS signal processing techniques, prototype impulsive sources, and conduct two sea tests • Cable Strum Mitigation • Improved Very Low Frequency (VLF) Type 1 autodetector • Spatial Doppler Reverberation Suppression • SXXX Version 2.0 autodetector • Development/operational demonstration of Environmentally Adaptive SQS-53C (EA-53C) sonar system • Procurement/integration of EA-53C controller/software for surface combatants	• Design and installation of an acoustic array testbed to support future passive sonar system designs • MSR feature detection • Sonar automation study to establish next generation Sonar Automation requirements • Auto-change detection, dwell time compensation for surveillance applications and multi-sensor auto-classification processing features for inclusion in the Interactively Trainable Passive Acoustic Classifier (IPAC) • Advanced development and testing of deployable LFA multistatic technologies. • Design and development of high frequency projector arrays for the Integrated Bow Conformal (IBC) program. • At-sea demonstrations of the EA-53C sonar system using fleet test platforms	• Sonar automation technology development plan
Continue	• Characterization of undersea threat signals and environmental clutter	• Characterization of undersea threat signals and environmental clutter	• Characterization of undersea threat signals and environmental clutter

	• Interactively Trainable Passive Acoustic Classifier (IPAC) • Design analysis of omni-charge (LWSS) source technology. • Single-Ping Hyperbolic Frequency Modulation (Markov Random Field (MRF))Cluster Version 2.0 pre-detection technique • Lightweight Broadband Variable Depth Sonar(LBVDS) system integration and verification; prepare for the initial at-sea engineering shakedown and operational test in FY01 • Analysis of Automatic Radar Periscope Detection and Discrimination (ARPDD) results from FY99 Airborne demonstrations; development of improved discrimination to reduce low sea state false alarms observed in airborne tests	• Cable Strum Mitigation technique • LWSS processing techniques and Impulsive omni-charge source technology development for SH-60R and other air platforms • Single-Ping Hyperbolic Frequency Modulation (Markov Random Field (MRF)) Cluster Version 2.0 pre-detection technique • Improved VLF Type 1 autodetector • Spatial Doppler Reverberation Suppression technique • SXXX Version 2.0 autodetector • Striation autodetector modified for IPAC • C2 cavitation autodetector • Integration and testing of LBVDS subsystems in preparation for the final fleet operational system demonstration in FY02 • At-sea engineering shakedown and structured operational test for LBVDS • Development of EA-53C signal processing and system control software	• Design and installation of an acoustic array testbed to support future passive sonar system designs • LWSS processing techniques, omni-charge technology, development of system concept, and preparation for transition in FY03 • MSR feature detection • Development of on-board, real-time processor and Engineering, Development and Manufacturing (EMD) assessment (Claymore Marine) • At-sea demonstration of LBVDS in an operational scenario • Development and fabricate a prototype of the high frequency transducer and array for the IBC program. • Conduct multiple EA-53C at-sea demonstrations using fleet test platforms
Complete	• Ridge Distance Measurement	• Transition of RDM active classification and Single-Ping	• Transition of Cable Strum Mitigation

	(RDM) classification • Single-Ping Range Rate detection • Single-Ping Cluster 1.0 detection	Range Rate detection techniques to the Advanced Processing Build (APB 01) • Transition of dwell-time compensation feature in IPAC for surveillance applications to APB 02 • ARPDD laboratory demonstration of reduced false alarm rate using data from FY99 airborne test; complete and publish final documentation	• Transition of the Single-Ping Hyperbolic Frequency Modulation Cluster Version 1.0 or the Hyperbolic Frequency Modulation (Markov Random Field)pre-detector to APB, depending on performance results • Transition of improved VLF Type 1 autodetector to APB 02 • Transition of Spatial Doppler Reverberation Suppression technique to APB 03 • Transition of C2 Cavitation Detector • Transition of SXXX Version 2.0 autodetector to APB 03 • Transition of MSR Feature detector to APB 03 • Transition of auto-change detection and multi-sensor auto-classification processing features of IPAC to APB 03 • Transition striation autodetector to APB 03 • Transition Single-ping Cluster to APB 03 • Transition of Improved Feature Space Classification technique • Analysis of system characterization test data and complete tactical testing (Claymore Marine)

Cooperative ASW	**FY00**	**FY01**	**FY02—$1,044**
Initiate	• Advanced Integrated ASW (IASW) data-fusion technologies • FY01 IASW sea-test planning • Active sonar/radar fusion and • Likelihood Ratio Tracking (LRT) for Extended Echo Ranging (EER) • IASW technology transition planning		
Continue	• Tactical ASW data-fusion and data-distribution architecture • Discrete bayesian data-fusion technologies • Littoral Warfare Advanced Development (LWAD) scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for three Littoral Anti-Submarine Warfare (LASW) at-sea experiments	• LWAD scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for three LASW at-sea experiments, one of which will be conducted overseas	• LWAD scientific support, fleet and research vessel coordination, test reconstruction, and environmental compliance support for two LASW Future Naval Capability (FNC)at-sea experiments and one overseas LASW FNC demonstration
Complete	• Data-collection efforts to support IASW data fusion algorithm development • Initial lab demonstration of	• Tactical ASW data-fusion and data-distribution architecture • Discrete bayesian data-fusion	

	IASW LRT EER data-fusion technologies	technologies • FY01 IASW sea-test planning • FY01 at-sea demonstration of IASW data-fusion capabilities • IASW technology transition planning to the Advanced Undersea Warfare Concept (AUSWC) program	

Although LWAD is applicable to all thrust areas, it is reflected in Cooperative ASW only to avoid redundancy of entries.

Neutrali-zation	FY00	FY01	FY02—$10,683
Initiate	• Rechargeable battery/fuel cell/other low-rate, long endurance power source development supporting undersea vehicle propulsion requirements • Dual-mode warhead concept for 6.25” vehicle	• Development of 6.25" diameter Anti-Torpedo Torpedo Tripwire System	• Development of weapon/platform connectivity technologies for integrated ASW capability demonstration
Continue	• Development of high-speed, supercavitating test bed; conduct preliminary wire-riding model tests • Frequency-agile, broadband-processing techniques in complex (countered) littoral engagements • Affordable countermeasure components in MK3 configuration and perform at-	• Rechargeable battery/fuel cell/other low-rate, long endurance power source development supporting undersea vehicle propulsion requirements • Frequency agility/optimum frequency selection using adaptive cancellation and low resolution imaging against countermeasures • Establish payoff in torpedo	• Development of broadband processing and intelligent control technologies for MK48 advanced capabilities (ADCAP) including integration with submarine HF sensors and surface ship active sensors • Development of broadband processing and intelligent control technologies for MK48 ADCAP including integration with

	sea testing	effectiveness of the baseline and Prototype Intelligent Controllers	submarine HF sensors
Complete	• Tactical control behavior design and coding representing full Anti-Submarine functionality	• Integrate affordable countermeasure components in MK4 configuration and perform at-sea testing • Dual-mode warhead concept for 6.25″ vehicle	

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy’s 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) (U) RELATED RDT&E:

- (U) PE 0204311N (Integrated Undersea Surveillance System)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602747N (Undersea Warfare Surveillance Research)
- (U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
- (U) PE 0602435N (Ocean Warfighting Environment Applied Research)
- (U) PE 0603254N (ASW Systems Development)
- (U) PE 0603506N (Surface Ship Torpedo Defense)
- (U) PE 0603553N (Surface ASW)
- (U) PE 0604221N (P-3 Modernization Program)
- (U) PE 0604261N (Acoustic Search Sensors (ENG))
- (U) PE 0604784N (Distributed Surveillance Systems)
- (U) PE 0604503N (SSN-688 and Trident Modernization)

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY
PROJECT NUMBER: R2916
PROJECT TITLE: UNDERSEA WARFARE ADVANCED TECHNOLOGY

(U) NON-NAVY RELATED RDT&E:

- (U) PE 0602173C (Support Technologies Applied Research)
- (U) PE 0602702E (Tactical Technology)
- (U) PE 0603739E (Advanced Electronics Technologies)
- (U) PE 0603763E (Marine Technology)

(U) SCHEDULE PROFILE: Not applicable

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603758N
PROGRAM ELEMENT TITLE: Naval Warfighting Experiments and Demonstrations
(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2918 Naval Warfighting Experiments and Demonstration	**	**	43,277

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603792N and 0603238N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The mission of this program is to mature select technologies to facilitate advanced operational experimentation. The coevolution of concepts and technologies requires that potentially revolutionary developments be investigated in Naval service operational experimentation: Fleet Battle Experiments (FBE), Advanced Warfighting Experiments (AWE) and Limited Objective Experiments (LOEs). Concept driven operational experimentation is constrained because the technology employed is either from currently deployed/available systems, or those about to complete the acquisition process. This program in collaboration with the concept development activities for the Navy and Marine Corps, identifies high leverage and potentially revolutionary technology/concept pairings and focuses developmental efforts on preparation of Operational Experiment Articles (OEA). The OEAs (fieldable technology prototypes) tailored for operational experimentation will provide the ability to operate/experiment with technologies and concepts that would otherwise be too advanced or high risk to be employed in the operational environment. Initial efforts will mature technologies in unmanned vehicles, High Speed Vessels, “Expeditionary Grid” elements, small low cost sensors, rapid target geo-location, combat Identification, advanced countermeasures and knowledge management systems, tailored for littoral environments and expeditionary operations. These technologies are key enablers for evolving Network Centric access concepts for Naval first on scene operations in conflict and operations-other-than-war. Through maturation of key enabling technologies, the program will provide surrogate capabilities, which would be otherwise unavailable, and allow leading edge operational experimentation. The iterative technology/concept collaboration will enable innovation and dramatically shorten the time to understand and capitalize on the ramifications of new technologies.

(U) This program also completes the following Advanced Technology Demonstrations (ATD): Reactive Material Advanced Warhead, Multi-Element Buoyant Cable Antenna, Multi-Platform Broadband Processing, and Forward Air Support Marine (FASM). ATD programs are selected for a match between technological potential and Navy requirements, which are derived from operational issues of concern to the fleet. Risk-reducing ATDs cover integrating and assessing technology in a realistic operational environment and are focused on laying the technical foundations for acquiring improvements to future joint warfighting capabilities. Each demonstration is designed to assess the extent to which the technology is feasible, affordable, and compatible with operational concepts and projected force structure.

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

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603758N
PROGRAM ELEMENT TITLE: Naval Warfighting Experiments and Demonstrations
PROJECT NUMBER: R2918:
PROJECT TITLE: Naval Warfighting Experiments and Demonstration

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design, development, simulation, and experimental testing or prototype hardware. It is also necessary to validate technological feasibility and concept of operations to reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

	FY00	FY01	FY02 $43,277
Initiate	• REACTIVE MATERIAL ADVANCED WARHEAD Advanced Technology Demonstration (ATD) – Objective is to utilize energetic fragments to enhance warhead effectiveness against missiles, aircraft and radar sites. • MULTI-ELEMENT BUOYANT CABLE ANTENNA (MBCA) ATD - Objective is to develop and demonstrate an advanced Buoyant Cable Antenna (BCA) System to provide a submerged submarine with two-way, high-data rate Ultra High Frequency (UHF) fleet satellite communications, line-of-site (LOS) L-band, K-band communications as well as accessory sensor functions such as Global Positioning System, Video, and Radar Warning. • MULTI-PLATFORM BROADBAND PROCESSING ATD – Objective is to develop and demonstrate		• Selection and maturation of technology for Operational Experiment Articles in the areas of: Unmanned Vehicles, High Speed Vessels, “Expeditionary Grid”, Small Low Cost Sensors, Rapid Target Geo-location, Combat Identification Advanced Countermeasures Knowledge Management These technologies are key enablers for operational experimentation to explore emergent Network Centric concepts.

	common, broadband acoustic signal processing algorithms for submarine, surface ship, and weapons sonar systems. • FORWARD AIR SUPPORT MARINE (FASM) Maritime Defense Demonstration (MDD) – Objective is to demonstrate a gun launched observation vehicle with a 3 hour/240 nmi flight endurance and capabilities for surveillance, battle damage assessment, targeting and ordnance dispensing.		
Continue		• REACTIVE MATERIAL ADVANCED WARHEAD ATD – Complete reactive fragment design and develop warhead design concept. • MBCA ATD - Complete demonstration system design and initiate antenna fabrication. • MULTI-PLATFORM BROADBAND PROCESSING ATD – Collect bistatic data for coordinated attack development. Conduct closed loop demonstration of simultaneous signal processing for torpedoes. Collect Low Band Variable Depth Sonar (LBVDS) sonar system in-water data. FASM MDD – Conduct first vehicle flight tests and	

		harden components for subsequent gun launch testing.	
Complete			• REACTIVE MATERIAL ADVANCED WARHEAD ATD – Conduct arena test demonstration of Reactive Warhead against representative target sets. • MBCA ATD – Conduct simulated submarine (surface ship) and actual submarine demonstration of antenna communication capabilities. • MULTI-PLATFORM BROADBAND PROCESSING ATD – Complete series of coordinated submarine and torpedo attack demonstrations utilizing common broadband acoustic signal processing. Demonstrate fully coherent broadband processing for all platforms (ships, torpedoes and submarines). • FASM MDD – Conduct gun launch and flight demonstration.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603758N
PROGRAM ELEMENT TITLE: Naval Warfighting Experiments and Demonstrations
PROJECT NUMBER: R2918:
PROJECT TITLE: Naval Warfighting Experiments and Demonstration

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
PE Restructure			43,247
NWCF Rate Adjustments			-20
Non-Pay Inflation			+62
NMCI Reduction	0	0	-12
FY 2002 Budget Submission	**	**	43,277

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603792N and 0603238N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.
(U) Schedule: Not Applicable.

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:

- (U) 0601152N In-house Lab Independent Research
- (U) 0601153N Defense Research Sciences
- (U) 0602114N Power Projection Applied Research
- (U) 0602123N Force Protection Applied Research
- (U) 0602131M MC Landing Forces Tech
- (U) 0602235N Common Picture Applied Research
- (U) 0602236N Warfighter Sustainment Applied Research
- (U) 0602271N RF Systems Applied Research
- (U) 0602435N Ocean Warfighting Environment Applied Research
- (U) 0602747N Undersea Warfare Applied Research
- (U) 0602782N Mine & Expeditionary Warfare Applied Research
- (U) 0603114N Power Projection Advanced Technology

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: May 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603758N
PROGRAM ELEMENT TITLE: Naval Warfighting Experiments and Demonstrations

PROJECT NUMBER: R2918:
PROJECT TITLE: Naval Warfighting Experiments and Demonstration

- (U) 0603123N Force Protection Advanced Technology
- (U) 0603235N Common Picture Advanced Technology
- (U) 0603236N Warfighter Sustainment Advanced Technology
- (U) 0603271N RF Systems Advanced Technology
- (U) 0603640M Marine Corps Advanced Technology
- (U) 0603729N Warfighter Protection Advanced Technology
- (U) 0603747N Undersea Warfare Advanced Technology
- (U) 0603757N Joint Warfare Program
- (U) 0603782N Mine & Expeditionary Warfare Advanced Technology

(U) NON NAVY RELATED RDT& E.
(U) 0603727D Joint Warfighting
- (U) 0603750D Advanced Concept Technology Demonstration

(U) SCHEDULE PROFILE: Not applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE
R2917 Mine and Expeditionary Warfare Advanced Technology	**	**	48,279
R2226 Shallow Water MCM Demos	48,294	45,200	0
R2720 Ocean Modeling Mine/Su	8,783	2,972	0
TOTAL	57,077	48,172	48,279

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603782N, 0603792N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Navy program element (PE) demonstrates technologies for naval Mine Countermeasures (MCM), U.S. Naval sea mines, Naval Special Warfare, and Department of Defense (DOD) Explosive Ordnance Disposal (EOD). It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capabilities through the demonstration of technologies to achieve military objectives (Power Projection from the Sea) with minimal casualties and collateral damage. The PE supports the Joint Littoral Warfare Mission Area by demonstrating technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. The MCM component concentrates on the development and demonstration of technologies for organic mine countermeasures and Future Naval Capabilities supporting Ship to Objective Maneuver. These include technologies for clandestine minefield surveillance and reconnaissance, organic self-protection, organic minehunting, neutralization/breaching and clearance. The sea mining component emphasizes offensive sea mining capabilities. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previously developed in 6.1 and 6.2 or developed and suggested by industry/academia.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U)MCM Technology: Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. “Desert Storm” demonstrated the U.S. Navy’s needs to counter the projected third world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water through the beach.

(U) This research directly supports the Department of Defense Joint Warfighting Science and Technology Plan and the Defense Technology Area Plans.

(U) The Navy Science and Technology program includes projects that focus on or have attributes that enhance the affordability of warfighting systems.

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

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED TECHNOLOGY DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing of prototype hardware to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAM CHANGE FOR TOTAL PE:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget	57,393	45,618	48,300
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
SBIR/STTR Transfer	-739		
Execution Adjustment	+653		
Congressional Plus-up		+3,000	
Federal Technology Transfer	-5		
Congressional Recission	-225	-446	
Non-Pay Inflation			+44

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

NWCF Rates			-6
Program Adjustment			-59
FY 2002 PRESBUDG Submission	57,077	48,172	48,279

The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work described in FY 2000 & 2001 was funded in PE(s) 0603782N, 0603792N.

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
PROJECT NUMBER/PROJECT TITLE										
R2917	**	**	48,279	44,679	43,929	43,498	44,366	43,091	CONT.	CONT.

** Due to the Science and Technology Program Element restructuring in FY 2002, funding levels are unavailable, however, the work described in FY 2000 & 2001 was funded in PE(s) 0603782N (R2226), 0603792N (R2721).

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and demonstrates prototype Mine Warfare (MIW) system components that support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore. Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. “Desert Storm” demonstrated the U.S. Navy’s needs to counter the projected third world mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water through the beach. This project supports the advanced development and integration of sensors, processing, warheads and delivery vehicles to demonstrate improved MIW capabilities. The Thrust Areas in this project are: (1) Surveillance and Reconnaissance; (2) Breaching and Neutralization; and 3) Sea Mining. The Mine Countermeasures (MCM) Thrust Areas support the Organic MCM Future Naval Capability.

(U) The Surveillance and Reconnaissance Thrust Area focuses on developing and demonstrating technologies to detect, classify, and identify mines and obstacles through out the Littoral Penetration Area. Efforts within this thrust includes: remote sensing techniques to survey threat mining activities and mine/obstacle field locations; advanced acoustic/non-acoustic sensors and processing technologies for rapid minefield reconnaissance and determination of the location of individual mines and obstacles. A major current focus is the development of technologies that provide rapid, surveillance and reconnaissance, specifically in the very shallow water, surf zone, beach zones, craft landing zones, and beach exit zones (VSW,SZ,BZ,CLZ,BEZ), that enable Ship to Objective Maneuver.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U) The Breaching and Neutralization Thrust Area focuses on developing and demonstrating technologies for stand-off breaching of mines and obstacles in the SZ/BZ/CLZ/BEZ and precision neutralization of individual mines. Efforts within this thrust includes: influence sweeping technologies for influence minefield clearance, explosive and non-explosive technologies for mine/obstacle field breaching, and advanced technologies to rapidly neutralize shallow water (SW) sea mines. A major current focus is the development of technologies that provide rapid detection and stand-off breaching of mines and obstacles, specifically in the VSW/SZ/BZ/CLZ/BEZ) that enable Ship to Objective Maneuver.

FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology PROJECT NUMBER: R2917 PROJECT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U)The Sea Mining thrust area focuses on developing and demonstrating technologies for a wide area sea mine. The requirements for improved sea mine technologies has changed due to the reduced threat of the traditional submarines and surface ships. The elevated threats today are the third world submarines and surface ships, which may be encountered in the littoral waters of regional conflicts. Despite the diminished sophisticated threat, it is imperative that the US Navy maintains a broad-based and robust sea mining capability to replace aging in-service mines. Emphasis is placed on potentially high payoff advanced sensors for target detection and discrimination and on low cost, wide area sea mine system concepts, including positive command/control mechanisms and expanded weapon effectiveness.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Surveillance/ Reconnaissance	**FY00**	**FY01**	**FY02 ($29,279)**
Initiate	**Vectored Thrust Ducted Propeller (VTDP) Compound Helicopter** • Initiated Advanced Technology Demonstration to enhance helicopter performance and safety/survivability • Initiated critical path hardware acquisition and fabrication	**Advanced Airborne Mine Detection** • Development of advanced electro-optic technologies for detection of minefields from a maritime Unmanned Airborne Vehicle (UAV)	**Data Fusion** • Multi-platform, multi-sensor data fusion • Common Tactical Picture to support maneuver planning

Continue	**Advanced Surveillance** • Continued algorithm refinement of critical environmental parameters; Transitioned critical battle space products to the naval oceanographic office **Modeling and Simulation** • Continued concept based assessment of technologies for Organic Mine Countermeasures **Very Shallow Water (VSW)/Explosive Ordnance Disposal (EOD) Reconnaissance** • Continued development of Unmanned Underwater Vehicle (UUV) based optimized search strategies for VSW reconnaissance • Continued development of sensing technologies and capability to conjunctively employ sensed information	**VTDP Compound Helicopter** • Design flight control system based on piloted simulation. Design H-60 airframe structural modifications. **Advanced Surveillance** • Transition of critical battle space products to the naval oceanographic office **Modeling and Simulation** • Concept based assessment of technologies for Organic Mine Countermeasures **VSW/EOD Reconnaissance** • Development of Unmanned Underwater Vehicle (UUV) based optimized search strategies for VSW reconnaissance • Development of sensing technologies and capability to conjunctively employ sensed information • Demonstrate and evaluate capability to communicate target information to a control authority • Demonstrate asset redirection • Demonstrate integrated search, marking, and report back in	**Modeling and Simulation** • Concept based assessment of technologies for Organic Mine Countermeasures **Advanced Airborne Mine Detection** • Development of advanced electro-optic technologies for detection of minefields from a maritime UAV **VSW/EOD Reconnaissance** • Development of UUV based optimized search strategies for VSW reconnaissance **Advanced Surveillance** • Optimize processing and data reduction tools for wide area detection of mined areas and obstacle belts

		test-bed minefields in VSW environments	
Complete	**Joint Countermine ACTD** • Completed Joint Countermine Advanced Concept Technology Demonstration (JCM ACTD) logistics support for select "residual" technologies **MINE IDENTIFICATION** • Integrated component STIL technologies in airborne minehunting sonar (AQS-20) towbody • Quantified performance as function of operational parameters • Transitioned Streak Tube Imaging Lidar (STIL) technology to PE0604373N (Airborne Mine Countermeasures) for AQS-	**Advanced Surveillance** • Algorithm development efforts on critical environmental information for amphibious operations **Expeditionary Warfare Communications Networking** • Evaluation/assessment of high capacity communications links between mine countermeasures ships at sea **MINE IDENTIFICATION** • Analysis of helicopter towed STIL mine identification technology	**VTDP Compound Helicopter** • Flight control system design • Modifications to H-60 helicopter

	20/X **Advanced Airborne Target Designator** • Completed field tests and documentation of results, quantifying localization errors **Expeditionary Warfare Communications Networking** • Demonstrated, during Fleet Battle Experiment-H, advanced high capacity communications link between mine countermeasures ships at sea **VSW/EOD Reconnaissance** • Demonstrated coordinated navigation and positioning in VSW through deployment of a search vehicle and inspection vehicle during Fleet Battle Experiment-H.		

Breaching/ Neutralization	**FY00**	**FY01**	**FY02 ($19,000)**

Initiate	• Development of reactive dart dispensing concepts • Development of chemical penetrator for neutralization of mines • Development of continuous rod warhead for obstacle reduction • Analysis of existing/planned fleet air/gun launched delivery systems for stand-off mine/obstacle breaching	• Development of chemical dart dispensing concepts	• Stand-off obstacle breaching • Autonomous influence minesweeping for assault breaching • Integration of high velocity, reactive dart warhead payload and delivery platform for system level demonstration
Continue	• Continued development and lethality testing of high velocity, reactive darts for neutralization of beach and surf zone mines.	• Development of reactive dart dispensing concepts • Development of chemical penetrator for neutralization of mines • Development of continuous rod warhead for obstacle reduction	• Development of chemical penetrator for neutralization of mines • Development of continuous rod warhead for obstacle reduction
Complete	• Demonstrated lethality of reactive dart against surrogate beach zone mines • Developed inverse guidance law concept using Global Positioning Systems position and velocity state data only	• Demonstration of lethality of reactive dart against representative surf zone mines • Demonstration of reactive dart dispensing • Demonstration of reactive hydrodynamic stability • Demonstration of chemical dart lethality against	• Demonstrate delivery of reactive darts from air delivered platform • Demonstrate chemical dart lethality against representative surf zone mines

		representative beach zone mines • Analysis of existing/planned fleet air/gun launched delivery systems for mine/obstacle breaching	

(U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes to this effort.

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602131M (Marine Corps Applied Research)
(U) PE 0602747N (Undersea Warfare Applied Research)
(U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
(U) PE 0602435N (Ocean Warfighting Environment Applied Research)
(U) PE 0603502N (Surface and Shallow Water MCM)
(U) PE 0603513N (Shipboard System Component Dev)
(U) PE 0603640M (Marine Corpse Advanced Technology)
(U) PE 0604373N (Airborne Mine Countermeasures)
(U) PE 0604784N (Distributed Surveillance System)

(U) NON-NAVY RELATED RDT&E:
(U) PE 0602712A (Countermine Systems)
(U) PE 0603606A (Landmine WF and Barrier Advanced Technology)

(U) SCHEDULE PROFILE: Not applicable.