(2)

DEPARTMENT OF THE NAVY
FY 1996/FY 1997 BIENNIAL BUDGET ESTIMATES



DTIC
ELECTE
MAY 11 1995
S C D

JUSTIFICATION OF ESTIMATES
BUDGET ACTIVITIES 1-3
FEBRUARY 1995

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

RESEARCH, DEVELOPMENT TEST & EVALUATION, NAVY
DESCRIPTIVE SUMMARIES (U)

19950509 035

DTIC QUALITY INSPECTED 5

PE	PE TITLE	R-1
0601152N	IN-HOUSE INDEPENDENT LABORATORY RESEARCH	1
0601153N	DEFENSE RESEARCH SCIENCES	2
0602111N	SURFACE/AEROSPACE SURVEILLANCE. AND WEAPONS TECHNOLOGY	3
0602121N	SURFACE SHIP TECHNOLOGY	4
0602122N	AIRCRAFT TECHNOLOGY	5
0602131M	MARINE CORPS LANDING FORCE TECHNOLOGY	6
0602232N	C3 TECHNOLOGY	7
0602233N	READINESS, TRAINING & ENVIRONMENTAL QUALITY TECHNOLOGY	8
0602234N	MATERIALS, ELECTRONICS & COMPUTER TECHNOLOGY	9
0602270N	ELECTRONIC WARFARE TECHNOLOGY	10
0602314N	UNDERSEA SURVEILLANCE & WEAPONS TECHNOLOGY	11
0602315N	MINE COUNTERMEASURES MINING & SPECIAL WARFARE TECHNOLOGY	12
0602435N	OCEANOGRAPHIC & ATMOSPHERIC TECHNOLOGY	13
0602633N	UNDERSEA WARFARE WEAPONRY TECHNOLOGY	14
0603217N	AIR SYSTEMS & WEAPONS ADVANCED TECHNOLOGY	15
0603238N	GLOBAL SURVEILLANCE PRECISION STRIKE/AIR DEFENSE TECHNOLOGY DEMONSTRATION	16
0603270N	ADVANCED ELECTRONIC WARFARE TECHNOLOGY	17
0603508N	SHIP PROPULSION SYSTEM	18
0603640M	MARINE CORPS ADVANCED TECHNOLOGY DEMONSTRATION	19
0603706N	MEDICAL DEVELOPMENT (ADVANCED)	20
0603707N	MANPOWER, PERSONNEL & TRAINING ADVANCED TECHNOLOGY DEMONSTRATION	21
0603712N	ENVIRONMENTAL QUALITY & LOGISTICS ADVANCED TECHNOLOGY	22
0603747N	UNDERSEA WARFARE ADVANCED TECHNOLOGY	23
0603771N	INDUSTRIAL PREPAREDNESS MAN TECH PROGRAM	24
0603782N	SHALLOW WATER MINE COUNTERMEASURES DEMONSTRATIONS	25
0603792N	ADVANCED TECHNOLOGY TRANSITION	26
0603794N	C3 ADVANCED TECHNOLOGY	27

Accesion For
NTIS CRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By per A2798775
Distribution /
Availability Codes
Dist | Avail and / or Special
A-1

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
ONR THRUSTS:										
Ocean Sciences	1,029	588	571	587	602	620	639	658	CONT.	CONT.
Advanced Materials	1,816	1,906	1,850	1,900	1,952	2,010	2,070	2,132	CONT.	CONT.
Information Sciences	1,104	1,178	1,143	1,174	1,206	1,242	1,279	1,317	CONT.	CONT.
Sustained Programs	12,849	13,416	12,520	13,491	13,876	14,250	14,638	15,040	CONT.	CONT.
TOTAL	16,798	17,088	16,084	17,152	17,636	18,122	18,626	19,147	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports the missions of the Naval Warfare Centers with high-risk/high-payoff research, responding as shown below to the Department of the Navy (DON) Joint Mission Areas/Support Areas (JMA/SA) and enabling the technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. The research addresses fundamental questions regarding existing and anticipated naval systems, and is supported within the Office of Naval Research (ONR) thrusts in Ocean Sciences, Advanced Materials, Information Sciences, and its Sustaining Program. This program reflects the integration of efforts both within Warfare Centers and among other research performers. Research efforts are proposed by the Warfare Centers, approved by ONR, and reviewed for the quality of science produced and for relevance to the naval mission.

(U) This program responds to the Joint Littoral JMA through ocean sciences research into the variability of the marine environment, such as acoustic shallow water (SW) models that incorporate wave-breaking sources, allowing superior signal processing in sw environments. Research advancing fundamental understanding of DON-essential materials and processes responds to operational capability requirements in the Maritime Support of Land Forces JMA, such as the recent development of an aluminum based, metal-matrix, high-temperature superconducting material that can be extruded into wires for significantly improved naval

UU4

electrical power systems. The program responds to the Joint Surveillance JMA through thrusts in information sciences that address naval-relevant computing applications including software engineering, high performance computing, artificial intelligence, and the use of computers in manufacturing. For example, the development of an advanced signal processing technique for the analysis of real Anti-Submarine Warfare (ASW) broadband acoustic data provides detection performance which exceeds the conventional energy detector in high noise ASW applications. Research in other areas supports requirements of the Readiness JMA, such as discovering redox chemicals for use in "smart" coatings which alter color when degraded and serve as early warning systems for corrosion of naval systems.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under BASIC RESEARCH because it encompasses scientific study and experimentation directed towards increasing knowledge and understanding in broad fields directly related to long-term Department of the Navy (DON) needs.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($1,029) Ocean Sciences responded to the Joint Littoral JMA by investigating a three-dimensional beam propagation model for the calculation of acoustic fields in SW, where the variation of bottom depth in range and bearing has a significant effect. There was reasonable agreement with exact solutions for a negative gradient SW channel and two difficult wedge cases.

- (U) ($1,816) Advanced Materials responded to the Joint Strike JMA by developing a theoretical model for shape memory alloys. The model differentiates between stress and temperature induced transformation strains, and accounts for phase change hardening. It has been incorporated into a composite material model which is being used to develop a shape memory metal matrix composite.

- (U) ($1,104) Information Sciences responded to the Joint Surveillance JMA through investigation of Adaptive Wavelet Transforms by means of Neural Networks in order to achieve ASW and Automated Target Recognition data processing capability. An adaptive theory of wavelet transforms was developed that can determine an appropriate mother wavelet according to a certain neural network performance measure.

- (U) ($12,849) Sustaining Programs responded to the Joint Surveillance and Joint Littoral JMAs by studying the direct and inverse scattering processes present in classical physics applications. The focus was toward finding novel or improved methods to theoretically predict and numerically compute wave fields scattered by bare or coated objects in the paths of incident waves, and to extract physical information about the targets that various types of sensors sense, from the echoes these objects return. The analysis of the transient interaction of acoustic and electromagnetic pulses of various types with elastic and dielectric structures has been completed and documented. A quasi-macroscopic Spectroscopy discipline has emerged. Sustaining Programs also responded to the Joint Surveillance JMA by analyzing nonlinear dynamics and fractals with a view toward control of nonlinear systems, and by studying parameters of ship signatures for reduced signature design.

2. (U) FY 1995 PLAN:

- (U) ($588) Ocean Sciences will respond to the Joint Littoral JMA by examining SW effects on high frequency sonar systems.

- (U) ($1,906) Advanced Materials will respond to the Maritime Support of Land Forces JMA by investigating grain size and particle concentration in metals to gain understanding of the microstructural influences on flow and fracture, leading to improved models for predicting material response to impact and explosive attack; and by continuing work in property enhancement for advanced structural composites to improve damage tolerance.

- (U) ($1,178) Information Sciences will respond to the Joint Surveillance JMA by investigating neural network wavelet processing for ASW, and developing nanotechnology for molecular computing resulting in electronic devices with greater computational power.

- (U) ($13,416) Sustaining Programs responds to the Joint Surveillance JMA through work to create thermally stable, active optical wave-guiding materials such as nonlinear optical polymers for use in the development of high-speed optical switches and modulators to be used in future communications and avionics signal processing devices; and through the development of scattering theory for detection and classification of submerged objects such as mines.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

3. (U) FY 1996 PLAN:

- (U) ($571) Ocean Sciences will respond to the Maritime Support of Land Forces JMA by studying remote sensing of water mass structures and currents, including surface fluxes and Langmuir circulation, small-scale Ocean-Atmosphere interaction, and current estimation from space, rain, and scattering.

- (U) ($1,850) Advanced Materials will respond to the Joint Littoral JMA by tailoring polymers at the molecular level to achieve reduced submarine acoustic signatures, and will respond to the Joint Strike JMA by enhancing the orientation stability in nonlinear optical polymers.

- (U) ($1,143) Information Sciences will respond to the Joint Strike and Surveillance JMA's by advancing the knowledge and skills of computational statistics as applied to image processing, and will respond to the Joint Littoral JMA by examining new classification techniques for threat neutralization.

- (U) ($12,520) Sustaining Programs will respond to the Joint Strike, Joint Littoral and Maritime Support of Land Forces JMA's by describing the underlying physics of the detonation process which will lead to new and novel warhead designs with desired degree of lethality, and will respond to the Readiness, Support and Infrastructure JMA by investigating biomedical preventions and treatments for operational injuries due to decompression and oxygen toxicity, heat and cold exposure, spatial disorientation, fatigue, hazardous materials, and radiation.

4. (U) FY 1997 PLAN:

- (U) ($587) Ocean Sciences will respond to the Joint Littoral JMA by investigating very-shallow-water (VSW) physics as it relates to the performance of mine countermeasure sensors.

- (U) ($1,900) Advanced Materials will respond to the Maritime Support of Land Forces and Joint Strike JMA's by investigating shock induced damage and failure mechanisms, at the atomic level, in metals used in warheads and in armor.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

- (U) ($1,174) Information Sciences (signal processing and statistical sciences) will respond to the Readiness JMA by using advanced time-frequency analysis techniques in conditioned based monitoring of shipboard machinery to better diagnose and maintain the surface and submarine fleet and will respond to Joint Strike JMA and the required improved effectiveness through autonomous target recognition\guidance by developing new signal and imaging processing algorithms.

- (U) ($13,491) Sustaining Program will respond to Joint Strike JMA by studying supersonic turbine engine combustion technology and improved energetic materials; will respond to the readiness, support and infrastructure JMA by researching biomedical methods for disease prevention and treatment, wound repair, blood loss, hemorrhagic and septic shock, transplantation,and musculoskeletal injury; and will respond to the Joint Littoral JMA by developing advanced processing technologies for mine countermeasure operations in SW and VSW.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	16,971	17,112	XXX	XXX
(U) FY 1995 Appropriated:	XXX	17,112	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-173	-24	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	16,798	17,088	16,084	17,152

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year execution Undistributed Congressional change. FY 1995 change reduction for travel (-24).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: In-House Laboratory Independent Research

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- PE 0601101A (In-House Laboratory Independent Research)
- PE 0601101F (In-House Laboratory Independent Research)
- PE 0601153N (Defense Research Sciences)
- PE 0602111N (Surface/Aerospace Surveillance & Weapons Technology)
- PE 0602234N (Materials, Electronics & Computer Technology)
- PE 0602314N (Undersea Surveillance & Weapons Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

333

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
ONR THRUSTS:										
OCEAN SCI.	127,632	135,700	135,750	138,465	141,234	146,883	158,634	169,738	CONT.	CONT.
ADV. MATLS.	48,158	54,084	56,247	58,497	60,837	65,704	68,332	71,065	CONT.	CONT.
INFO. SCI.	35,160	38,266	39,797	41,389	43,045	46,489	48,349	50,283	CONT.	CONT.
SUSTAIN. PGM.	184,126	173,485	153,973	163,256	168,533	169,004	178,087	190,013	CONT.	CONT.
TOTAL	395,076	401,535	385,767	401,607	413,649	428,080	453,402	481,099	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program sustains U.S. naval scientific and technological superiority, provides new concepts and technological options for the maintenance of naval power and national security, and provides the means to avoid scientific surprise, while exploiting scientific breakthroughs. The program responds as noted below to the science and technology (S&T) requirements from the Department of the Navy (DON) Joint Mission Areas/Joint Support Areas (JMA/JSA) and enables the technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. It also seeks to exploit new science opportunities relevant to long term naval requirements. The Office of Naval Research (ONR) responds to requirements through major research thrusts in Ocean Sciences, Advanced Materials, Information Sciences, and the Sustaining Program. These efforts are part of an integrated DON S&T process initiated in 1993.

(U) This program responds to the Joint Strike JMA through research leading to better structural materials to increase platform survivability; automated target recognition algorithms to improve identification of friend or foe, and to help improve real-time targeting under camouflage conditions; and physics and chemistry foundations for improved multispectral, all-weather sensors and electronics. Responses to the Joint Littoral JMA, which covers forward operations in high-threat coastal regions, involve knowledge of near-shore ocean and atmospheric circulation and optical transmission to improve mine detection and removal, special operations capabilities and submarine detection; novel structural materials for better ship damage tolerance;

data fusion research to integrate environmental prediction products into Command, Control, Communications, Computers and Intelligence (C4I) systems; and new concepts in batteries and propellants for improved torpedo performance. The program responds to requirements in the Joint Surveillance JMA with research into advanced materials for improved sensors and electronics; and better signal processing for automated target recognition allowing rapid ship self-defense and identifying relocatable targets. Requirements of the Joint Space Electronic Warfare (SEW)/Intelligence JMA are matched by research to extend our knowledge of ocean and atmospheric properties, allowing sensors to operate more effectively under varied weather conditions; and by network and data studies to address real-time, all-weather surveillance and targeting, with short revisit times using multiple high capacity data links. Research into improved aerodynamic shapes for high endurance surveillance responds directly to a requirement of the Strategic Deterrence JMA. Research in response to the Readiness and Support & Infrastructure JSAs includes developing knowledge of acoustic/boundary interactions for improved navigation capabilities in poorly charted areas; exploring longer service life materials for reduced logistics; and investigating chemical and biological processes for clean handling of shipboard waste. Finally, cognitive research leading to more efficient and cost-effective training techniques responds to the Manpower & Personnel and Shore Training JSAs.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is funded under BASIC RESEARCH because it encompasses scientific study and experimentation directed towards increasing knowledge and understanding in broad fields directly related to long-term Department of the Navy (DON) needs.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($127,632) Ocean Sciences responded to Joint Littoral JMA requirements with an extensive field study of atmospheric mesoscale dynamics in coastal regions to improve coastal surveillance; to Joint Strike JMA requirements with improved prediction of operating environments through new models of marine aerosols and arctic storms; and to Joint Surveillance JMA requirements through magnetic characterization of undersea hills to aid in submarine detection.

- (U) ($48,158) Advanced Materials responded to the Joint Surveillance JMA by bringing out new ferroelectric and piezoceramic materials for lightweight, highly-sensitive underwater sensors; and to the Joint Strike JMA with a new insensitive explosive, and with novel organometallic and polymer materials for improved detection systems.

- (U) ($35,160) Information Sciences responded to the Joint Strike JMA by introducing a new algorithm for autonomous navigation, an inverse algorithm for remote sensing of glaciers, and a new matrix-based procedure for reverberation suppression and signal detection for improved sonar system designs; to the Joint Littoral JMA with a new method for elasticity computations that are key to detection of mine-like objects; and to the Manpower & Personnel JSA with a geometric system to construct and manipulate objects in next generation virtual environment simulators.

- (U) ($184,126) Sustaining Programs responded to the Joint Strike JMA by producing a neuromorphic chip for better-designed computers and signal processors, and advanced turbulence and eddy models for improved surface ship design; to the Joint Surveillance JMA with an advanced neural network for classifying radar targets; to the Maritime Support of Land Forces JMA with condition-based maintenance techniques using neural nets to classify faults in helicopter gearboxes and pulsed lasers to monitor oil debris in motor lines; and to the Readiness JSA with microbes to degrease shipboard oil/water separators, simulation codes to predict ship structure vulnerability to fractures and cracks from explosive loading, and environmentally responsible oxetane solvent systems for propellant and explosive binders.

2. (U) FY 1995 PLAN:

- (U) ($135,700) Ocean Sciences will respond to Joint Littoral JMA requirements by investigating coastal environment mixing & optics related to mine detection; convective overturning processes and layer stratification for improved undersea surveillance; and underwater detonics of metallized explosive compositions to optimize underwater target destruction.

- (U) ($54,084) Advanced Materials will respond to the Joint SEW/Intelligence JMA by exploring epitaxial growth optimization in crystals and synthesized materials to improve radiation resistance of electronic materials; advanced biological self-assembling materials for use in electro-optic systems; nanostructure array fabrication for electronics and opto-electronics; and science and modeling of etching processes in plasma reactors; it will support Joint Surveillance requirements through exploring interfaces of high temperature superconductors with metals, insulators and superconductors for improved detection and propulsion systems; processing science and routes to affordable manufacturing of layered materials; and materials and mechanisms of superconductivity for improved radio frequency and computer systems.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

- (U) ($38,266) Information Sciences will respond to the Readiness JSA through developing hybrid learning techniques for humans and artificial systems, and virtual environment displays for spatial disorientation training; and to the Precision Strike JMA by exploring the nonlinear dynamics of noisy, complex neural systems to uncover principles leading to novel sensors, controls, and robotics.

- (U) ($173,485) Sustaining Programs will respond to the Readiness JSA by investigating multi-domain simulation of ocean structures to predict nonlinear behavior affecting their stability and integrity.

3. (U) FY 1996 PLAN:

- (U) ($135,750) Ocean Sciences will respond to Joint Strike JMA requirements by investigating atmospheric modeling and prediction of the battle environment for improved tactical decision making and operational planning, and to Joint Littoral JMA requirements by developing coastal models and sensors leading to improved prediction of hydrodynamic, acoustic, and electro-optical propagation to allow reliable detection of targets in shallow water environments. These and related efforts also respond to the Forward Presence JMA through improved awareness and sustainability.

- (U) ($56,247) Advanced Materials will respond to the Joint Strike and Joint Surveillance JMAs by investigating wide band gap semiconduction materials for ultra-linear, wide band width, low noise, high efficiency amplifiers; new electronic materials for processing information at high speeds and volumes; improved acoustic imaging materials for mine detection in turbulent water; and superconducting materials for superdirective antenna arrays and stable oscillators for radar.

- (U) ($39,797) Information Sciences will respond to Joint Strike JMA requirements by exploring algorithms using nonlinear inverse techniques to detect weak signals amid clutter and jamming, multi-spectral and wideband modulation algorithms to analyze the sensed field, and missile aimpoint selection algorithms to improve performance of multi-spectral seekers; science base for information management and tactical decision.

- (U) ($153,973) Sustaining Programs will respond to the Joint Strike and Joint Surveillance JMAs through exploring biological and machine vision to develop neural models supporting visual processing for real time retargeting and rapid mission planning; biomimetics to develop unique enzymatic sensors for detecting hazardous chemicals; and silicon-based neural networks for automated pattern recognition.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

4. (U) FY 1997 PLAN:

- (U) ($138,465) Ocean Sciences will respond to Joint Littoral and Joint Surveillance JMAs by exploring concepts and techniques for autonomous ocean sampling from unmanned platforms for improved mine detection and countermeasures, and to the Joint Strike JMA by applying a range of advanced techniques to assimilate data into complex environmental models so that actual environmental measurements can be reconciled with models in real time for improved system design, realistic training, doctrine development, and tactical decision making.

- (U) ($58,497) Advanced Materials will respond to Joint Strike JMA requirements by investigating high temperature superconducting materials in magnetic anomaly detectors for enhanced mine countermeasures; advanced metals and ceramic composites for light weight and unmanned underwater vehicles used in sea-land assault; and light weight structural materials for engines and missile frames to improve range and operational capabilities.

- (U) ($41,389) Information Sciences will respond to Joint Strike and Joint Littoral JMAs by exploring a variety of artificial intelligence approaches, including neural networks, knowledge-based systems, and pattern recognition methods, to help automate target identification and decision-making; by applying recent theories to achieve the capability to track many targets over long periods of time; and by refining numerical and computational techniques using massively parallel processing/networked work stations for near real-time electromagnetic prediction for over-the-horizon detection of targets to enhance ship self-defense.

- (U) ($163,256) Sustaining Programs will respond to the Joint Strike and Joint Surveillance JMAs by investigating the principles required for high energy, high efficiency, high repetition rate, very short pulse, miniaturized lasers for rapid, wide area reconnaissance sensors essential for effective mine countermeasures; particle wave applications in high precision gyroscopes for navigation systems; and design of super-quantum well focal plane arrays for simultaneous multi-spectral infrared (IR) detection.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	395,749	407,971	XXX	XXX
(U) FY 1995 Appropriated:	XXX	420,971	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-673	-19,436	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	395,076	401,535	385,767	401,607

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Funding decrease in FY 1994 is due to end-of-year execution updates (-673) to reflect below threshold reprogrammings. Funding decrease in FY 1995 is due to congressional undistributed cuts for University Research (-13,051), Consulting Services (-80), Federally Funded Research and Development Centers (-58), Travel (-563), an assessment for Small Business Innovative Research (-5,684), and a congressional adjustment (+13,000).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 1

PROGRAM ELEMENT: 0601153N
PROGRAM ELEMENT TITLE: Defense Research Sciences

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601102A (Army Defense Research Sciences)
(U) PE 0601102F (Air Force Defense Research Sciences)
(U) PE 0601152N (In House Laboratory Independent Research)
(U) PE 0602111N (Air & Surface Weapons Technology)
(U) PE 0602121N (Surface Ship & Submarine HM&E Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics & Computer Technology)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0603207N (Air/Ocean Tactical Application)
(U) PE 0603785N (Combat Systems Oceanographic Performance Assessment)
Activities are coordinated through Tri-Service 6.1 Reliance Scientific Planning Groups.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Air and Surface Weapons Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Surface/Aerospace Surveillance and Weapons Technology	32,158	36,388	32,658	35,387	37,476	39,635	40,831	41,863	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) has been restructured by transferring the Surface and Aerospace Surveillance Technology portion of this program element with the exception of the FY 1995 Congressional Plus-up to P.E. 0602232N, Information Warfare. The name of the P.E. 0602111N is changed to "Air and Surface Weapons Technology". This restructured P.E. will support future weapons systems for surface and air platforms for Naval Warfare relating to the Joint Mission Area of Joint Strike Warfare and Littoral Warfare. Specifically:

(U) The Joint Strike Mission Area includes technology issues in weapons disciplines relating to real-time targeting and retargeting, surgical lethality, platform survivability, and Battle Damage Assessment. Programs include mission planning, missile and propulsion technology, advanced warheads, and precision targeting.

(U) The Joint Littoral Warfare Mission Area includes technology issues in air and surface battlespace dominance relating to ship self defense, air superiority, Naval Surface Fire Support, and Theater Defense. Programs include low cost missile guidance and control, hypervelocity guns and guided projectiles, airborne and shipboard fire control, missile propulsion, and feasibility investigations of innovative weapon system concepts.

(U) These efforts support the Joint Warfare Strategy "Forward...from the Sea". Programs in this PE are jointly planned in the Reliance process with the Air Force and Army through panels of the Joint Directors of Laboratories (JDL).

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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Air and Surface Weapons Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($9,995) SHIP SELF DEFENSE IN SUPPORT OF SURFACE BATTLESPACE
  - (U) Initiated:
    - (U) Investigation of beam steering, multipath, and glint problems associated with miniature Radio Frequency (RF) seekers for medium caliber gun launched projectiles in support of more lethal point defense systems.
  - (U) Continued:
    - (U) Hydro-code and small scale test lethality evaluation of explosively generated water columns for ship terminal defense with full scale multi-charge tests for generating water barrier to validate FY 1993 hydro-code analysis, and conduct barrier effectiveness test against fragments and missiles.
    - (U) Low cost infrared (IR) tracker development incorporating innovative optical dither scan/signal processing technique to improve target detection in clutter.
    - (U) Design and fabrication of multi-purpose composite launcher tube and package in box configuration for cheaper and more reliable ship defense systems.
  - (U) Completed:
    - (U) High energy laser head-on missile defense test at White Sands and determined the viability of laser anti-ship missile defense systems.

- (U) ($10,316) AIR SUPERIORITY:
  - (U) Initiated:
    - (U) Reactive fragment warhead investigation for more lethal warheads.
  - (U) Continued:
    - (U) Hardware in-the-loop (HWIL) simulations of lock on after launch (LOAL) guidance and control (G&C) components to improve air-to-air combat survivability.
    - (U) Diamond dome development by investigating means to increase strength of chemical vapor deposition (CVD) diamond and develop low cost polishing technique.
    - (U) Guidance-integrated fuse (GIF) efforts jointly with Army and Air Force for improved air-to-air missile lethality.
  - (U) Completed:

-- (U) Scale tests of selected close encounter warheads and established criteria for fullscale smaller, lighter, and cheaper warheads.
-- (U) Situational awareness/fire control investigations and established requirements for future air superiority aircraft.
-- (U) Development of high angle of attack aerodynamic predictive codes and innovative control theory for more highly agile air defense missiles.

- (U) ($11,847) STRIKE AND ANTI-SURFACE WARFARE (ASUW) WEAPONRY:
  - (U) Initiated:
    -- (U) Simulations within Advanced Research Projects Agency (ARPA) WARBREAKER environment of parallel distributed processing techniques for route and mission planning and adaptive mission control technologies.
    -- (U) Solid fuel air explosive (SFAE) warhead feasibility investigations for increased strike warhead lethality.
  - (U) Continued:
    -- (U) Application investigation of parallel distributed processing techniques for timely route and mission planning and adaptive mission control functions in support of improvements to the Tomahawk missile.
    -- (U) Development and airborne testing of real-time multi-sensor correlation algorithms for land attack targeting in support of follow-on development of multi-sensor precision targeting technology demonstration.
  - (U) Completed:
    -- (U) Algorithm and processor development for ships classification in berth and transitioned technology to the Joint Surveillance Target Attack Radar System (JSTARS).
    -- (U) Development of automatic processor and image transition methods for real-time confirmation of relocatable targets in Synthetic Aperture Radar (SAR) imagery for littoral application.

2. (U) FY 1995 PLAN:

- (U) ($10,364) SHIP SELF DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Continue:
    -- (U) Hydro-code and small scale test lethality evaluation of explosively generated water columns for

ship terminal defense with a determination of optimal water barrier timing and spacing requirements.
-- (U) Fabrication of breadboard low cost, light weight, Infrared Focal Plane Array (IRFPA) test-bed tracker for self-defense weapon fire control investigations.
-- (U) Fabrication and test of barrel and chamber sealing mechanism for multi-purpose composite launcher.
-- (U) Miniature RF Guidance Technology Development; demonstration of miniature RF seeker guidance accuracy in multi-path/clutter via HWIL simulation.

- (U) ($10,698) AIR SUPERIORITY:
  - (U) Initiate:
    -- (U) Investigation of coherent fiber bundle scene transformation technique for IR scene generation.
  - (U) Continue:
    -- (U) HWIL demonstration of LOAL guidance components for improvement of air-to-air combat survivability.
    -- (U) HWIL simulations of GIF breadboard hardware for improved air-to-air missile lethality.
  - (U) Complete:
    -- (U) Diamond IR dome efforts with fabrication, polishing and testing of a 2.5 inch diameter, 1mm thick dome with high optical, thermal and strength properties suitable for high speed missile operation.

- (U) ($12,292) STRIKE AND ASUW WEAPONRY:
  - (U) Initiate:
    -- (U) Feasibility investigations for long range gun launched rocket assisted guided projectile that will be compatible with acceleration levels (up to 20,000 g's) and muzzle pressures (up to 10,000 psi) of emerging new Electro-Thermo Chemical (ETC) gun technologies.
  - (U) Continue:
    -- (U) ARPA WARBREAKER environment simulations of parallel processing algorithms for near real-time mission planning and adaptive in-flight mission replanning capabilities for future Navy smart weapons.
    -- (U) Application investigation of parallel distributed processing techniques for timely route and mission planning and adaptive mission control functions in support of improvements to the Tomahawk missile.
    -- (U) SFAE warhead development.
  - (U) Complete:
    -- (U) Airborne testing and evaluation of real-time multi-sensor correlation algorithm for land attack targeting.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Air and Surface Weapons Technology

- (U) ($3,034) SURVEILLANCE: (Congressional Plus-up)
  -- (U) Multi-Spectral Shipboard Surveillance Technology; this increase is intended to significantly increase the scope of the effort to include large scale demonstrations and contractor proposed initiatives over and above the previously planned program which provided only for technology development.

3. (U) FY 1996 PLAN:

- (U) ($9,813) SHIP SELF DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Initiate:
    -- (U) Precision track RF technology; Design and analysis of precision track concepts for targeting.
  - (U) Continue:
    -- (U) Miniature RF Guidance Technology Development; by designing and fabricating a breadboard millimeter wave receiver/antenna and developing processor and precision range resolution algorithms.
    -- (U) Fabrication, test & evaluation of breadboard low cost, lightweight, IRFPA test-bed tracker for self-defense weapon fire control investigation.
  - (U) Complete:
    -- (U) Fabrication and test of barrel and chamber sealing mechanism for multi-purpose composite launcher.
    -- (U) Hydro-code and small scale lethality test and evaluation of explosively generated water columns for water barrier ship self-defense.

- (U) ($8,045) AIR SUPERIORITY:
  - (U) Initiate:
    -- (U) Aerodynamic prediction code techniques including computational fluid dynamic code development and experimental wind tunnel experiments that are needed to predict the aerodynamic performance of non-axisymmetric missile airframe shapes at high angles of attack flight conditions and over a speed regime from transonic up to Mach 3.5.
    -- (U) Conformal aperture active array investigation for guidance integrated fuze application.
    -- (U) Application of structural composites (fiber reinforced, resin-matrix composite materials) for developing lightweight, low cost missile airframe design concepts that will satisfy low-to-high temperature (1000 deg. F), high strength (>300ksi), and high stiffness requirements (for high gs:>60g) of future Air-to-Air tactical missiles.

- (U) Continue:
  - -- (U) HWIL simulations of IR GIF breadboard hardware for improved air-to-air missile lethality.
  - -- (U) Investigation of coherent fiber bundle scene transformation technique for IR scene generation.
- (U) Complete:
  - -- (U) HWIL simulation of LOAL components for improved air-to-air combat survivability.

• (U) ($10,800) STRIKE AND ASUW WEAPONRY:
- (U) Initiate:
  - -- (U) Develop high speed, small, low power processor utilizing off-the-shelf hardware for automatic, near real time, high resolution (2000x2000 pixel) image processing for real time re-targeting and rapid mission planning for cruise missiles.
  - -- (U) Affordable Seeker Concepts: Analysis of requirements and design for a strike seeker using concurrent engineering techniques to reduce design and prototype fabrication times.
  - -- (U) Feasibility studies for an adaptive warhead concept that will reduce the number of different warhead types from three to one to address the wide spectrum of surface target types, thus alleviating a significant vertical launch system (VLS) load out problem.
- (U) Continue:
  - -- (U) Application of parallel distributed processing techniques for routing and adaptive mission planning for cruise missile application.
  - -- (U) SFAE warhead technology development.
- (U) Complete:
  - -- (U) ARPA WARBREAKER environment simulations of parallel processing algorithms for near real-time mission planning and adaptive in-flight mission re-planning capabilities for future Navy smart weapons.

• (U) ($2,000) NAVAL SURFACE FIRE SUPPORT:
- (U) Initiate:
  - -- (U) An investigation into the feasibility of weaponizing ram accelerator technology, an innovative "ram-jet-in-a-tube" propulsion technology that, in principle, is capable of producing projectile velocities of up to 8Km/sec using common gaseous propellants.
- (U) Continue:
  - -- (U) Efforts in long range gun launched rocket propulsion technology initiated in FY 1995 under Strike and ASUW weaponry by conducting rocket motor sub-system preliminary designs.

- (U) ($2,000) THEATER DEFENSE:
  - (U) Initiate:
    - (U) Technology definition studies in the area of advanced guidance and control, lethality enhancement and divert propulsion for kinetic energy hit-to-kill interceptors in support of Navy theater ballistic missile defense needs.
    - (U) Lethality investigation (terminal velocity, mass & kill criteria) for long rod kinetic energy hit-to-kill concepts.

4. (U) FY 1997 PLAN:

- (U) ($8,260) SHIP SELF DEFENSE IN SUPPORT OF SURFACE BATTLESPACE:
  - (U) Initiate:
    - (U) Target response modeling for development of valid, realistic flight simulations of anti-ship cruise missiles to determine threat response to damage from advanced warhead kill mechanisms for ship self defense application.
    - (U) Advanced surface target vulnerability application analysis to expand on newly developed methodologies and databases to support cumulative damage affects on surface targets.
    - (U) Development of low cost, lightweight IRFPA tracker for ship self-defense based on breadboard design work which completes in this year.
  - (U) Continue:
    - (U) Miniature RF seeker guidance technology development for improved multi-path/clutter discrimination.
    - (U) Precision track RF technology; Refine candidate system concepts, system simulation and modeling, and solid state transmitter/receiver module evaluation.
  - (U) Complete:
    - (U) Test & evaluation of breadboard low cost, lightweight, IRFPA test-bed tracker.

- (U) ($7,460) AIR SUPERIORITY:
  - (U) Continue:
    - (U) Aerodynamic advanced prediction code development for advanced airframe application.
    - (U) Conformal antenna array and processing investigation development for GIF applications.
    - (U) LOAL missile guidance component integration for sub-system test & evaluation.

-- (U) Application of structural composites for developing lightweight, low cost missile airframe design concepts.
- (U) Complete:
-- (U) HWIL simulations of IR GIF breadboard hardware for improved air-to-air missile lethality.
-- (U) Investigation of coherent fiber bundle scene transformation techniques for IR scene generation.

• (U) ($12,648) STRIKE AND ASUW WEAPONRY:
- (U) Initiate:
-- (U) Investigation of advanced data and image compression techniques to support real time retargeting capabilities for cruise missiles.
-- (U) Investigation of gray scale high frame-rate spatial light modulators to implement a high speed databus for down-loading data to the missile (GigaBits/sec) supporting realtime retargeting and rapid mission planning for cruise missiles.
- (U) Continue:
-- (U) High speed, small, low power processors for automatic, near real time, high resolution image processing for real time retargeting and rapid mission planning for cruise missiles.
-- (U) Affordable Seeker Concepts: using concurrent engineering techniques to reduce time and cost; complete requirements analysis, design, development and begin fabrication of a strike seeker for test and evaluation.
-- (U) Adaptive warhead concept studies by conducting scale evaluations of advanced explosive materials developed under PE 0602314N.
- (U) Complete:
-- (U) Parallel distributed processing techniques for routing and mission planning applications with transition to PE 0603217N, for captive flight test evaluations.
-- (U) SFAE warhead technology development.

• (U) ($3,203) NAVAL SURFACE FIRE SUPPORT:
- (U) Continue:
-- (U) Gun launched rocket technology development by fabricating an advanced motor and conducting structural and performance evaluations.
-- (U) Ram Accelerator technology by conducting preliminary design studies for cold start concept, computational fluid dynamic modeling of in-bore combustion processes during cold start and conducting

scale-up investigations for large caliber gun applications.

- (U) ($3,816) THEATER DEFENSE:
  - (U) Initiate:
    - -- (U) Sensor/optics algorithms and processors development for upper tier interceptor guidance as identified and prioritized in FY 1996 technology definition studies.
    - -- (U) Propulsion, airframe and flight control technology investigations as identified and prioritized in the FY 1996 technology definition studies.
  - (U) Continue:
    - -- (U) Long rod kinetic energy penetrator lethality investigation.
  - (U) Complete:
    - -- (U) Technology definition studies.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	67,822	75,088	XXX	XXX
(U) FY 1995 Appropriated:	XXX	78,122	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-35,664	-41,734	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	32,158	36,388	32,658	35,387

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year Execution Update (-81), TRP reprogramming (-2,000), and Comparability Adjustment (-33,583). FY 1995 changes due to Comparability Adjustment (-40,761), Congressional undistribution reductions for Consulting Services Support (-42), Federally Funded Research Development Center reductions (-309), travel (-48), and an assessment for Small Business Innovative Research (-574).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602111N
PROGRAM ELEMENT TITLE: Air and Surface Weapons Technology

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable

(U) RELATED RDT&E: This PE adheres to Tri-Service Reliance agreements with oversight provided by the JDL. This PE is related to and fully coordinated with efforts in the following:

- (U) Conventional Air/Surface Weaponry:
  (U) PE 0601153N (Defense Research Sciences)
  (U) PE 0602203F (Aerospace Propulsion)
  (U) PE 0602232N (C3 Technology)
  (U) PE 0602234N (Materials, Electronics and Computer Technology)
  (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 0603609N (Conventional Munitions)
  (U) PE 0603640M (Marine Corps Advanced Technology Demonstration)
  (U) PE 0603790D (NATO Research and Development)
  (U) This is in accordance with the ongoing Reliance joint planning processes.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: FEBRUARY 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Surface Ship and Submarine HM&E Technology	30,700	35,059	36,786	42,430	48,893	53,734	55,717	57,354	CONT.	CONT.

* FY 1994 and FY 1995 reflect FY 1996 S&T restructure. Funding moved to this P.E. from PE 0602323N.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides for surface ship and submarine technology developments that contribute to meeting the top joint warfare capabilities established by the Joint Chiefs of Staff; namely to promptly engage regional forces in decisive combat on a global level, to employ a range of capabilities more suitable to actions at the lower end of the full range of military operations which allow achievement of military objectives with minimum casualties and collateral damage, and to counter the threat of weapons of mass destruction and future ballistic missile and cruise missiles to the United States and deployed forces.

(U) This PE develops affordable hull, mechanical, and electrical (HM&E) technology for increased covertness, reduced vulnerability to weapons, and improved operational efficiency of all Navy surface ships and submarines. This PE addresses specific technology needs in the areas of signature reduction and control, weapons effects, damage control, and maneuvering and control, as well as efficiency and maintainability of advanced propulsion, mechanical, and electrical systems. These technology needs bridge all Joint Mission Areas requiring covertness, survivability, and operational efficiency as these are primary attributes for Naval operations.

(U) These efforts apply to Surface Ships and Submarines and support the Joint Warfare Strategy "Forward ...From the Sea." The program is organized into four technology thrusts: Signature Control, Structrual Systems, Power and Automation, and Maneuvering and Seakeeping.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT Budget Activity because

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

it investigates technological advances with possible applications toward solution of specific Naval problems, short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

(U) ($6,819) SURFACE SHIP SIGNATURE CONTROL:

- Initiated validation of analytical model for combining anti-radiation coatings and hull transmission path blockers to reduce ship radiated noise signatures.
- Initiated development of quiet rudder concepts.
- Initiated development of design guidelines for vertical axis propulsor for noise signature reduction.
- Demonstrated feasibility of electro-optic electromagnetic environment monitoring concept to remotely monitor shipboard radio frequency emission over the entire radio frequency spectrum.
- Transitioned closed loop degaussing magnetic-signature modification system for steel hull ships to Advanced Degaussing Technology Demonstration.
- Developed low observable concept that reduces mast radar cross section by more than 15dBSM over current masts and improves sensor performance. Transitioned to Advanced Enclosed Mast/Sensor System (AEM/S) ATD (PE 0603792N).

(U) ($3,611) SURFACE SHIP STRUCTURAL SYSTEMS:

- Demonstrated maneuvering contact tracking algorithms for self-defense against high speed weapons.
- Completed payoff studies of design options for frigate survivability which will guide future research and development investments in this area.
- Completed at-sea testing of sub-scale composite hull Advanced Materiel Transporter.
- Developed composite structural concept for transition to Advanced Enclosed Mast/Sensor System ATD (PE 0603792N) and fabricated quarter scale test article.
- Demonstrated capability to predict response of surface ships to underwater explosion using highly discretized, but uncoupled, finite element/finite difference models.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

(U) ($6,687) SURFACE SHIP POWER AND AUTOMATION:

- Demonstrated capability of fiber optic differential pressure sensor for flooding level detection.
- Developed algorithms for vertical heat transfer modeling for ships with steel decks.
- Completed assessment of an alternate alloy candidate for wire and magnetic components of a low temperature superconducting electric drive system.
- Completed the development of dynamic model and design guidelines for a limited duty cycle generator.
- Completed technology feasibility assessment of resonant transformer for potential shipboard pulse power network application.
- Began demonstration of solid-state power converter and switching components for zonal electrical power distribution system.
- Initiated conceptual design of a new family of shock-hardened Air Circuit Breakers.
- Completed assessment of artificial intelligence/neural network technology for intelligent machinery control.
- Conducted at-sea trials of a low-cost, high-speed, high payload, Advanced Materiel Transporter model.
- Completed assembly of a diesel fuel reformer and performed a ship impact assessment of fuel cell power plants on Navy combatants.
- Completed assessment of advanced composite materials applications and ship impact of lightweight non-magnetic diesel engines.

(U) ($4,293) SUBMARINE SIGNATURE CONTROL:

- At-sea trials demonstrated feasibility of modern control techniques to reduce electromagnetic signatures.
- Demonstrated small scale machinery raft for control of machinery generated tonal and broadband noise.
- Constructed detailed finite element model, which enaables evaluation of sonar self-noise designs, of integral sonar dome/sonar boot system for the hybrid composite bow dome.
- Performed flow-induced noise tests for quiet weapons launch systems to develop technology required to minimize transient flow noise.

(U) ($3,100) SUBMARINE STRUCTURAL SYSTEMS:

- Integrated experimental/numerical efforts to increase knowledge of pressure hull underwater explosion response and damage evolution.
- Initiated investigation of hull failure due to multi-compartment interactions.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

- Enhanced numerical analysis for improved treatment of bubble-structure interaction effects.
- Developed models to predict physical response of acoustic coatings subjected to shockwaves, bubble pulses, and hydrostatic loadings.
- Initiated transducer technology development to make possible in-situ measurements of coating response to underwater explosion response loading.
- Initiated modelling of the structural dynamics of submarine internal systems subjected to hull shock forces.
- Continued development of shock-resistant machinery cradles.

(U) ($1,950) SUBMARINE POWER AND AUTOMATION:

- Performed laboratory demonstration of a full-scale shaftless seawater pump.
- Completed Malone cycle experiments for alternative, non-ozone depleting, air conditioning.
- Transitioned analysis methods and concepts for next generation electrical system to NAVSEA.
- Performed verification of electric noise models using a 2 Hp and a 200 Hp permanent magnet motor.
- Contracted for 2 Hp permanent magnet motor components for laboratory evaluation of motor analysis.
- Continued development of advanced power distribution architectures, circuit breakers, and cables to enable use of emerging power electronic devices for a more electric submarine.
- Identified research requirements for development of a more electric submarine.

(U) ($4,240) SUBMARINE MANEUVERING AND SEAKEEPING:

- Developed and validated analytical design tools for submarine maneuvering and control.
- Evaluated hydroacoustic impact of advanced material concepts for advanced propulsors.
- Validated analytical methods for evaluating radiation efficiency of complex propulsor structures.
- Performed experimental validation of simulations of inflow distortions into the propulsor and resulting unsteady forces generated by the propulsor.
- Established high speed computational capability at the Hydrodynamics/Hydroacoustics Technology Center for highly unsteady flow predictions.
- Performed wake signature reduction measurements on the Large Scale Vehicle.

2. (U) FY 1995 PLAN:

623

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

(U) ($5,398) SURFACE SHIP SIGNATURE CONTROL:
- Initiate performance testing of vertical axis propulsor.
- Transition lightweight, low-observable, electromagnetically-compatible glass-reinforced plastic mast concept to Advanced Technology Development. (PE 0603792N)
- Develop electromagnetic analysis models and interface reduction techniques for ultra wide band radio frequency systems.
- Develop cost-effective radar absorbing structure and compatible infrared signature control concepts for low observable ship designs.
- Demonstrate active noise control techniques for quieting shipboard fluid systems.
- Initiate development of improved magnetic sensors to support future closed loop degaussing systems.
- Develop concepts for cavitation reducing rudders and appendages.

(U) ($6,478) SURFACE SHIP STRUCTURAL SYSTEMS:
- Initiate development of shipboard magazine protection and damage containment concepts.
- Initiate development of expert systems decision aids for damage control to assess structural integrity of ships at sea and for damage control decision management.
- Develop improved slamming load prediction methodology.
- Transition guidelines for probabilistic structural analysis to advanced development (PE 0603563N).
- Develop guidelines for design of unidirectional double hull ships.
- Evaluate low cost fabricator of a sub-scale composite primary hull midship section.

(U) ($9,717) SURFACE SHIP POWER AND AUTOMATION:
- Initiate scale model demonstration of advanced concept electrical power distribution system.
- Complete laboratory validation of resonant transformer for pulse power networks.
- Complete performance testing of cryogenic turbo expander for low-temperature superconducting systems.
- Complete performance testing of low-temperature superconducting wire alloys.
- Demonstrate low-weight, low-signature composite diesel components.
- Demonstrate diesel-fed high-power-density fuel cells.
- Complete demonstration of permanent magnet propulsion system on patrol craft.
- Complete conceptual design of a new family of shock-hardened air circuit breakers and fabricate broadband

hardware for laboratory evaluation.

(U) ($3,415) SUBMARINE SIGNATURE CONTROL:
- Demonstrate electromagnetic signature quieting independent of geographic locations.
- Initiate feasibility study on large-scale acoustic holography.
- Perform initial verification of target strength simulation tool.
- Continue demonstration of techniques to reduce low-frequency strucural acoustic phenomena.
- Perform cost/performance tradeoff evaluations for the hybrid composite bow dome.
- Quantitatively assess the transient flow noise generated by slot flow geometry in weapons launcher systems.

(U) (3,813) SUBMARINE STRUCTURAL SYSTEMS:
- Utilize new transducer technologies and advanced numerical methods to enhance the quality of deep submergence test data.
- Transition damage prediction methods for stiffened cylindrical hull sections to NAVSEA and PEO Sub Program.
- Develop analytical shock analysis techniques for non-pressure hull components.
- Continue developing analytical models for dynamic strength of multi-compartment failures.
- Continue evaluation of composite sail with integrated technology with both acoustic and non-acoustic signature applications.
- Develop methods to model dynamic response of composites in structural applications.

(U) ($2,962) SUBMARINE POWER AND AUTOMATION:
- Transition shaftless seawater pump technology to NAVSEA.
- Develop quiet, reliable, compact electro-mechanical and electrohydraulic actuators which enable zoned distributed systems and eliminate noisy, complex central hydraulic power plants and piping.
- Continue development of advanced power distribution architectures, circuit breakers, and cables to enable emerging power electronic devices for a more electric submarine.
- Perform laboratory demonstration of 2 Hp permanent magnet motor.
- Determine the acoustic quieting issues associated with advanced design permanent magnet motors.

(U) ($3,276) SUBMARINE MANEUVERING AND SEAKEEPING:

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

- Develop models to simulate submarine maneuvering and control in shallow water; transition the results for converstion into design tools at the Hydrodynamics/Hydroacoustics Technology Center.
- Validate broadband vibration noise procedures and models for early stage propulsor design predictions; transition predictive code to the Hydrodynamics/Hydroacoustics Technology Center.
- Develop and implement techniques for computing flows around the stern with various propulsor/appendage configurations.

3. (U) FY 1996 PLAN:

(U) ($4,723) SURFACE SHIP SIGNATURE CONTROL:
- Complete broadband high-frequency antenna concept and integration into AEM/S ATD (PE 0603792N).
- Develop advanced topside ship concepts that provide affordable and balanced radar and infrared signature control utilizing shaping and signature control materials.
- Develop fluid system quieting techniques using active control technology.
- Develop computational techniques for wide band and ultra-wide band electromagnetic systems.

(U) ($5,431) SURFACE SHIP STRUCTURAL SYSTEMS:
- Evaluate analytical methods for predicting ship motion in a seaway.
- Complete evaluation of low cost/high quality composite hull structures for mine hunters and small combatants.
- Continue development of models and design guidelines for more affordable and reliable naval ships based on statistical quantification of life-cycle loads and ship failure mode definition.
- Explore the multi-use capabilities (protection/signature reduction) of ceramic armor to increase survivability.
- Evaluate coupled finite-element/finite-difference analytic methods for predicting the response of ship structures to weapons effects.

(U) ($8,240) SURFACE SHIP POWER AND AUTOMATION:
- Develop non-ozone depleting total flooding fire fighting agent to replace halon.
- Initiate development of advanced cooling systems to reduce shipboard heat exchanger cost, size, weight, and maintenance.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

- Continue development of lightweight low-signature composite diesel engine.
- Demonstrate a single zone of the Advanced Concept Electrical System architecture and validate simulations.
- Continue development of diesel fuel processing components for fuel cell system.
- Continue development and demonstration of Power Electronic Building Blocks.

(U) ($5,296) SUBMARINE SIGNATURE CONTROL:
- Demonstrate proof-of-concept for automatic control of electromagnetic signatures.
- Perform intermediate scale demonstration of active control of machinery rafts.
- Demonstrate and validate target strength simulation; transition for design tool development at the Hydrodynamics/Hydroacoustics Technology Center.
- Demonstrate and validate accurate, cost effective analytical tools for evaluating weapons launcher systems.
- Conduct large-scale experiments to evaluate feasibility of acoustic holography.

(U) ($4,309) SUBMARINE STRUCTURAL SYSTEMS:
- Initiate shock design capability for non-pressure hull components to improve submarine survivability against weapons and mines.
- Develop transducer technology for in-situ measurements of underwater explosion loading of pressure hulls.
- Demonstrate and validate models to assesss the dynamic resonse of a acoustically-coated hulls to dynamic loads.
- Develop criteria for hull/frame failure model for steel pressure hulls under dynamic loads.
- Initiate development of analysis methods to achieve balanced, static-dynamic pressure hull design.

(U) ($3,481) SUBMARINE POWER AND AUTOMATION:
- Continue development of electrohydraulic/electromechanical actuators as components for advanced electrical architectures.
- Continue development of advanced power distribution architectures, circuit breakers, and cables to enable use of emerging power electronic devices for a more electric submarine.

(U) ($5,306) SUBMARINE MANEUVERING AND SEAKEEPING:
- Initiate evaluation of physics-based maneuvering tools for improving prediction of submarine trajectory.
- Initiate two-body, physics-based modeling to understand the interaction between two submerged vehicles as they

maneuver in close proximity.
- Validate analytical models of radiation efficiency for complex propulsor structures to enable development of quiet, reduced-cost propulsors.
- Initiate experimental evaluation of full-stern/integrated propulsor concept.

4. (U) FY 1997 PLAN:

(U) ($5,304) SURFACE SHIP SIGNATURE CONTROL:
- Begin development of high-performance ship hull concepts which meet low-observable requirements.
- Develop advanced computational and experimental techniques to evaluate composites for radar and infrared signature reduction.
- Develop low-noise propeller concepts for MCM, MHC, and other combatant ship classes operating in littoral areas.
- Complete development of fluid system quieting technology utilizing active control.

(U) ($6,364) SURFACE SHIP STRUCTURAL SYSTEMS:
- Develop predictive code to model fatigue behavior of large composite structures.
- Perform shipboard testing of structural data acquisition system.
- Demonstrate the ability to predict reactive gas flow in non-burst compartments following an explosion.
- Demonstrate new concepts to prevent or significantly lower the threshold for mass detonation initiation of magazines.

(U) ($9,547) SURFACE SHIP POWER AND AUTOMATION:
- Complete development of damage control algorithms that will predict fire and smoke movement.
- Continue development and demonstration of advanced low-signature/high-efficiency composite diesel engine.
- Complete hardware development of 250k Watt prototype fuel cell system for powering an advanced electric propulsion motor or ship service load.
- Develop intelligent machinery control system for laboratory demonstration.
- Transition multi-warfare integration and scene generation algorithms for quick-response ship self defense to the Anti-Submarine Warfare Control System Advanced Development Model.
- Develop advanced damage control sensors with automated sensing capabilities to measure state of closure of

hatches and pressure and flow rates of air and water.
- Develop analytical algorithms to integrate with sensors for protection against progressive flooding damage.

(U) ($6,270) SUBMARINE SIGNATURE CONTROL:
- Continue demonstration of proof-of-concept for an algorithm that provides automatic control of electromagnetic.
- Demonstrate physics-based sonar self-noise models; transition these models for conversion into design tools at the Hydrodynamics/Hydroacoustics Technology Center.
- Demonstrate advanced rafting structural acoustic models; transition these models for conversion into design tools at the Hydrodynamics/Hydroacoustics Technology Center.
- Initiate development of quiet, small-device launcher.
- Demonstrate and validate target strength simulation models.

(U) ($4,546) SUBMARINE STRUCTURAL SYSTEMS:
- Initiate development of advanced mounts/snubbers technology for shock mitigation.
- Transition analysis capabilities to evaluate response of acoustically-coated hull to shock loading.
- Demonstrate and validate analysis of pressure hull rupture/toughness of internally stiffened hulls.
- Continue development of analysis methods to evaluate balanced static-dynamic pressure hull design.

(U) ($4,180) SUBMARINE POWER AND AUTOMATION:
- Continue development of advanced power distribution architectures, circuit breakers, and cables to enable use of emerging power electronic devices for a more electric submarine.
- Complete development of solid state circuit breaker technology for improved electrical system performance.
- Complete development of adaptive magnetic bearings for increased bearing life and noise control.

(U) ($6,219) SUBMARINE MANEUVERING AND SEAKEEPING:
- Transition unsteady flow analysis for evaluating nonacoustic wake signatures to Hydrodynamic/Hydroacoustic Technology Center.
- Complete evaluation and validaton of physics-based maneuvering tools.
- Incorporate autonomous undersea vehicle dynamics into two body maneuvering model.
- Initiate analysis of submarine control appendages having improved control authority and minimal signatures.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

- Demonstate feasibility of low-cost propulsor concepts.
- Demonstrate hydrodynamic and hydroacoustic performance of full-stern/integrated propulsor concept.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	19,103	19,884	XXX	XXX
(U) FY 1995 Appropriated	XXX	17,684	XXX	XXX
(U) Adjustments from Appropriated/PRESBUDG:	11,597	17,375	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	30,700	35,059	36,786	42,430

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes reflect comparability adjustments from 0602323N (14,383), end-of-year adjustments to reflect below threshold reprogrammings (-2,286) and TRP Adjustment (-500). FY 1995 changes reflect comparability adjustment (19,557), Congressional reduction (-2,200), an assessment for Small Business Innovative Research (-100) and Congressional undistributed reductions for University Research (-2,026) and travel (-56).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) OTHER APPROPRIATION FUNDS: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N
PROGRAM ELEMENT TITLE: SURFACE SHIP AND SUBMARINE HM&E TECHNOLOGY

DATE: FEBRUARY 1995

(U) RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0602233N (Readiness, Training and Environmental Quality Technology)
- (U) PE 0602234N (Materials, Electronics, and Computer Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0603502N (Surface and Shallow Water MCM)
- (U) PE 0603508N (Ship and Submarine HM&E Advanced Technology)
- (U) PE 0603513N (Shipboard System Component Development)
- (U) PE 0603514N (Personnel/Ship Survivability)
- (U) PE 0603553N (Surface Anti-Submarine Warfare)
- (U) PE 0603561N (Advanced Submarine Systems Development)
- (U) PE 0603563N (Ship Concept Advanced Design)
- (U) PE 0603564N (Ship Preliminary Design and Feasibility Studies)
- (U) PE 0603569E (ARPA S&T Program)
- (U) PE 0603573N (Advanced Surface Machinery Systems)
- (U) PE 0603792N (Advanced Technology Transition)
- (U) PE 0604558N (New Design SSN Development)
- (U) PE 0604561N (SSN-21 Development Program)
- Under the Tri-Service Reliance Agreement, the Navy has the lead for this Navy-unique program.

D. (U) SCHEDULE PROFILE: Not applicable

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Aircraft Technology	21,690	28,622	22,238	26,328	28,985	32,683	33,613	34,571	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program develops technology for naval aviation, with emphasis on the demands imposed by aircraft carrier flight operations and Marine Corps amphibious and field operations relating to the Joint Mission Areas of Joint Strike Warfare and Joint Littoral Warfare. This program exploits the emerging technologies of: (a) composite and matrix materials for structures to reduce airframe and propulsion plant weight and the effects of saltwater corrosion; (b) reduced observable aerodynamic designs of Navy-unique aircraft components; (c) advanced gas turbine engine component designs for extended range/endurance; and (d) longer service life to bring about reduced at-sea replacements and spares inventory. Technologies are developed for needed upgrades to shipboard launch and recovery systems, visual landing aids for safer flight operations, aircraft maintenance test equipment, and integration requirements of seabased low observables for increased weapon system availability. The program provides mission area analysis and concept definition required for the Exploratory Development phase of air vehicle and weapon system programs.

(U) Aircraft Technology develops the manned airborne platform future joint warfighting capabilities to promptly engage regional forces in decisive combat on a global basis and to employ a range of capabilities more suitable to actions at the lower end of the full range of military operations, which allow achievement of military objectives with minimum casualties and collateral damage. This element adheres to Tri-Service Reliance Agreements and supports the Department of Defense Science and Technology Strategy, which coordinates and minimizes duplication of aircraft technology efforts. The individual Navy aircraft technology exploratory efforts are selected to fill technology gaps that are in the United States Air Force, Army, National Aeronautics and Space Administration, Advanced Research Projects Agency and industry programs, which if successfully demonstrated, would meet Navy aviation needs.

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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($ 6,323) PROPULSION:
  - (U) Completed:
    - -- (U) Development, testing, and evaluation of remote sensing concepts for assessing the performance of aircraft engines. Individual remote sensing concepts were developed to acquire and analyze engine test parameters (i.e. acoustics, electrostatics, and thermal) and to assess, detect, predict and identify engine failures.
    - -- (U) Fabrication of Axially Staged, Triangularly Aligned combustor at Pratt & Whitney, started in FY92. This will serve as Pratt's next generation commercial engine combustor.
    - -- (U) The design and fabrication of the General Electric five-stage high-pressure compressor, focused towards the Integrated High Performance Turbine Engine Technology Phase II goal of increasing engine thrust-to-weight ratio 60%. Aerodynamic advancements included increased efficiency of 4% and a 25% improvement in stage loading. The compressor incorporates a titanium metal matrix composite bladed ring in stage 2, providing a 21% weight savings over current designs. In addition, a high-temperature metallic titanium rear stage provides a 35% weight savings per stage over current nickel alloy compressors.

- (U) ($ 5,614) AIR VEHICLE:
  - (U) Completed:
    - -- (U) Flight demonstration of a Navy magnetic head tracker for a helmet-mounted display, together with Air Force three-dimensional biaural sound system in the TAV-8B for increased air-to-air combat effectiveness.
    - -- (U) Development of a computer model for next generation Navy aircrew station/interface function specification. The model can be used by industry to design future cockpits, backseat crewstations, and ejection capsules.
    - -- (U) Development of lightweight metal matrix material landing and arresting gear components capable of withstanding the stress of carrier landings.

-- (U) Development and evaluation analysis methods for composite fuselage design concepts, including woven preforms and transversely reinforced structures.
-- (U) Technical work on Laser Sequencing of Escape Systems. This aircrew escape system approach offers a weight savings over current mechanical systems, a low maintenance requirement, and minimizes problems of inadvertent actuation of electrically sequenced ejection seats.

- (U) ($ 5,286) DYNAMICS OF FLIGHT:
  - (U) Completed:
    -- (U) Flight simulations and development of design guidelines for improving helicopter operations at sea during degraded visual conditions.
    -- (U) Flight testing with Advance Research Projects Agency, of X-31A, including demonstrations of close-in combat capabilities for increased maneuverability. Also demonstrated the integration of helmet-mounted display and three-dimensional audio technologies into the X-31.
    -- (U) Development of new design/analysis methodologies in aerodynamics for better performance through vortex flow control and airfoil/wing optimization.
    -- (U) Testing of fillets on a double delta wing in a wind tunnel, whereby the effectiveness of the fillets to control vortex formation was demonstrated. The data is important for the F-18E configuration, since it validates lift enhancement previously predicted by Computational Fluid Dynamics.

- (U) ($ 1,300) SEABASED AIRCRAFT SUPPORT:
  - (U) Completed:
    -- (U) Development of simulations of an imaging sensor viewing an aircraft approaching a carrier deck and a pilot's view while approaching a carrier. These simulations are to be used in evaluating the combined glideslope and line-up visual landing aid concepts.
    -- (U) The integration of an aircraft engine installation/removal trailer, with the omni-directional vehicle platform. The platform was tested/demonstrated at Naval Air Station Lemoore and aboard the aircraft carrier, Constellation (CV-64).

- (U) ($ 3,167) OXIDE PURPLE:
  - (U) Classified.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

2. (U) FY 1995 PLAN:

- (U) ($ 6,614) PROPULSION:
  - (U) Continue to:
    - -- (U) Test the Advanced Turbine Engine Gas Generator Phase II combustor (Axially Staged, Triangularly Aligned).
    - -- (U) Develop combustion, turbine, mechanical, and control and integration of propulsion components for Integrated High Performance Turbine Engine Technology Phase II.
  - (U) Complete:
    - -- (U) The development and transition of advanced technology low spool components for fighter/attack aircraft technology demonstrator engines that meet the Integrated High Performance Turbine Engine Technology goals and highlight increased performance, life, reliability and maintainability goals with respect to improving the capabilities of advanced Navy carrier-based aircraft.
    - -- (U) Testing of an innovative, vaneless, 1-1/2 stage, counter-rotating, low-pressure turbine in a Turbine Rig Research Facility. The advanced aerodynamics and structural technologies will increase temperature capability by 600 deg F, reduce engine specific fuel consumption by 0.5% and reduce engine weight by approximately 100 lbs, relative to a conventionally vaned two stage design.
- (U) ($ 7,180) AIR VEHICLE:
  - (U) Initiate:
    - -- (U) Development of new thermal management approaches to economically cool next generation avionics.
    - -- (U) Design of advanced, innovative, high precision technology devices, software, and system, as well as enabling/integration techniques for precision, real time retargeting cockpit control/display systems.
  - (U) Continue to:
    - -- (U) Develop advanced cockpit concepts, which will be incorporated into the real time retargeting displays, including the Cyborg Eye and Window-to-the-World Graphics, which would provide information to the pilot during enemy laser attack, and Three-Dimensional Volumetric Display.
    - -- (U) Test and evaluate metal matrix composite arresting gear, capable of working with today's fleet of aircraft and those under development.

-- (U) Develop aircraft components and performance criteria for reduced cost, weight and maintenance and increased performance, service life and mission effectiveness.
-- (U) Demonstrate ability of smart metallic structures to perform real-time assessments and monitoring of damage and fatigue life.
-- (U) Develop and demonstrate new design concepts and analytical methods for low observable aircraft and aircraft components which were developed under a classified program.
-- (U) Develop and test an integral starter/generator and Integrated Power Unit for the More Electric Initiative Joint USAF/Navy Program.

- (U) Complete:
  -- (U) Development of advanced crew station concepts and performance evaluation metrics.
  -- (U) Development of the Smart Aircraft Vehicle Management System architecture and demonstrate its use with selected smart components.
  -- (U) Testing and evaluation of a damped composite aircraft centerbody structure, started in FY91, to demonstrate vibration and dynamic effects alleviation. The lifetime and safety margin of this structure will increase, while the combined weight and volume of the active control and redesigned structure is reduced.

• (U) ($ 7,884) DYNAMICS OF FLIGHT:
- (U) Initiate:
  -- (U) Development and evaluation of control laws to assist the pilot in outer-loop control functions (i.e., control of acceleration, as well as other dynamic aspects of the air vehicle).
  -- (U) Wind tunnel tests of a small scale model to investigate the aerodynamic performance and the rotor dynamics in hover and in wing-borne flight, to determine the feasibility of the Canard/Rotor Wing concept.
  -- (U) Detailed design, fabrication, and risk reduction ground testing of a near-flight quality Vectored Thrust Ducted Propeller (VTDP) Concept.

- (U) Continue to:
  -- (U) Develop air/ship dynamic interface computer simulation techniques for reduced training costs and safer helicopter operations from ships.

- (U) Complete:
  -- (U) New design/analysis methodologies in aerodynamics for better performance through vortex flow control and increased correlation of wind tunnel models, computational fluid dynamic models, and actual aircraft testing.

• (U) ($ 2,560) SEABASED AIRCRAFT ADVANCED SUPPORT (formerly Seabased Aircraft Support):
- (U) Initiate:
  -- (U) Development of concepts for the rapid turnaround of low observable aircraft operating from aviation capable ships. The concepts may include the use of automated platforms to transport sensor systems on congested hangar deck environments.

- (U) Continue to:
  -- (U) Develop Remote LIDAR Sensor for measuring the turbulent wind flow fields which adversely effect seabased aircraft launch and recovery operations aboard all aviation capable ships.

- (U) Complete:
  -- (U) Development and demonstration of an Advanced Aircraft Tracking System to provide accurate aircraft tracking, identification and position/rate information under all seabased environmental conditions.

• (U) ($ 4,384) OXIDE PURPLE:
- (U) Classified.

3. (U) FY 1996 PLAN:

• (U) ($ 6,489) PROPULSION:
- (U) Initiate:
  -- (U) Development of moderate bypass ratio fan to meet Phase III goals.
  -- (U) Design of a reduced part count Phase III advanced combustor with an integral fuel nozzle/diffusor concept.

- (U) Continue to:
  -- (U) Test Phase II Joint Technology Demonstrator Engine fan.

- (U) Complete:
  - -- (U) Design of Phase III Advanced Turbine Engine Gas Generator/Joint Technology Advanced Gas Generator Combustor.
  - -- (U) Fabrication of high pressure turbine rotor system with a dual alloy disk. The design will provide turbine temperature capability improvement of 600F, cooling flow reduction of 35% and weight reduction of 10%.
  - -- (U) Fabrication and test of a full set of first-stage, vaneless, counterrotating low-pressure turbine blades, yielding a reduction in weight and cooling requirements over current technology.
  - -- (U) Rig test of a hydraulic thruster device and load sensor to demonstrate effective rotor thrust load modulation with minimal heat generation.
  - -- (U) Rig test and final design of fan, low pressure turbine, augmentor and controls components in preparation for 1997 Integrated High Performance Turbine Engine Technology Phase II demonstration.

• (U) ($ 7,020) AIR VEHICLE:
- (U) Continue to:
  - -- (U) Demonstrate Voice Recognition & Synthesis and helmet-mounted display/head tracker technology integration. Full-mission flight simulators will be used to validate the performance benefits.
  - -- (U) Demonstrate multi-function programmable display pad designs, including high definition technology flat panel displays.
  - -- (U) Demonstrate through lab & flight testing, sensor, display, avionics architecture, and image processing integration, the Cyborg Eye concept of pilot visual/display system enhancement.

- (U) Complete:
  - -- (U) Testing of the Power Management & Distribution for a More Electric Aircraft and the Integrated Power Unit in coordination with U.S. Air Force Wright Labs.

• (U) ($ 2,270) DYNAMICS OF FLIGHT:
- (U) Continue to:
  - -- (U) Integrate and test an intelligent (learning augmented) flight control system on a real-time piloted flight simulation.
  - -- (U) Develop and evaluate control laws to assist the pilot in outer-loop control functions.

- (U) ($ 2,723) SEABASED AIRCRAFT ADVANCED SUPPORT (formerly Seabased Aircraft Support):
  - (U) Initiate:
    - -- (U) Development of a Seabased Low Observable Multi-Spectral Inspection System for the purpose of contributing to the rapid turnaround of low observable aircraft operating from aviation capable ships.
    - -- (U) Simulations of low observable post-maintenance validation inspection operations in a seabased hangar deck environment.
    - -- (U) Develop Remote LIDAR Sensor for measuring turbulent wind flow fields, included will be a landbased sensor performance evaluation.

- (U) ($ 3,736) OXIDE PURPLE:
  - (U) Classified.

4. (U) FY 1997 PLAN:

- (U) ($ 7,428) PROPULSION:
  - (U) Initiate:
    - -- (U) Development of Phase III compressor, turbine, and control components for integration into an 6.3 Advanced Turbine Engine Gas Generator demonstrator.

  - (U) Continue to:
    - -- (U) Test Phase III Joint Technology Demonstrator Engine fan.

  - (U) Complete:
    - -- (U) Design for Phase III Joint Technology Demonstrator Engine combustor.
    - -- (U) Flight testing of electronic engine control system with Wright Labs. The system design, will utilize ruggedized optic connectors and combine optics and electronics on one chip to minimize size and weight.

-- (U) Fabrication, assembly and testing in a 6.3 demonstrator engine of additional Integrated High Performance Turbine Engine Technology Phase II advanced fan, compressor, combustor, high/low turbine, augmentor, bearings, and controls technologies. This will be transferred to the 6.3 engine demonstration of 60% improvement on thrust/weight and 30% reduction in fuel consumption over a YF-119 engine.

- (U) ($ 9,464) AIR VEHICLE:
  - (U) Continue to:
    - -- (U) Demonstrate hardware and software for advanced high definition Visually-Coupled Displays for sensor fusion and precision real time retargeting, threat warning, and extended aircraft/aircrew vision under adverse attitude, maneuvering, and environmental conditions.
    - -- (U) Demonstrate in a lab environment, a ceramic on-board oxygen generating system, utilizing. zeolite materials to optimize the efficiency of oxygen production.
    - -- (U) Demonstrate new thermal management approaches to economically cool next generation avionics.
    - -- (U) Develop a robust composite sandwich structure.
  - (U) Complete:
    - -- (U) A more structurally efficient hat stiffener design concept.

- (U) ($ 2,800) DYNAMICS OF FLIGHT:
  - (U) Continue to:
    - -- (U) Demonstrate artificial intelligence Cooper-Harper Ratings System for flying qualities evaluations on a high fidelity man-in-the-loop simulation.
    - -- (U) Perform real-time demonstrations of integrated environment and aircraft models for shipboard dynamic interface to be correlated with LIDAR turbulent ship wind flow data.
    - -- (U) Develop and evaluate control laws to assist the pilot in outer-loop control functions (i.e., control of acceleration, as well as other dynamic aspects of the air vehicle).
    - -- (U) Develop techniques for performing detailed two-dimensional and three-dimensional analyses for evaluating high lift aerodynamic concepts.
    - -- (U) Develop a combined CFD/FEM design/analysis tool for accurately predicting aerodynamic loads of and designing the structure for aircraft empennages.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

- (U) ($ 3,200) SEABASED AIRCRAFT ADVANCED SUPPORT:
  - (U) Initiate:
    - -- (U) Development of a composite aircraft/ship dynamic interface Computational Fluid Dynamics model. The composite Computational Fluid Dynamics model will provide information relating to the dynamic interface envelope between aviation capable ships and aircraft based upon the LADAR turbulent wind sensor measurement data.
  - (U) Continue to:
    - -- (U) Develop the Seabased Low Observable Multi-Spectral Inspection System.
    - -- (U) Simulate low observable post-maintenance validation inspection operations in a seabased hangar deck environment.
  - (U) Complete:
    - -- (U) Development of Remote LIDAR Sensor for measuring turbulent wind flow fields, included will be an at-sea evaluation/demonstration.
- (U) ($ 3,436) OXIDE PURPLE:
  - (U) Classified.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	21,014	24,691	XXX	XXX
(U) FY 1995 Appropriated:	XXX	30,145	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG	+676	-1,523	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	21,690	28,622	22,238	26,328

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to end-of-year execution update (+1,176) and TRP reprogramming (-500). FY 1995 changes due to Congressional undistributed reductions for University Research (-1,347), Consulting Services Support (-36), travel (-35) and an assessment for Small Business Innovative Research (-105).

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable.

(U) RELATED RDT&E: This program adheres to Tri-Service Reliance Agreements on Air Vehicles (Fixed), Air Vehicles (Rotary), Integrated Avionics, and Aeropropulsion with oversight provided by the Joint Directors of Laboratories.

(U) Work in this Program Element (PE) is related to and fully coordinated with efforts in the following PEs:

(U) PE 0601101F (Geophysics)
(U) PE 0601102F (Materials)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602201F (Aerospace Flight Dynamics)
(U) PE 0602202F (Human Systems Technology)
(U) PE 0602203F (Aerospace Propulsion)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602233N (Readiness, Training and Environmental Quality Technology)
(U) PE 0602234N (Materials, Electronic and Computer Technology)
(U) PE 0602708E (Cockpit Autonomous Landing)
(U) PE 0603003A (Rotary Wing Aircraft Technology)
(U) PE 0603106F (Logistics Systems Technology)
(U) PE 0603112F (Advanced Materials)
(U) PE 0603202F (Aerospace Propulsion Subsystems Integration)
(U) PE 0603205F (Flight Vehicle Technology)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602122N
PROGRAM ELEMENT TITLE: Aircraft Technology

(U) PE 0603211F (Aerospace Structures)
(U) PE 0603216F (Aerospace Propulsion and Power Technology)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603231F (Crew Systems and Personnels)
(U) PE 0603245F (Advanced Flight Technology Integration)
(U) PE 0603706N (Medical Development(Advanced))
(U) PE 0603792N (Advanced Technology Demonstrations)

(U) Advanced Technology Transition in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) COST (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Marine Corps Landing Force Technology	17,005	16,774	17,623	18,040	20,199	21,866	22,064	22,787	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program is the only Department of Defense Exploratory Development program that develops the technologies needed to support Marine Corps expeditionary forces warfighting requirements, which are unique for land combat forces due to the amphibious/littoral entry into the battlespace. The primary focus of this program is Landing Force Technology in direct support of Marine Corps needs as defined in pertinent documents. It also collaterally supports the following Joint Mission Areas: Strike, Littoral Warfare, and Surveillance. This is a continuing program based on an annual review of progress, needs, and emerging technology opportunities.

(U) By law, the National Security Act of 1947, the Marine Corps is tasked to develop those phases of amphibious operations that pertain to doctrine, tactics, techniques, and equipment used by the landing force, and which are of common interest to the Army. This program element (PE) and its associated Technology Program Plan MQ1A cover eight major technology thrusts that will lead to new or improved capabilities in a variety of functional areas.

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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($2,599) Surface Mobility: Evaluated and developed advanced vehicle concepts. Initiated Broad Agency Announcement (BAA) selections. Began full scale Crypto Pulse Propulsor. Analytically evaluated the water jet de-aeration system. Tested full vehicle set of lightweight band track with best elastomer compound. Continued testing cooling systems (air-liquid and liquid-liquid). Transitioned turbine air inlet development to PE 0603640M, Marine Corps Advanced Technology Demonstrations (ATD).

- (U) ($2,775) Mine Detection: Continued image processing and Automatic Target Recognition development and implementation. Transitioned preliminary implementation for use in Coastal Battlefield Reconnaissance and Analysis (COBRA) to the Marine Corps ATD program (PE 0603640M). Conducted design trade-off study for a tunable filter multi-spectral camera in the ultra-violet, visible, and infrared spectrum. Conducted parallel investigation of a field-deployable agile tunable laser to slow night-time mine detection.

- (U) ($2,620) Mine Countermeasures: Evaluated selected anti-mine munitions for integration into Distributed Explosive Technology tasks. Investigated heavy metal liner concepts (tungsten, tantalum, alloys). Completed exploration of initiation concepts for explosive arrays. Focused on Anti-Helicopter Mines via threat characterization, conceptual countermeasures, predictive modelling, and breadboard systems.

- (U) ($2,677) Marine Air-Ground Task Force (MAGTF) Command, Control, Communications, Computers and Intelligence (C4I): Completed three Intentional Short Range Communications Phase II contracts. Specified Tactical Cellular System. Solicited and evaluated industry proposals through the BAA process for Over The Horizon (OTH) Communications. Developed hardware/software specification for most promising approaches for OTH Communications. Demonstrated automated capability for air support request and landing plan generation. Analyzed requirements and specified a battalion level, field-capable, tactical simulator and decision aid. Began development of a prototype field Korean/English language translator system for tactical reporting and air/ground support request.

- (U) ($1,520) Survivability: Completed Phase II multi-spectral camouflage paint. Initiated effort on radar false target generator concepts. Continued joint lightweight armor database work. Evaluated new ceramic armor materials and ceramic-metal composites and techniques for forming and combining. Participated jointly with

Advanced Research Projects Agency (ARPA), Arlington, Virginia, in Advanced Land Combat Systems Generation II.

- (U) ($2,534) Advanced Amphibious Logistics: Demonstrated Radio Frequency Tagging and Tracking in a functionality based scenario. Evaluated User Net (USENET) technology to facilitate cooperative logistics coordination and sharing in a chaotic environment, and for information distribution. Hosted USENET on emerging Command, Control, and Communications systems as a demonstration. Assessed and evaluated Low Earth Orbit, Very Low Frequency satellites for geographical (geo)-tagging facilitation of a two-way communications link. Surveyed, re-applied, and modified existing logistics computer models to construct new models to test advanced internet working and object-based paradigms to determine expected Operational Maneuver From The Sea (OMFTS) logistics systems behavior.

- (U) ($1,473) Targeting Sensors: Continued implementation of Intelligent Fire Control (IFC) testbed concepts. Implemented processing paradigms in Fourier, wavelet, and harmogram pre-processing techniques. Demonstrated functionality of Expendable Acoustic Remote Sensors. Continued investigation of technologies in near infrared spectrum and provided system trade-off studies for Generation II/III obscurant challenges. Initiated modeling effort to study the entire range-gated imaging scenario. Re-evaluated Combat Identification efforts in light of ongoing joint efforts. Compared detailed radar design concepts to optimal systems engineering designs to permit down-selection from Non-Development Items. Completed detailed radar design. Transitioned Riverine Acoustic Sensor Systems effort to Advanced Development. Decreased the scope of effort due to technical findings and analysis.

- (U) ($807) Weaponry: Integrated auto-loading components of mortar system into a full scale mock-up to determine space claims and human engineering factors. Continued BAA evaluation process. Developed and tested various particle size and packing configurations with burster to optimize cloud configuration. Determined ignition time requirements and optimized over-pressure. Measured combined performance through field tests. Tested and evaluated dissemination techniques, visibility recognition ability, and marker-terrain contrast in point recognition tasks. New efforts included contract award under BAA and establishment of Professional (Pro)-Engineering station in support of weapon development.

2. (U) FY 1995 PLAN:

- (U) ($2,699) Surface Mobility: Continue fabrication of the Joint Tactical Electric Vehicle and conduct performance testing and demonstrations. Complete evaluation of Articulated Electric Drive Trailer. Complete

fabrication of Inductive Coupler technology and test. Continue Corrosion Prevention and Control development, procurement, and testing. Develop system level concepts and technology roadmap of future surface mobility assets supporting OMFTS. Award BAA contracts.

- (U) ($2,600) Mine Detection: Complete Automatic Target Recognition effort. Transition program to COBRA ATD, (PE 0603640M, Project C2223). Complete design and fabricate a tunable filter multi-spectral camera. Complete field-deployable agile tunable laser effort. Initiate investigation of alternate sensor technologies for mine detection, especially in adverse environments (rain, fog, turbid water). Initiate multi-spectral visible/thermal infrared camera image fusion investigation for cued mine detection. Solicit BAA responses.

- (U) ($2,290) Mine Countermeasures: Continue execution of selected BAAs to emulate threat capabilities. Conduct full scale tests in mechanical mine neutralization. Complete definition of surrogate mine countermeasures systems requirements. Evaluate countermeasures techniques. Complete modelling and simulation and conduct system demonstration.

- (U) ($2,045) MAGTF C4I: Demonstrate Tactical Cellular System. Complete Phase I contracts for OTH Communications hardware/software specification and design. Expand artificial intelligence as part of Amphibious Assault Planner and evolve into client-server environment. Demonstrate a prototype battalion level, field-capable, tactical simulator and decision aid. Demonstrate a prototype field Korean/English language translator system for tactical reporting and air/ground support request.

- (U) ($1,450) Survivability: Continue current false target generator effort. Continue participation jointly with ARPA in Advanced Land Concepts Systems Generation II, Phase II. Continue work in evaluating new materials for armor system applications. Continue tactical decal work. Initiate development of Electro-Armor Systems for Marine Corps specific applications. Continue optimization of ceramic-metal armor technologies.

- (U) ($3,070) Advanced Amphibious Logistics: Complete system concept for Recording and Tracking. Begin system configuration integration for Recording, Tagging, and Tracking. Develop Expeditionary Engineering Technologies concepts. Develop Bulk Liquid system concept. Initiate sea-basing cargo transfer technologies support efforts. Continue solicitations and award to selected BAAs in support of roadmap.

- (U) ($1,920) Targeting Sensors: Demonstrate IFC System. Conduct "all-up" demonstration of Expendable Acoustic

Remote Sensor. Participate in joint service "smoke week" demonstration. Complete Gated Laser Video System proof of concept and prepare for transition to Marine Corps ATD, PE 0603640M. Continue solicitation and award of selected BAAs.

- (U) ($700) Weaponry: Demonstrate auto-loader mortar and transition to Program Manager. Demonstrate advanced concepts in point recognition projectile jointly with the Army. Evaluate and award BAAs.

3. (U) FY 1996 PLAN:

- (U) ($2,709) Surface Mobility: Complete testing of the Joint Tactical Electric Vehicle and transition technology to Marine Corps ATD, (PE 0603640M). Complete Inductive Coupler tests and transition technology to Marine Corps Advanced Technology. Continue development and execution of Surface Mobility Program Plan and technology roadmap. Refine system concepts for supporting power projection and sustainment by conducting performance, cost and technological risk trade-offs. Continue Corrosion Control investigations and tests.

- (U) ($2,614) Mine Detection: Integrate the tunable filter multi-spectral camera with the field-deployable agile tunable laser, and test in laboratory and field environment. Analyze any remaining technology shortfalls and solicit BAA responses to correct. Initiate transition to Marine Corps ATDs (PE 0603640M) to start in FY 1997. Design and fabricate feasibility demonstration sensor device for mine detection in adverse environments (rain, fog, turbid water); begin laboratory tests. Solicit BAA responses to extend the standoff range for multi-spectral mine detection and improved buried mine detection. Demonstrate visible/thermal image fusion technologies; transition to Demonstration/Validation (DEM/VAL) COBRA follow-on program (PE 0603635M, Marine Corps Ground Combat/Support System, Project C2247) as a product improvement.

- (U) ($2,657) Mine Countermeasures: Continue technology search for advanced mine kill mechanisms through BAA solicitation and award with the goal of reducing weight and volume and increasing effectiveness over more difficult surfaces and barriers. Complete full scale testing of mechanical mine neutralization. Complete Off/Route Smart Mine breadboard and key countermeasures concept testing. Complete evaluation of countermeasures techniques and transition activities to the Army (joint effort with Belvoir Research and Development Center (BRDEC), Ft. Belvoir, Virginia) and Program Manager. Complete vehicle landmine survivability system demonstrations and transition activities to the Army (joint effort with BRDEC) and Program Manager. Continue execution of selected BAAs to develop countermeasures techniques. Test countermeasures breadboard systems versus

emulator. Model countermeasures effectiveness.

- (U) ($2,514) MAGTF C4I: Complete Phase II contracts for OTH Communications and provide demonstration of Block I prototypes. Demonstrate intelligent automated landing plan generator. Provide complete order of battle capability for battalion level, tactical simulator and demonstrate. Expand field language translator system to provide briefing capability. Perform Phase I technology application for collaborative planning and decision aids. Exercise cellular communications in support of joint operations. Expand joint countermeasures C4I architecture to support OMFTS.

- (U) ($1,361) Survivability: Continue development of Electro-Armor systems. Continue ceramic-metal development and integration into Marine Corps specific vehicles and systems. Continue Low Observable efforts. Continue false target generator efforts. Continue Advanced Land Concepts Systems Generation II efforts, Phase II. Continue work in evaluating new materials for armor system applications.

- (U) ($2,926) Advanced Amphibious Logistics: Select and award BAA contracts in support of technology roadmap. Complete Recording and Tracking system configuration integration. Complete Expeditionary Engineering Technologies system concepts. Begin concept validation. Complete validation of Amphibious Bulk Liquid Technology system configuration. Continue developing technology concepts for sea-basing cargo transfer technologies. Initiate technology support efforts for Maritime Prepositioning Force operations technology. Solicit BAA responses for demonstratable system components to support concepts and follow-on Marine Corps ATD efforts in PE 0603640M.

- (U) ($1,849) Targeting Sensors: Complete advanced testbed development. Transition Gated Laser Video System to Marine Corps ATD (PE 0603640M). Start development of sensor registration, sensor orientation, multiple sensor data fusion, and sensor communications and tactical target tracking in near perfect real-time tactical IFC System. Continue to exploit emerging technology through the BAA process.

- (U) ($714) Weaponry: Transition Mobile Automatic Fire Support System auto-loader to Program Manager. Develop concepts for inexpensive, autonomous and guided, mortar rounds for the auto-load system. Analyze technology deficiencies, and continue to nullify those deficiencies through the BAA process.

- (U) ($279) Modeling and Simulation: Define and develop environment features of the littoral battlespace (land, air, sea) for applications in virtual prototyping and the advanced training device. The environmental features

will include the various sensor media being exploited in other Exploratory Development efforts. Explore new concepts using legacy and emerging Navy and Marine Corps communications assets to support at sea construction and virtual training.

4. (U) FY 1997 PLAN:

- (U) ($2,648) Surface Mobility: From technology roadmap of future surface mobility assets, select and award BAA contracts for high pay-off thrust areas. Continue detailing sustainment concept of integrating advanced development systems and components. Analyze synergistic effect of the high technologies and determine operational suitability. Transition new systems and demonstrate in Marine Corps ATD (PE 0603640M). Continue Corrosion Control and transition promising materials and processes to Marine Corps ATD.

- (U) ($2,687) Mine Detection: Complete tests of alternate sensor device for mine detection in adverse environments to quantify performance, analyze remaining technology shortfalls and solicit BAA responses to correct. Initiate transition to Marine Corps ATD (PE 0603640M) to start in FY 1998/FY 1999. Continue development of technologies to extend the standoff range for multi-spectral mine detection and improved performance for buried mine detection.

- (U) ($2,887) Mine Countermeasures: Complete development and testing of countermeasures techniques. Demonstrate countermeasures capability in field environment. Complete modeling and simulation.

- (U) ($2,591) MAGTF C4I: Continue efforts in developing OTH Communications capability for landing forces. Complete prototype tactical simulator and demonstrate. Develop C4I information transfer and management architectural specification based on Marine Corps requirements and technology search. Initiate Phase II collaborative planning and decision making effort. Identify computer hardware technology and investigate ability of improving speak-easy radio technology for man-portable scenarios.

- (U) ($1,394) Survivability: Continue development and integration of Electro-Magnetic Armor systems. Continue tactical decal work with specific application, test and evaluation. Continue false target generator efforts with system integration into overall vehicle system. Continue Advanced Land Concepts System Generation II, Phase II participation. Continue new material armor evaluation and optimization.

- (U) ($2,903) Advanced Amphibious Logistics: Complete configuration integration for Amphibious Bulk Liquid

technologies and Expeditionary Engineering technologies. Complete technology system concepts and begin concept validation for sea-basing cargo transfer technologies. Develop technology concepts for Maritime Prepositioning Force operations technology.

- (U) ($1,890) Targeting Sensors: Continue to demonstrate sensor registration, sensor orientation, multiple sensor fusion, and communication links components for real-time tactical IFC System. Develop concepts for remotely programmable adaptive sensors. Continue to exploit technology through the BAA process.

- (U) ($772) Weaponry: Demonstrate components of lightweight, close-in Air Defense Systems. Demonstrate components of autonomous-guided, auto-loader mortar rounds. Continue to exploit emerging lightweight weapons technology through the BAA process.

- (U) ($268) Modeling and Simulation: Continue development of environment features of the littoral battlespace. Explore new concepts using legacy and emerging Navy and Marine Corps communications assets to support at sea construction and virtual training.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	16,847	17,783	XXX	XXX
(U) FY 1995 Appropriated:	XXX	17,783	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	+158	-1,009	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	17,005	16,774	17,623	18,040

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 funding changes due to end-of-year execution adjustments ($158K). FY 1995 funding changes due to congressional undistributed reductions for: Consulting Services ($-96K); University Research ($-684K), and Travel ($-25K); and an assessment for Small Business Innovative Research ($-204K).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602131M
PROGRAM ELEMENT TITLE: Marine Corps Landing Force Technology

(U) Schedule: This FY 1995 funding decrease delayed the schedules for Mine Countermeasures and MAGTF C4I by 12 months.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) 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 0603606A (Improved Dispersed Explosives Technology)
(U) PE 0603619A (Improved Dispersed Explosives Technology)
(U) PE 0603611M (Marine Corps Assault Vehicles)
(U) PE 0603635M (Marine Corps Ground Combat/Support System)
(U) PE 0603640M (Marine Corps Advanced Technology Demonstrations)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0603782N (Shallow Water Mine Countermeasures Demonstrations)
(U) The Army, Air Force, and Navy Technology Base Programs are monitored by Marine Corps Project Officers through their counterparts in those organizations to ensure that no unwarranted duplication exists.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Space and Electronic Warfare (SEW) Technology	50,471	60,546	60,090	65,540	70,022	76,996	79,579	81,725	CONT.	CONT.

A. (U) Mission Description and Budget Item Justification: This PE supports future command, control, communications (C^3) and surveillance systems for surface, air, and space platforms for Naval Warfare. This program develops C^3 technology necessary for the delivery of critical tactical information to decision makers in a timely manner for the transmission, fusion, and management of information between the warrior, the command center, and National Command Authority. Technology developments include areas of connectivity, networking, distributed computer processing, information management, tactical data quality, decision aids and navigation. The major goal is to provide the Navy with the capacity to interconnect government and commercial telecommunication assets in a worldwide network that is responsive to regional theater challenges to the National interest. Surface/Aerospace Surveillance technology development supports theater surveillance, Battle group area surveillance, ship self defense, air battle space surveillance and surveillance to support strike missions. Both C^3 technology and surveillance technology are related to the Joint Mission Areas of Joint Strike Warfare, Littoral Warfare, Joint Surveillance, and Space-Electronic Warfare-Intelligence (SEW/I). Specifically: Joint Strike efforts address technology issues in real-time targeting and Battle Damage Assessment (BDA). Programs include mission planning, en route C^3, precision targeting and BDA. Littoral Warfare efforts address issues in air and surface battlespace and develops technology for ship self-defense, cooperative engagement and power projection systems including ship-based and off-ship radar and electro-optic/infrared (EO)/(IR) sensors, connectivity and robust enduring communications. Joint Surveillance efforts address issues of real-time targeting, connectivity, counter-jamming and deception. Program includes multi-platform radar and IR sensors for detection, identification, tracking, damage assessment, BDA, and timely distribution of surveillance information to all levels of command. Space-Electronic Warfare-Intel. (SEW/I) efforts address information warfare issues. Programs include sensors and C^3 to provide timely situation awareness of the total battlespace and indications and warning of threat operations and intentions.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

(U) These efforts support the Joint Warfare Strategy "Forward... From the Sea". Programs are jointly planned in the Reliance process with the Air Force, Army and other agencies through technology panels of the Joint Directors of Laboratories (JDL).

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the Exploratory Development Budget Activity because it investigates technological advances with possible application towards solution of specific Naval problems short of a major development effort.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($19,039) RADAR TECHNOLOGY:

(U) Completed land target portion of Space Time Adaptive Processing (STAP) for Mountain Top Test Radar System. The STAP has demonstrated significant increases in radar capability to suppress countermeasures and background clutter during surveillance of small targets in land backgrounds.
(U) Demonstrated High Frequency radar detection and track of low altitude airborne targets at greater than twice the normal detection range of horizon limited shipboard sensors. This technology has the potential for doubling the reaction time of the ship self defense systems against low altitude anti-ship missiles.
(U) Completed design and initiated system development with industry of multi-channel, coherent wideband radar for ship self defense operations. The multi-channel radar is expected to provide horizon detection and consistent tracking of low altitude, high-speed targets in extreme clutter and multipath conditions.

- (U) ($13,883) EO/IR TECHNOLOGY:

(U) Completed Ship Multi-Color Infrared Search and Track (IRST) system performance analysis and focal plane array (FPA) design optimization for detecting and tracking low contrast, low altitude targets at the ship's horizon.
(U) Completed devleopment (via contract to Hughes Aircraft) of the Indium Antimonide medium-wavelength infrared (MWIR) scanning FPAs for IRSTs. Developed alternate sampling technique for second generation FPA design that permits their dual use in forward-looking infrared systems (FLIRs). The alternate sampling design has been

incorporated into Advanced Research Projects Agency's (ARPA) long-wavelength infrared (LWIR) IRFPA Program.
(U) Completed baseline multi-dimensional IRST algorithms for the detection and tracking of low-observable subsonic and supersonic anti-ship missile threats. The algorithms were jointly developed by the IRST Signal Processing Working Group of the Joint Directors of Laboratories Technology Panel for Sensors.
(U) Completed the beta version of the IR tool workstation software. The IR tool workstation has three primary purposes: (1) performance modeling of shipboard and airborne IRST systems, (2) analysis of simulated and real IRST scenes with and without targets, and (3) development of detection and processing algorithm streams.
(U) Completed the multi-national Marine Aerosol Properties and Thermal Imager Performance (MAPTIP) trials. MAPTIP was organized by NATO AC/243 Panel 4, Research Study Groups 5 and 8. The trials provided calibrated data to improve and validate vertical marine aerosol models for electro-optic propagation over the ocean and to enable assessment of the performance of thermal imaging sensors in a variety of target and environmental conditions.

- (U) ($2,494) C^3 SYSTEM ARCHITECTURE:

(U) The three Services have agreed to jointly develop a Theater-Extension Network (TENet). To do this, a tri-service testbed was developed to evaluate standard protocols and demonstrate the capability to interoperate. The testbed will link Air Force Rome Laboratories, Army Communications Electronics Command, and the Naval Command, Control, and Ocean Surveillance Center (NCCOSC/NRAD) with commercially-based high-data-rate links. The first demonstration will show capability to communicate at 1.544Mbps (commercial T1 rate). Military communication networks differ from commercial networks in that they require more elaborate management capability to control network configuration in response to jamming, failed links, failed routers and bridges, changes, additions and deletions to addresses in order to accommodate network members such as aircraft and submarines that enter and depart a network, etc. In addition, information must be derived on network status, usage and available capacity. Finally, the issue of incorporating standard high data rate protocols such as Asynchronous Transfer Mode (ATM) in a networking involving Radio Frequency (RF) links is being addressed.
(U) Two quasi-standards are in use, simple network management protocol (SNMP) based on internet standards, and common management internet protocol (CMIP) developed by the International Standards Organization (ISO). Eventually, a common, open, network management architecture adopted by all Services will be developed.

(U) Extension of the networking protocols to submarine platforms to accommodate their entry into and exit from battlegroup networks require further modification of the network protocols. Simulations of such modifications were successfully conducted to investigate the network concepts for disadvantaged nodes as represented by submarine platforms.

- (U) ($7,600) COMMUNICATIONS:

(U) Installed equipment onboard a submarine to test the on-hull extremely-low-frequency (ELF) antenna, determined technology options for Super High Frequency (SHF) antennas on a submarine, and conducted a single-antenna field test of the ELF corona antenna that would provide the Navy with a transportable ELF station that would significantly increase the earth coverage of ELF transmissions to submarines.
(U) Demonstrated a laboratory breadboard of a 3x3 aircraft antenna-array panel covering the 0.5 to 2.0 Ghz band, conducted a laboratory demonstration of the advanced, miniaturized ultra-high frequency (UHF) airborne communications relay, and initiated an investigation into airborne networking technology that would provide dynamic network membership in battlegroup networks for naval aircraft as a new operational capability.
(U) Constructed an SHF multifunction phased array antenna containing two independent antenna beams. Two beams provide high data rate communications and radar functions simultaneously. Developed channel equalization algorithms for higher data rate UHF propagation over very dynamic over-water propagation paths. Successfully conducted two at-sea demonstrations of a newly developed LAMPS Mark III high data rate, full duplex communications system providing up to 3.1 Mbps, which is orders of magnitude greater than current ship-to-ship capability, making possible new communications services to the fleet such as video conferencing, white boarding, file transfer, and shipboard LAN to LAN connectivity.
(U) Completed investigation into optimum jamming techniques against high-frequency (HF) communications systems, and developed laboratory model of an electron bombarded semiconductor (EBS), HF power amplifier and demonstrated operation at 300 watts using two diodes. Further development and tests have as an objective the demonstration of a 10,000 watt transmitter capability suitable for airborne as well as ship and land mobile uses needed in joint force operations.

- (U) ($5,800) COMMAND SUPPORT:

(U) Implemented, tested and transitioned the Express Transfer and Remote Data Access (RDA) software protocols to National Institute of Science and Technology (NIST) and commercial standards organizations for consideration as national standards for distributed real-time computing systems and for remotely accessing data from distributed nodes.
(U) Modified and evaluated a new software architecture called THETA that provides a trusted, secure distributed operating systems for a heterogeneous computing environment.
(U) Developed and simulated algorithms that generate optimized interdependent routing for joint mission force-level planning of strike missions.
(U) Developed, demonstrated and transitioned image compression software and an advanced image exploitation decision aid to the Joint Maritime Command Information System (JMCIS); a distributed heterogeneous computer operating system for multiple mission planning systems; and joint courses-of-action selection software tool kit to US Space Command (USPACOM) Theater Crises Management Systems for supporting operational and logistics planning during the execution phase of a strike.

- (U) ($1,655) NAVIGATION:

(U) Performed critical design review for the shipboard fiber optic gyro program, performed lab evaluations to determine performance relative to design goals, performed real-time at-sea testing of the absolute velocity measuring concept, conducted flight test of the stellar-inertial navigation system in a joint program with the Air Force, and determined impact of error-correcting coding on video bandwidth-compression algorithms in an effort to determine optimized video compression algorithms for the military environment.

2. (U) FY 1995 PLAN:

- (U) ($22,612) RADAR TECHNOLOGY

(U) Continue:
- (U) Development of radar survivability waveforms and power management technology to reduce radar vulnerability to anti-radiation missiles.

- (U) Development of compact multi-mode radar (Synthetic Aperture/Inverse Synthetic Aperture/Moving Target Indicator) for airborne surveillance and identification of land and ocean surface targets.
- (U) Design of ultra-wideband space fed phased array for multi-target tracking while scanning.
- (U) Signal processing and algorithms to enable fleet AN/APS-137 radars to automatically identify ship targets.
- (U) Design of voltage controlled diode affordable phased array (goal of 70% reduction in phased array cost).
- (U) Development of STAP for Mountain Top Phase II experiments. STAP technology will significantly reduce effects of jamming and clutter on radar performance in detecting low altitude targets in land and sea background environments.

(U) Complete:
- (U) Fabrication and acceptance testing of brassboard multi-channel coherent wideband radar for ship self-defense evaluation.
- (U) Evaluation of ship self defense engagement radar breadboard against reduced cross section targets.
- (U) Transition high frequency (HF) radar technology to HF Surface Wave Radar Advanced Technology Demonstration (ATD). The ATD will assess the over-the-horizon detection and tracking capability of HF radar in an at-sea shipboard operational environment.

• (U) ($13,706) EO/IR TECHNOLOGY

(U) Continue:
- (U) Continue design and performance assessment of signal processor architecture and algorithms for Multi-Color shipboard infrared search and track sensor to enable rapid low false alarm rate detection and tracking of low altitude, low contrast targets at the sensor horizon (joint with array).
- (U) Development of Shared aperture (TV, Forward Looking Infrared, IRST) EO Sensor for surveillance and targeting of air and surface targets from fighter/attack multi-mission aircraft.
- (U) IR background measurement and modeling program, emphasizing multi-nation assessment and validation of environmental effects models developed under this program.
- (U) Developement of multi-hyper spectral EO sensor for airborne surveillance of land targets (joint with USAF).

- (U) Development of integrated active/passive IR sensor for surveillance, precision track and target recognition.
- (U) Infrared measurement and analysis of cloud wake phenomonology from high altitude and space platforms to determine detectability of surface ships transmitting beneath cloud cover (Joint United States, United Kingdom (UK) with Advanced Research Projects Agency (ARPA) and National Aeronautics and Space Administration (NASA)) participation.
- (U) Development and initial, performance testing of precision electro-optical interferometer. Initial testing will include imaging of stellar and orbiting objects from Sowell observatory in Flagstaff, Arizona.

(U) Complete:
- (U) Contract (SAGEM of France) development of stabilized multi-aperture optical director for ship IRST applications.
- (U) Installation of second generation mid and long wave focal plane arrays in ship IRST brassboard and performance testing and characterization in a maritime environment.

• (U) ($4,180) MULTI-SENSOR TECHNOLOGY

(U) Continue:
- (U) Design of compact multi-sensor surveillance system for airborne surveillance and targeting with emphasis on multi-platform utility.
- (U) Development of technology to enable sensor integration, adaptive resource management and data fusion.

(U) Complete:
- (U) Multi-sensor architecture definition and commercial off-the-shelf (COTS) sensor availability assessment.

• (U) ($3,077) C^3 SYSTEM ARCHITECTURE:

(U) Because of the unique features of military communications networks such as those mentioned earlier, there are no commercial networks that can be procured and installed directly into battlegroup networks. The Navy needs to develop military communications networks that will be compatible and allow for connectivity to fixed commercial networks. A major objective is much higher data rates than are available in current narrow band Navy

communications systems. The plan is to demonstrate the capability to communicate at T3 rates (45 Mbps) over the Tri-Service testbed. Further downstream, investigations will be conducted into extending the data rate to OC-3 rates (155 Mbps).

(U) Multicast is the transmission of messages from one to many addresses. It is used extensively by the Navy. Present standard protocol suites such as Transmitter Control Protocol/Internet Protocol (TCP/IP) do not support multicast, and there is no standard protocol package being developed for commercial application. The plan therefore is to develop an enhanced standard multicast protocol for military networks and demonstrate it over the Tri-Service testbed.
(U) Apply the submarine network simulation model to the Navy Communications Support System (CSS) architecture, which is the eventual transition program.

- (U) ($9,299) COMMUNICATIONS:

(U) Significant improvements in military communications capabilities need to be developed to exploit commercial communications advances, particularly in boosting the data-rate capability to the commercial T1 rate, and in developing more capable antennas appropriate for military aircraft, ships and submarines. Antenna development must address the proliferation of antennas on military platforms and the potential for mutual interference. Additionally, antennas must be developed to cover the SHF band (nominally 2-20 Ghz) which previously has not been used for military communications. Not to be overlooked is the need to develop counter-communications capability that would deny or disrupt enemy communications.

(U) Continue development of key communications technologies for air, ship and submarine platforms.
- (U) Conduct at-sea measurements and demonstration of the submarine on-hull ELF antenna, perform two-antenna field tests of the ELF corona antenna array, and initiate field tests of a submarine SHF antenna that has potential for achieving a significant increase in data rates and an associated reduction in time required for transfer of Tomahawk mission data updates for joint strike operations.
- (U) Demonstrate a laboratory model of a reconfigurable feed network for the 3x3 aircraft antenna array panel, investigate Microwave Monolithic Integrated Circuit (MMIC) and silicon integrated circuit designs for the advanced miniaturized airborne communications relay, and adapt network protocols developed for the ship community to the air platform to accommodate a strongly connected transient network user that would make battlegroup networks interoperable with tactical data links for joint strike operations.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

- (U) Complete testing of the SHF multifunction antenna array and conduct tests of optical control for the antenna array, conduct on-air tests of the higher data rate UHF algorithms to acquire over-water propagation statistics and establish baseline performance using simple modulation techniques, and creation of a more advanced high data rate LAMPS Mark III capability that would allow line-of-sight, full duplex capability up to the T3 (45 Mbps) rate.
- (U) Make the HF jamming techniques data base compatible with the standard Navy TAC III computer, develop an automatic device to identify foreign languages, and transition the HF EBS power amplifier to a shipboard communications/counter-communications system.

• (U) ($6,072) COMMAND SUPPORT:

(U) Demonstrate Express Transport Protocol (XTP) integration with the real-time MACH distributed operating system.
(U) Integrate the THETA distributed operating system with the High Grade Security (HIGS) testbed for test and evaluation.
(U) Complete and transition Anti-Submarine Warfare (ASW) Quality Monitoring System which allows JMCIS to determine data quality and relevance of tactical messages and target tracks to speed up and facilitate decision making.
(U) Develop jointly with the Air Force, based on an evolving national standard, a Common Object Request Broker Architecture (CORBA) technology allowing military implementation of distributed object-oriented data bases.
(U) Continue development of optimized multiple interdependent routing algorithms for strike warfare that incorporate joint strike/weapon capability against non-mobile targets and demonstrate graphical user interface (GUI) for routing module.
(U) Demonstrate 3-node distributed planning algorithm over a network using weapon-target algorithm to determine proper target assignments.
(U) Demonstrate intelligent object oriented image and text retrieval tools and active database to support collaborative information management.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

- (U) ($1,600) NAVIGATION:

  (U) Complete the shipboard fiber optic gyro development and transition to the NAVSEA 6.3 ship gyrocompass program, develop the design concept for a shipboard infrared stellar-inertial navigation system, test and evaluate the superconducting gyro design for improved accuracy over conventional ring-laser gyros, and conduct simulation of video-compression algorithms with encoding for high noise environments typical of military operations as compared with the commercial environment.

3. (U) FY 1996 PLAN:

- (U) ($22,679) RADAR TECHNOLOGY:

  (U) Continue:
  - (U) Field test of Radar Survivability/Counter Anti-Radiation Missile (ARM) Waveforms in a Low Probability of Intercept Radar test bed to assess level of immunity to anti-radiation homing seekers.
  - (U) Development of Compact Multi-Mode Radar Synthetic Aperture Radar/Moving Target Indicator/Inverse Synthetic Aperture Radar (SAR)/(MTI)/(ISAR) for manned and unmanned aircraft for Ocean and Land Surveillance.
  - (U) Field test of Ultra-Wideband Radar System for ship self defense against high speed low observable missiles.
  - (U) Development of scale model Ultra-Wideband Space Fed Phased Array for multi-target tracking while scanning.
  - (U) Integration and testing of Horizon Search, Track and Engagement Radar with Ship Self Defense Combat System to enable rapid engagement of anti-ship missiles.
  - (U) Development of ISAR improvements for automatic ship classification for fleet AN/APS-137 radar upgrade.
  - (U) Development of Voltage Controlled Diode Affordable Phased Array (goal of 70% reduction in phased array cost).
  - (U) Development of Diamond Semiconductor highly efficient Radar transmitter (goal of 70% efficient transmitter vice 20% efficiency with current technology).

(U) Complete:
- (U) Space Time Adaptive Processing for Airborne Early Warning (AEW) Radar to provide effective operation in dense clutter and jamming.
- (U) Lab Testing of Two Dimensional Air Target Identification Algorithms. To be integrated with AN/APG-71 radar for flight testing.
- (U)Wideband AEW Radar Testbed integration to enable evaluation of concepts for next generation AEW Radar.
- (U) Initiate:
- (U) Roof Top Testing of Wideband AEW Testbed Radar to assess wideband performance against real targets.
- (U) Integration of Two Dimensional Air Target Identification Algorithms in AN/APG-71 Radar Signal Processor for subsequent flight tests (Joint with United States Air Force (USAF)).

• (U) ($13,019) EO/IR TECHNOLOGY:

(U) Continue:
- (U) Real-Time Signal Processor and Algorithm development for Multi-Color Shipboard Infrared Search and Track (IRST) to enable rapid low false alarm rate detection, track of low altitude targets at the sensor horizon (Joint with Army).
- (U) Field and Flight Testing of Shared Aperture (TV, Forward Looking Infrared (FlIR), IRST) EO Sensor for Fighter/attack aircraft surveillance and targeting.
- (U) IR background measurements and modeling program including IR Background Model(s) Validation with North Atlantic Treaty Organization (NATO) and TTCP Nation Participation.
- (U) Development of Multi/Hyper Spectral EO Sensor for Airborne Surveillance of Land targets (Joint with USAF).
- (U) Development of integrated active/passive IR sensor for surveillance, ranging and target recognition.
- (U) IR measurement of cloud wake phenomenology from Hi-altitude platforms to determine detectability of surface (ship) targets, transitting beneath cloud cover. (Joint United States (US), United Kingdom (UK)) with Advanced Research Project Agency (ARPA) and National Aeronatics Space Administration (NASA) participation.

(U) Complete:
- (U) EO Interferometer at Lowell Observatory for precision imaging of aircraft and orbiting objects.
- (U) Laboratory/land testing of ship Multi-Color IRST to quantify performance in a Marine environment prior to at sea trials.
- (U) IR Sensor Performance Prediction Decision Aid Workstation for fleet use.
- (U) Analysis of Initial Cloud Wake phenomenology experiments (Joint with U.K.)

(U) Initiate
- (U) Joint US/UK sea trials of ship Multi-Color IRST (British Frigate).
- (U) Development of flyable calibrated Multi-Spectral Radiometer IR Sensor for IR background and target measurements.

- (U) ($3,361) MULTI-SENSOR TECHNOLOGY:

(U) Continue:
- (U) Development of Compact Multi-Sensor (Multi-Mode Radar, EO, ESM) System for Unmanned Air Vehicle (UAV) and manned aircraft surveillance and targeting. The UAV Joint Program Office (JPO) has incorporated the output of this project in their sensor payload roadmap for FY 1996.
- (U) Sensor Integration and Data Fusion Technology for Airborne Surveillance of land areas.

- (U) ($3,201) C3 SYSTEM ARCHITECTURE:

(U) Develop the capability to increase data rates over the Tri-Service testbed to OC-3(155Mbps).
(U) Apply the submarine network simulation model to specific network protocol suites, such as the Minimum Coverage Approximation/Handoff Assigned Multiple Access (MINCAP/HAMA) and Enhanced Link 16, to establish a performance baseline for submarine participation in battlegroup networks, a capability nonexistent today.

- (U) ($10,055) COMMUNICATIONS:

(U) Continue development of key communications technologies for air, ship and submarines.
- (U) Complete at-sea measurements of the on-hull ELF submarine antenna, continue field tests of the corona-mode ELF antenna, investigate extending the frequency range of submarine low-profile antennas into the UHF

band as a means of increasing data rates, and assess the suitability of novel as well as known SHF antenna designs for submarine deployment, taking into consideration link analysis requirements, electrical and mechanical performance, and housing and deployment requirements.

- (U) Perform analysis to extend the aircraft antenna array design to a conformal array for curved surfaces, considering both slots and dipole antenna elements, fabricate breadboards of the miniaturized airborne communications relay to verify the MMIC circuit designs and performance, and determine applicability of submarine communications network protocols to the aircraft platform.
- (U) Complete testing of the optically controlled antenna and explore transition potential to aircraft platforms, investigate the feasibility of employing Frequency Selective Surfaces (FSS) for composite masts in order to reduce the number of antennas aboard ships, assess alternative bandwidth efficient modulation formats for use in maritime UHF line-of-sight communications, explore the use of existing commercial modems that incorporate bandwidth efficient modulations and adaptive signal processing techniques, and modify the existing LAMPS Mark III ships to permit video teleconferencing using only the omni-directional LAMPS Mark III antenna, thereby eliminating the need to maintain positional knowledge of teleconferencing partners.
- (U) Develop an HF jammer processor to aid the operator in making timely decisions concerning optimum frequencies for jamming specific targets, interference effects with own communications, propagation conditions etc., and develop algorithms for speaker recognition.

- (U) ($6,125) COMMAND SUPPORT:

(U) Demonstrate and transition Strike Routing Module into 6.3 Real-time Support program (PE 0603794N).
(U) Verify and report out of a tested approach to perform fast, complex simulations of mission force level planning.
(U) Initiate task for developing interdependent multiple search missions for mobile critical targets.
(U) Initiate requirements analysis for virtual simulation and visualization taking into account sensor placement over terrain and weather effects during strike missions.
(U) Complete and transition image/text exploitation and retrieval tools, CORBA-compliant distributed computing to 6.3 ATD, Portable C4I for the JTF, and distributed security system to a selected operational command site for evaluation.
(U) Integrate high-performance computing infrastructure and resource management software into a heterogeneous distributed computing environment.

- (U) ($1,650) NAVIGATION:

(U) Fabricate a feasibility model of a shipboard infrared star tracker for shipboard application, perform data reduction and analysis of test results of the superconducting gyro, and transition the video bandwidth-compression algorithms to the JTIDS(Joint Tactical Information Distribution System) joint-service program.

4. (U) FY 1997 PLAN:

- (U) ($23,815) RADAR TECHNOLOGY:

(U) Continue:
- (U) Development of compact multi-mode radar (SAR/MTI/ISAR) for Ocean and Land Surveillance from manned aircraft and UAV's.
- (U) Ultra-Wideband space fed phased array (Scale Model of 8x8 elements).
- (U) Performance testing of horizon search, track and engagement radar integrated with ship self defense combat system in a high speed low altitude target environment.
- (U) Development of voltage controlled diode affordable phased array.
- (U) Development of diamond Semiconductor efficient Radar Transmitter.
- (U) Laboratory tests of wideband AEW testbed radar in simulated, clutter, counter measure, and target environments.
- (U) Integration and validation of two dimensional Air Target Identification technology in AN/APG-71 radar.

(U) Complete:
- (U) Field Test of Ultra-Wideband radar system against targets of varying cross section and flight regimes.
- (U) Transition automatic ship classification technology to Naval Air Systems Command for AN/APS-137 upgrade.

- (U) Initiate:
- (U) Joint Program with USAF to add terrestrial Inverse Synthetic Aperture Mode and moving target image processing to existing SAR Radar System (JSTARS and AN/APG-76).
- (U) Development of breadboard hardware VHF/UHF Stepped Frequency Ultra Wideband Radar Technology for concealed target exploitation.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

- (U) ($14,503) EO/IR TECHNOLOGY:

(U) Continue:
- (U) Development of real-time signal processor for Multi-Color shipboard IRST.
- (U) Flight Tests of shared aperture (TV/FLIR,IRST) EO Sensor.
- (U) IR background and targets measurement, analysis and modeling program (Joint with USAF, Army).
- (U) Development of Multi/Hyper Spectral EO Sensor for Airborne Surveillance of land targets (Joint with USAF).
- (U) Development of integrated active/passive IR Sensor for surveillance, ranging and target recognition.
- (U) IR measurements of cloud wake phenomenology from high-altitudes platforms.
- (U) Development of flyable calibrated Multi-Spectral radiometric IR sensor for background and target measurements.

(U) Complete:
- (U) Joint US/UK sea trials of ship Multi-Color IRST.
- (U) Validation of IR background models. Transition to fleet for use in decision aids use and to Government, academic and industrial R&D facilities to aid in development of IR sensor and signal processing developments.

(U) Initiate:
- (U) Development of distributed Aperture Infrared Imaging/Search and Track Sensor for high-resolution target detection and passive ranging.
- (U) Exploitation of EO discriminates for non-imaging, unresolved targets detection and recognition.

- (U) ($4,282) MULTI-SENSOR TECHNOLOGY:

(U) Continue:
- (U) Development of Compact Integrated Multi-Sensor System for UAV and manned aircraft surveillance, targeting and BDA.
- (U) Development of Data/Sensor fusion architecture for multi-sensor surveillance system.

(U) Complete:
- (U) Data/Sensor Fusion Processor Design.

(U) Initiate:
- (U) Procurement of Commercial Off-The-Shelf (COTS) sensors for integrated multi-sensor system testbed.

- (U) ($3,621) C3 SYSTEM ARCHITECTURE:

(U) Conduct tests of the Tri-Service testbed at data rates up to OC-3 (155 Mbps). Investigate extension to data rates beyond OC-3.
(U) Develop modifications to protocols specifically suited to the submarine as a disadvantaged node. Employ the submarine network simulation model to assess the modifications.

- (U) ($11,121) COMMUNICATIONS:

(U) Continue development of key communications technologies for air, ship and submarines.
- (U) Transition the on-hull ELF antenna to the Submarine Integrated Antenna System engineering development program, fabricate the more promising low-profile submarine antenna for testing and demonstration, transition the corona-mode ELF antenna to the Navy ELF program, and assess the more promising submarine SHF antenna and develop brassboard for testing.
- (U) Conduct experiments to verify analyses of conformal antenna arrays on curved surfaces, perform simulations and testing of aircraft networking protocols, and transition an automated message distribution system to naval C3 aircraft.
- (U) Complete development of bandwidth-efficient modulations for UHF communications and transition to the Communications Support System program, and investigate chaotic synchronization of nonlinear circuits for improved covert communications.
- (U) Conduct field tests and demonstrations of the HF jammer processor on airborne and ship platforms, and complete development of the language/speaker recognition processor which is increasingly needed as the military threats shift from the Soviet Union to countries of the Third World.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

- (U) ($6,548) COMMAND SUPPORT:
  (U) Continue work on mobile land targets decision aid.
  (U) Continue work on virtual world simulation for mission planning and targeting.
  (U) Integrate and demonstrate a secure, CORBA-compliant Trusted Heterogeneous Architecture (THETA) in a distributed computing environment.

- (U) ($1,650) NAVIGATION:

  (U) Conduct lab tests of the ship IR star tracker using star simulators to verify acquisition and tracking capability, develop a transition strategy for the superconducting gyro technology, and investigate gravity measurements for passive submarine terrain avoidance that make possible GPS-independent underwater navigation.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	17,905	21,099		
(U) FY 1995 Appropriated		21,099		
(U) Adjustments from Appropriated/PRESBUDG:	+32,566	+39,447		
(U) FY 1996/97 OSD Budget Sumit:	50,471	60,546	60,090	65,540

(U) CHANGE SUMMARY EXPLANATION:

- (U) Fund adjustments in FY 1994 are for: End-of-Year execution (-1,017) to reflect below threshold reprogramming and Comparability Adjustment(+33,583). Fund adjustments in FY 1995 are for; Comparability Adjustment (+40,761); Congressional Undistributed Cuts for University Research (-1,074); FFRDC Reductions (-121); Travel (-88); and, an assessment for Small Business Innovative Research (-31).

- (U) Schedule: None

- (U) Technical: None

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This program adheres to Tri-Service Reliance Agreements with oversight provided by the JDL. Work in this PE is related to and fully coordinated with efforts in the following PEs:

(U) PE 0601153N (Defense Research Science)
(U) PE 0601102F (Defense Research Science)
(U) PE 0602101F (Geophysics)
(U) PE 0602102F (Materials)
(U) PE 0602702F (Command, Control and Communications)
(U) PE 0603428F (Space Subsystems Technology)
(U) PE 0603741D (Air Defense Initiative)
(U) PE 0603789F (C3I Technology Development)
(U) PE 0601101F (In-House Laboratory Independent Research)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602712E (Materials and Electronics Technology)
(U) PE 0602782A (Command, Control and Communications (C3) Technology)
(U) PE 0603109F (Integrated Aircraft Avionics)
(U) PE 0603203F (Advanced Avionics for Aerospace Vehicles)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603253F (Advanced Avionics Integration)
(U) PE 0605502F (Small Business Innovation Research
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602709A (Night Vision Technology)
(U) PE 0603203F (Advanced Avionics for Aerospace Vehicles)
(U) PE 0603253F (Advanced Avionics Integration)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0603710A (Night Vision Advanced Technology)
(U) PE 0602782A (Command, Control and Communications Technology)
(U) PE 0602702F (Command, Control Communications)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602232N
PROGRAM ELEMENT TITLE: Space & Electronic Warfare (SEW) Technology

(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0603794N (C3 Advanced Technology)

(U) Advanced Technology Transition is in accordance with the on-going Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Readiness, Training and Environmental Quality Technology	41,038	50,089	40,511	42,122	43,988	46,788	48,150	49,553	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides generic enabling technologies in support of all Joint Mission Areas/Joint Support Areas (JSA), in particular the JSAs for Readiness; Manpower & Personnel; and Shore Training. These JSAs encompass requirements for manning, operating, and maintaining fleet assets, and for providing the necessary training, facilities, and equipment to maintain operating forces in a high state of readiness. The PE also supports the Joint Warfare Strategy "From the Sea" as well as three of the "Top Five" Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff--in particular, capabilities related to: (a) conducting limited-objective warfare (e.g., technology for enhancing the performance of special forces personnel, aiding decision makers in highly ambiguous situations, and improving casualty care); (b) promptly engaging regional forces worldwide (e.g., technology for deployable training and mission rehearsal, and for logistics support of amphibious landings); and (c) countering weapons of mass destruction (e.g., technology for responding to chemical and biological threats). This PE encompasses the following areas:

(U) Personnel, Training, and Human Factors technologies enhance the Navy's ability to select, assign, and manage its people; to train effectively 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 in these areas responds to a variety of requirements, including: providing more affordable approaches to training and skill maintenance; 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.

(U) Medical technologies improve safety and enhance personnel performance capabilities under adverse conditions; enhance diagnosis of medical emergencies and treatment of casualties; and prevent 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 prepositioned medical supplies such as blood; providing better stress endurance/control for key personnel; and providing enhanced casualty care onboard amphibious casualty receiving ships.

(U) Logistics technologies increase operational readiness through effective management and movement of supplies ashore and at-sea, and advanced techniques for more cost-effective construction and maintenance of shore and off-shore facilities. Technology development in these areas responds to a variety of requirements, including: providing the logistic support needed to support amphibious landing; providing the diagnostic technologies that will enable the implementation of a condition-based vs. time-based maintenance philosophy; and providing a long distance logistics supply chain with short reaction time.

(U) This PE also seeks to strengthen the educational pipeline vital for maintaining a strong technology development capability, by supporting programs at a wide range of educational institutions, including Historically Black Colleges & Universities, and other Minority Institutions. In addition, the PE provides funding for the Navy Science Assistance Program, the purpose of which is to improve the ability of the Navy's science and technology community to respond rapidly to urgent fleet needs. Programs in this PE are jointly planned in the Reliance process with the Air Force and Army via panels of the Joint Directors of Laboratories, the Joint Engineers, the Training & Personnel Systems Science & Technology Evaluation and Management Committee, and the Armed Services Biomedical Research Evaluation and Management Committee.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT 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:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($14,586) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - (U) Initiated:
    - -- (U) evaluation of experimental tools for facilitating collaborative tactical situation assessment by the Space and Electronic Warfare Commander and his team.
    - -- (U) development of improved tactile and force sensors and displays for deployable training devices and

for enhanced control of teleoperated systems.

- (U) Continued:
  - -- (U) development and evaluation of an experimental system designed to enhance human decision making performance under conditions of high stress and ambiguity.
  - -- (U) development and evaluation of active sonar simulation techniques to improve training for shallow water antisubmarine warfare (ASW) and mine detection and recognition.
- (U) Completed:
  - -- (U) development of personnel strength forecasting techniques to improve manpower planning and policy decisions, thereby improving the Navy's ability to manage force reductions with minimal impact on readiness.
  - -- (U) development of high-performance special-purpose simulation co-processor concepts to reduce the costs of high fidelity training devices.
  - -- (U) development of advanced data visualization techniques for rapid review of large volumes of undersea surveillance data, to reduce analysis time, facilitate manpower reductions and improve ASW decision support.

• (U) ($15,807) MEDICAL AND CHEMICAL BIOLOGICAL DEFENSE (CBD) TECHNOLOGY:

- (U) Initiated:
  - -- (U) simulated agent destruction test by microwave plasma device for ship CBD collective protection systems.
  - -- (U) Naval battle analyses including CB warfare for improved threat analysis capability by including CBD threats.
  - -- (U) in-vivo characterization of the immune system's response to prospective therapeutic reagents for enhanced casualty care.
- (U) Continued:
  - -- (U) development of Dihydroxy Epi-Aldosteroric (DHEA), a natural steroid, as an immunoprotectant for prevention of sepsis.
  - -- (U) post-attack shipboard chemical hazard analysis to improve operational capabilities in CBD environment.
  - -- (U) hardware development of micromachined chemical, biological sensor for detection of single molecule.
- (U) Completed:

-- (U) development of corona chemical agent destruction device to be installed in ship CBD collective protection systems.
-- (U) transition of experimental therapies for Adult Respiratory Distress Syndrome to improve casualty care.
-- (U) determination of sites of destruction of blood substitutes which will ultimately contribute to improved prepositioned blood supplies.
-- (U) toxicity trials for immune system oral adjuvant which will ultimately improve disease prevention through enhanced immunization.
-- (U) transition to industry of a prototype of a mass spectrometry device for automated quality control of recombinant proteins used in casualty treatment.

- (U) ($10,645) LOGISTICS TECHNOLOGY:
  - (U) Initiated:
    -- (U) new capabilities for quickly and accurately predicting the geo-technical characteristics of potential amphibious landing sites.
    -- (U) development of non-destructive test methodologies for piers and associated fendering.
  - (U) Continued:
    -- (U) techniques to reduce pile handling time associated with construction of expeditionary pier facilities.
    -- (U) development of new techniques and equipment to pump fuel ashore in support of amphibious landings.
  - (U) Completed:
    -- (U) integration of hose, fittings, and other components into a compact, lightweight amphibious refueling system.
    -- (U) development of an analytical model that will predict the useful life and most cost-effective design of synthetic mooring lines.

2. (U) FY 1995 PLAN:

- (U) ($18,963) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - (U) Initiate:
    -- (U) development of advanced techniques for personnel classification, based on artificial intelligence

technologies, to enhance readiness and retention by improving the Navy's ability to match individuals to jobs.
-- (U) development of mathematical modeling techniques for training resource allocation, to optimize the scheduling and management of finite Navy training assets.
- (U) Continue:
-- (U) evaluation of decision support technology and advanced team training strategies for tactical decision making in ship air defense, limited-objective warfare scenarios.
-- (U) development of computer-based dynamic visual-spatial tests that can result in improved job performance, fewer training failures, and less equipment downtime.
-- (U) evaluation of 3-dimensional audio and visual displays for improved air combat maneuvering and ASW training.
- (U) Complete:
-- (U) development of algorithms to simulate multi-element/beam sonar processing for more cost-effecive air and surface ASW training systems.
-- (U) development of techniques to identify, measure and train aircrew coordination skills in order to enhance mission effectiveness and safety.

• (U) ($16,421) MEDICAL AND CBD TECHNOLOGY:
- (U) Initiate:
-- (U) development of abzyme for removal of Rh(D) antigen from red blood cells along with scale-up and limited clinical testing of enzymatically converted type A red blood cells to ultimately contribute to improved prepositioned blood supplies.
-- (U) development of recombinant growth factors and cytokines to enhance recovery of injured blood forming and immune systems to improve casualty care.
-- (U) development of data to revise over-conservative standards for safe microwave radiation exposures which currently put all weather decks off limits, to improve operational readiness without risking occupational injury.
-- (U) development of dual-use biosensors with medical applications.
-- (U) development of prototype aircrew life support system.
-- (U) development of a therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.

-- (U) development of a chemical that enhances delivery of oxygen by blood and blood substitutes.

- (U) Continue:
  -- (U) Naval Battle Analyses including CB Warfare and Post-attack Shipboard Chemical Hazard Analysis which will improve operational capabilities in CBD environment.
- (U) Complete:
  -- (U) hardware development of micromachined chemical, biological sensor for detection of single molecule for improved fleet CBD detectors.
  -- (U) simulant agent destruction by Microwave Plasma device to be installed in ship CBD collective protection systems.
  -- (U) documentation, validation, and revision of VSLTRACK 1.5/2.0 which will be installed in joint service CBD hazard prediction models and Navy Mobile Operational Support System.
  -- (U) determination of mechanisms whereby sepsis and/or endotoxemia induces vascular tissue contractile dysfunction for improved casualty care.
  -- (U) definition of intracellular targets for growth factor modulation in hematopoietic cells for improved casualty care.
  -- (U) determination of effects of freeze-dried platelet transfusion which will ultimately contribute to improved prepositioned blood supplies.

• (U) ($14,705) LOGISTICS TECHNOLOGY:
- (U) Initiate:
  -- (U) development of an obstacle clearing vehicle that can more rapidly prepare amphibious landing sites.
  -- (U) development of the capability to predict maintenance requirements based on equipment condition, instead of time-based criteria.
  -- (U) development of anti-fouling and anti-corrosion coatings.
  -- (U) development of biosonar for operations to clear littoral areas.
  -- (U) development of Marine Environmental Research and Training Station.
- (U) Continue:
  -- (U) development of capability to examine real-time images of debris in oil lubricating systems and make decisions regarding wear or failure condition of the machinery.
  -- (U) diagnostic and modeling technology for the prediction of pier structural capacity.
- (U) Complete:

-- (U) development of a fire retardant, foam-in-place dispensing system for shipboard use to aid in protecting expensive repair parts.
-- (U) equipment design of a faster, more capable underway replenishment system for shipboard use.
-- (U) diagnostic technology to assess more accurately the structural safety of Navy heavy lift cranes.

3. (U) FY 1996 PLAN:

- (U) ($19,389) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - Initiate:
    -- (U) development of a virtual environment locomotor interface to permit the training of tasks requiring movement within large work areas.
    -- (U) development of enhanced measures of effectiveness sufficiently sensitive for use in determining how training interventions affect operational readiness.
  - Continue:
    -- (U) development of generative adaptive testing techniques which permit computer generation of new test items.
  - Complete:
    -- (U) operational evaluations of team training strategies that will minimize the adverse effects of stress on decision-making performance.
    -- (U) development and evaluation of a multi-criteria network model for optimizing assignments in the face of complex and conflicting assignment policies.

- (U) ($10,883) MEDICAL TECHNOLOGY:
  - Initiate:
    -- (U) testing of liposome encapsulated hemoglobin in combination with therapeutic agents that prevent/correct reperfusion injury in hemorrhagic models.
    -- (U) evaluation of dinitromed as a cellular cryoprotectant that eliminates the need for washing frozen blood components.
    -- (U) evaluation of therapeutic drugs/hormones that modulate body temperature in a sub-freezing cold injury model.
    -- (U) development of amiloride formula for improved perfusion of organs for transplant.

- Continue:
  -- (U) development of antibody-based enzymes for removing Rh determinant from red cells.
  -- (U) development of a therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.
  -- (U) development of bacterial endo-beta-galactosidase as a more efficient enzyme for removing A determinant from red cells.
  -- (U) evaluation of immunoregulatory monoclonal antibodies as adjuvants in inflammatory diseases.
- Complete:
  -- (U) transition to industry of oral adjuvants for prevention of mucosal infections.
  -- (U) transition to industry of DHEA immunoprotectant for use in surgery patients and casualties to prevent sepsis and promote wound healing.
  -- (U) transition to industry of a monoclonal antibody that neutralizes an immunosuppressive factor produced by casualties.

• (U) ($10,239) LOGISTICS TECHNOLOGY:
- Initiate:
  -- (U) proof-of-concept test and demonstration of best material handling and stowage concepts for ships.
  -- (U) development of methods to exploit the combined use of future state predictors and failure progression models in mechanical diagnostics.
  -- (U) development of a standard stability assessment procedure for pontoon facilities and prepare an operational guideline for open ocean use.
- Complete:
  -- (U) development of plasma arc pyrolysis technique as a means of destroying ship's solid waste.

4. (U) FY 1997 PLAN:

• (U) ($19,922) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
- Initiate:
  -- (U) development of user interface technology to enable the training of tasks involving interactions among multiple people, including team members, adversaries, and instructors.
- Continue:

-- (U) development and evaluation of unconventional visual and auditory cuing techniques to enhance learning of complex perceptual-motor skills.
-- (U) development of algorithms for driving a real-time, adaptively automated assistant in realistic tactical aviation environments.

- Complete:
  -- (U) evaluations in operational environments of experimental tools to assist decision-makers in rapid situation assessment under conditions of high uncertainty.
  -- (U) evaluations of the effects on human perceptual performance of processing techniques to enhance operator use of synthetic aperture radar and other sensor imagery.

• (U) ($12,045) MEDICAL TECHNOLOGY:
- Initiate:
  -- (U) development of field-portable ultrasonic imager to detect radiolucent shrapnel.
- Continue:
  -- (U) development of antibody-based enzymes for removing Rh determinant from red cells.
  -- (U) development of bacterial endo-beta-galactosidase as a more efficient enzyme for removing A determinant from red cells.
  -- (U) evaluation of immunoregulatory monoclonal antibodies as adjuvants in inflammatory diseases.
  -- (U) development of therapeutic resuscitation fluid to enhance recovery of organ function in hemorrhagic shock.
- Complete:
  -- (U) evaluation of liposome encapsulated hemoglobin in combination with therapeutic agents that prevent/correct reperfusion injury in hemorrhagic models.
  -- (U) evaluation of dinitromed as a cellular cryoprotectant that eliminates the need for washing frozen blood components.

• (U) ($10,155) LOGISTICS TECHNOLOGY:
- Complete:
  -- (U) model testing of pier fendering system to enable accurate prediction of forces exerted upon piers during berthing operations.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602233N PROJECT NUMBER: N/A
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology PROJECT TITLE: Readiness, Training and Environmental Quality Technology

-- (U) feasibility study and design criteria for advanced modular lighterage system in discharging cargo during amphibious operations.
-- (U) bench scale testing and develop design parameters required for Integrated Waste Treatment Plant to meet future Navy requirements.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	41,338	42,753	XXX	XXX
(U) FY 1995 Appropriated:	XXX	52,453	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-300	-2,364	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	41,038	50,089	43,511	42,122

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year Execution Update (+1,000), and Technology Reinvestment Support Prototype (TRP) reprogramming (-1,300). FY 1995 changes due to: Congressional undisdributed reductions for University Research (-2,133); Contrator Support Services (-166); Travel (-60); and an assessment for Small Business Innovative Research (-5).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602233N PROJECT NUMBER: N/A
PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technology PROJECT TITLE: Readiness, Training and Environmental Quality Technology

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0603706N (Medical Development (Advanced))
(U) PE 0603707N (Manpower, Personnel and Training Advanced Technology Development)
(U) PE 0603712N (Environmental Quality and Logistics Advanced Technology)
(U) PE 0602202F (Human Systems Technology)
(U) PE 0602205F (Personnel, Training and Simulation)
(U) PE 0602716A (Human Factors Engineering Technology)
(U) PE 0602727A (Non-System Training Device Technology)
(U) PE 0602785A (Manpower, Personnel and Training Technology)
(U) PE 0602787A (Medical Technology)

This PE adheres to Tri-Service Reliance Agreements on Training Systems, Manpower & Personnel, Human Systems Interface, Medical, CBD, Civil Engineering, and Environmental Quality. Oversight is provided by the JDL, TAPSTEM, ASBREM, and Joint Engineers.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Materials, Electronics, and Computer Technology	70,521	94,259	74,849	86,515	92,131	100,958	104,047	106,088	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) provides exploratory development to support all Navy advanced weapon and platform system concepts and needs in the areas of materials, electronics, and computer technology. Developmental tasks address significant improvements in terms of performance, reliability, environmental impact, advanced distributed manufacturing, and cost to effect transition of advanced technology to the Navy fleet. Development efforts are part of an integrated Department of Navy Science and Technology process managed by the Office of Naval Research.

(U) This PE develops enabling technologies that support the following Joint Mission Areas: Strike, Littoral Warfare, Surveillance, Space and Electronics Warfare/Intelligence (SEW/I), Strategic Deterrence, Forward Presence, and Maritime Support of Land Forces. Specifically:

(U) Joint Strike addresses technology issues in real-time targeting, surgical lethality, platform survivability, and battle damage assessment. Programs include advanced thermal management materials for avionics, missile domes and seeker technology, advanced materials for aircraft and missile engines.

(U) Littoral Warfare addresses issues in air, surface, and undersea battlespace and develops technology for ship self-defense, air combat, and survivability. Programs include acoustic signature reducing materials, torpedo warhead materials, fiber optic sensors, vacuum electronics, solid state low noise amplifiers, complex systems engineering, and high performance computing.

(U) Joint Surveillance addresses issues of real-time targeting, connectivity, counter-jamming and deception. Programs include infrared sensors, broadband adaptive transmitter/receiver modules, and control components, fiber optics technology, high performance computing, and artificial intelligence.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

(U) SEW/I is pervasive across all DoD science and technology thrusts and primarily addresses issues in seven major functional areas to include surveillance, communications, command and control warfare, non-cooperative target recognition, and affordability. Programs include lightweight and radiation-hard satellite materials, radio frequency (RF) solid state devices, high performance computing, complex systems reengineering and reuse, software engineering environments, formal systems requirement specifications, human computer interaction, and expert computer systems.

(U) Strategic Deterrence addresses issues of maintaining a responsive readiness to support and conduct strategic nuclear offense, coordinated air strikes and amphibious warfare. Programs include advanced ballistic missile launcher materials, RF solid state devices for secure communications, engineering of complex systems, and high performance computing.

(U) Forward Presence addresses issues of supporting forward naval forces to protect and promote U.S. interests, enhance regional stability, deter aggression, improve interoperability with friends and allies, and provide timely initial crisis response. Programs include high temperature pavements for advanced aircraft, RF solid state devices for secure communications, high power transmitters for precision strike, high performance computing, and artificial intelligence for decision aids.

(U) Maritime Support of Land Forces addresses issues of supporting DoD strategic mobility and logistics requirements as well as employment of naval forces to control open ocean areas and assure access to littoral regions. Programs include development of advanced distributed manufacturing capabilities and advanced long-life materials for repair of aircraft at sea.

(U) In addition, this PE directly underpins the Readiness Joint Support Area and Support and Infrastructure Joint Support Area especially in the domains of environmental quality and logistics. Programs include environmentally acceptable coatings for both aircraft and ships and the maintenance of the Navy pier and wharf infrastructure for surge capacity.

(U) This PE also supports the Office of the Secretary of Defense Science and Technology Investment Strategy in the following Future Joint Warfighting Capabilities: Real-Time Knowledge of the Enemy, Prompt Engagement of Regional Forces on Global Basis, Lower-End Actions, Space Control, and Countering Threat of Weapons of Mass Destruction. In particular, materials projects support affordable performance increases in radomes, infrared windows, advanced engines, and platform signature reduction that will allow achievement of military objectives with minimum casualties and collateral damage. Materials

U 3.2

programs also directly support lightweight, survivable satellite and spacecraft thermal control materials that will positively affect the U.S. ability to control the use of space. The PE is an integral part of the following Department of Defense Key Technology Areas: Materials and Structures, Electronic Devices, and Computers. As a foundational technology area it has impact in most other DoD Key Technology areas as well.

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

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($779) SHORE FACILITIES MATERIALS supports the shore infrastructure of piers, wharves, and other facilities required by naval logistics and operations, e.g., magazines and tank farms. This year's efforts include:

  -- Transitioned retrofit cathodic protection anode materials and procedures for Navy sheetpiling systems protecting wharfs and quaywalls. This bi-polar cathodic protection system provides corrosion protection to steel sheet piling bulkheads at 20% the cost of deep embedment anode systems.

  -- Transitioned accelerated testing procedures for shore facilities paints and coatings to permit screening of new materials and performance prediction to augment expensive long-term coupon testing in the field.

- (U) ($8,848) AIRBORNE MATERIALS supports naval aircraft, including airframes, propulsion, and air weaponry. This year's efforts include:

  -- (U) Completed development and installation (jointly with Advanced Research Projects Agency (ARPA)) of an intelligent hot isostatic press capability for affordable near-net-shape (within 10% of final dimension)fabrication of aircraft components.

  -- (U) Produced 1 mm thick artificial diamond disks that meet infrared optical requirements for infrared missile domes.

-- (U) Transitioned ceramic joining procedures to the Navy sparrow missile homing improvement program. This permits the combination of a ceramic infrared window with a ceramic radome, permitting the option of two seeker modes in this and similar missiles.

-- (U) Developed high hot hardness, corrosion resistant, carburizable stainless steel bearing alloy capable of 300° C for aircraft engine application. Bearings with this temperature capability are needed to meet the requirements of the Integrated Turbine Engine Technology Initiative Phase II demonstrators. Compatible high temperature lubricants are being developed as part of the Air Force science and technology program under Defense Reliance agreements. Engine tested cast gamma titanium aluminide low pressure turbine blades weighing 40% less than contemporary nickel blades.

- (U) ($7,586) SEABORNE MATERIALS supports all ship, submarine, and related needs, such as machinery materials, hull coatings, and seaborne weapons materials. This year's efforts include:

-- (U) Transitioned hollow superplastic formed/diffusion bonded ship propeller development for decreased noise. Hollow propellers can be damped to reduce noise associated with cavitation and frictional stimuli. The application of superplastic forming/diffusion bonding, developed for aircraft and spacecraft, provides a cost effective fabrication method.

-- (U) Completed development of first generation welding consumables, especially welding wire and fluxes, for 100,000 pounds/sq.in tensile strength hull steels. Advanced ship hull steels based on modern high strength low alloy steels require little or no preheating prior to welding, but do need welding materials and processes that are matched to their strength and chemistry.

-- (U) Completed characterization of texture in tantalum shaped-charge liner materials for advanced torpedo warheads to improve the lethality of these heavy metals.

-- (U) Conducted successful radio-frequency testing of nitroxyceram missile radome material in simulated hot supersonic flight appropriate to launching a Standard missile in foul weather. Nitroxyceram has better thermal shock and erosion resistance than slip-cast fused silica, which is the current baseline material.

- (U) ($3,102) MISSILE/SPACE MATERIALS supports naval satellite and tactical ballistic missile needs. This year's efforts include:

  -- (U) Completed tests of carbon-carbon satellite radiators for lower weight thermal management systems. The incorporation of high thermal conductivity carbon fibers in a carbon matrix will provide a low density thermal radiator option for satellites. Carbon-carbon composites are more resistant to laser and electromagnetic pulse damage than the copper alloys currently used.

- (U) ($4,734) MULTI-MISSION MATERIALS supports certain promising developing technologies, such as biomolecular materials that have wide potential, and materials that provide support to naval systems across a wide spectrum, such as laser eye and sensor protection materials. This year's efforts include:

  -- (U) A series of optical power limiting materials and concepts were supplied to all Services and ARPA for evaluation as laser protection for optical sensors. These materials react to the intensity of laser light, becoming opaque or reflective and blocking or redirecting the energy from a sensor system preventing permanent damage to the sensor.

  -- (U) Demonstrated high permittivity dielectric composites incorporating microtubules (very small soda-straw-like structures based on biomaterials) in lightweight, flexible polymers. These materials provide one approach to artificial dielectrics for high performance capacitors and potentially in flat panel displays.

- (U) ($6,425) RF SOLID STATE DEVICES AND CONTROL COMPONENTS support activities to generate, control, radiate, receive, and process VHF, UHF, microwave, millimeter-wave and sub-millimeter wave power. This year's efforts include:

  -- Completed the development of GaAs Ka-band two-terminal avalanche devices (IMPATTs) for missile seeker applications. The Navy requires all-weather intercepts of Theatre Ballastic Missile (TBM) defense with hit-to-kill potential.

  -- (U) Completed the development of high power field effect transister (FET) planar device (800-1400 MHz) that provides the basis for a high power, high efficiency FET device for airborne Communication Navigation Intelligence (CNI) and radar systems.

-- (U) Fabricated a microwave gallium nitride (GaN) FET that exhibited an f_{max} of 22 GHz. This demonstrates the viability of GaN technology for high power/high temperature device and circuit applications.

- (U) ($14,333) VACUUM ELECTRONICS supports activities to generate and receive microwave, millimeter-wave and sub-millimeter wave power. This year's efforts include:

-- (U) Demonstrated a 100-W transmit microwave power module operating from 6 to 18 GHz with a center-band efficiency of 40%. Three of these units were combined in a linear array to demonstrate array performance for an Air Force high-power electronic countermeasure application.

-- (U) The MMACE (Microwave and Millimeter-Wave Advanced Computational Environment) Phase I prototype framework and integrated design tool set for helix Traveling Wave Tube (TWT) design was released to the US microwave power tube industry. Initial applications of the prototype design system have demonstrated design cycle time reductions from three weeks to two days for electron gun design (at ITT) and from several days to tens of minutes for parametric helix TWT design (at Hughes).

-- (U) Stable operation of a high-gain, wide-band, two-stage tapered gyro-TWT amplifier demonstrated for the first time with a five times higher power-bandwidth product than that of current technology. Such performance improvements are needed for broadband ship-based jamming capabilities to counter advanced MMW threats.

-- (U) The fundamental mode ubitron amplifier successfully demonstrated the high-power, efficient, broadband characteristics of a free electron maser operating in an untapered configuration. Peak powers obtained extend the state-of-technology for broad-band amplifiers in the Ku-band frequency range by more than an order of magnitude.

-- (U) A high-duty, reduced noise cross field amplifier for the AEGIS radar (CFA) has been developed for the AN/SPY-1.

-- (U) A record current density of 1,600 A/cm2 at 40 V was reported for a close-packed vertical Field Emitter Array (FEA) fabricated using laser interferometric lithography. The transconductance of these structures was 1-to 2-mS, values sufficient to support power gain at frequencies less than 10 GHz.

- (U) ($4,935) ELECTRO-OPTICS TECHNOLOGY supports activities to develop infrared focal plane arrays and fiber optics technology for improving existing and future Naval electronic systems, sensor systems, and communications/data systems. This year's efforts include:

  -- (U) Developed an InGaAlAs laser diode operating at 1.3 microns that operates from -50°C to 125° C and does not require a thermoelectric cooler.

  -- (U) Developed techniques for the multiplexing of fiber Bragg grating strain sensors to provide for the remote sensing of strain at a number of points along structures such as bridges, wings, and ship hulls.

  -- (U) Demonstrated true time delay operation of an optically controlled 2-8 GHz phased array radar that can replace the use of coaxial cables and permit, in general, the realization of remote sensor systems.

  -- (U) Demonstrated a photovoltaic detector in GaInSb/InAS superlattice material. This material offers improvements over HgCdTe for higher temperature operation at longer wavelengths.

- (U) ($5,314) MICROELECTRONICS supports activities to develop primarily silicon-based technology for low power, high speed, radiation-hard systems applications. This year's efforts include:

  -- (U) Demonstrated the cancellation of two large interfering signals by 60dB using an adaptive processor circuit that operates to 80MHz. The adaptive processor circuit will be used for collocated interference-cancellation for communication, jamming, and electronic intelligence systems.

  -- (U) Demonstrated that a 32-bit microprocessor fabricated on thin epitaxial material has significantly lower susceptibility to single event upset and is therefore more robust to radiation effects.

  -- (U) Demonstrated a high efficiency (95-97%) power supply with a power density of 100W/in^3 to reduce, in some cases, the system volume consumed by the power supply from 80% to 20%, as well as reduce the power supply weight by a factor of 10.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($2,171) ELECTRONIC AND E/O MATERIALS supports activities to develop substrate materials, thin film materials, processing materials and superconducting device technology for RF components, electro-optics, and microelectronics applications. This year's efforts include:

  -- (U) Total strain relaxation has been achieved by growing InGaAs epitaxial layers and quantum wells on intermediate, compositionally step graded buffer layers on GaAs substrates. The use of GaAs substrate materials for InGaAs electro-optic devices will result in increased reliability and decreased costs over more commonly used InP substrate materials.

  -- (U) Demonstrated the ability to deposit ferrite materials for nonreciprocal microwave and millimeter wave device applications and the results have been transitioned to ARPA programs via the Ferrite Consortium.

  -- (U) Completed effort to improve crystal quality of GaAs with effort transitioned to program using bulk crystals for room temperature operation as gamma ray detectors.

  -- (U) Completed the demonstration of prototype, compact, circulator-coupled, narrow bandwidth high temperature superconducting analog multiplexers suitable for EW applications.

- (U) ($1,602) HYBRID SIGNAL PROCESSING activities are concentrated on missiles and other smart weapon systems where there are stringent mission needs for real time operation (sensor processing being predominant), and extremely constrained packaging (power, weight, etc.). This year's efforts include:

  -- (U) Initiated task in software reuse/reengineering within the missile signal processing domain to adopt and adapt Ptolemy, Khoros, and MATLAB software tools in an effort to minimize costs.

  -- (U) Developed wavelet-aided missile tracking algorithms for classification of image motion in structured clutter for point targets.

  -- (U) Demonstrated integration of a passive 8x8 cell of passive detectors to underlying signal processors using epitaxial liftoff to minimize size, weight and power requirements in a missile.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($2,042) HIGH PERFORMANCE COMPUTING (HPC) is a broad area focused towards accelerated insertion of new high performance computing resources into the operational community. This year's efforts include:

  -- (U) Parallelized shipboard infra-red search-and-track (IRST) sensor-processing algorithms (focus on ease-of-programming and efficient signal-processing). Transitioned to the Navy's IRST program within Naval Sea Systems Command and the ONR IRST thrust.

  -- (U) Reconfigured the Navy's operational Global Ocean Prediction Systems software to run on a Thinking Machines Corporation CM5 massively-parallel, distributed-memory computer to measure its performance in this new technology and assess grid granularity needed to measure eddy currents and to predict behavior in littoral areas critical to support Navy operations.

  -- (U) Continued to apply parallel computers to demonstrate extending the performance limits of a long-line towed-array sonar system aboard a submarine.

  -- (U) Develop software tools to automatically translate an engineer's design of a system into affordable, compact portable software on the system's parallel processors (cost is approaching one third and one tenth of the schedule man coded software). Results are being transitioned directly into ARPA's Rapdi Prototyping of Application - Specific Signal Processors (RASSP) Program.

- (U) ($2,336) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION provides generic technology for a large number of application and mission areas that require reasoning under uncertainty (making maximum use of human cognitive capabilities) and operation of autonomous systems. This year's efforts include:

  -- (U) Achieved rapid, computationally efficient object recognition in complex scenes using range image data.

  -- (U) Built an initial module for a testbed for case-based reasoning (CBR) and evaluated a CBR approach to sonogram classification to reduce operator workload.

  -- (U) Demonstrated a narrowband multi-media terminal that implements a 1200 bit per second speech algorithm in real-time while simultaneously transferring imagery between two portable computers; results can be used in dual-use functions such as remote briefings and remote medical support to military field operations.

-- (U) Demonstrated verifier enhancements in the use of formal specifications for real-time software; this is a critical component of assured computing, particularly in systems where automation failures can cause loss of life or other critical resources.

- (U) ($6,314) ENGINEERING OF COMPLEX SYSTEMS pursues the combination of technologies needed to reliably, cost-effectively produce future, and enhance current, computer-intensive systems, through selection of adequate hardware, software and human resources to perform specified complex missions within their specified performance envelopes. This year's efforts include:

-- (U) Developed and demonstrated a first generation prototype (DESTINATION) of automated specification, design and traceability tools for complex processor-intensive military systems. This establishes key integrated capabilities to support a full forward system composition methodology for design, prototyping, and assessment of large-scale, computer-based systems and enables the production of reliable, predictable and affordable systems. System design structuring and resource allocation capabilities include manipulation of various levels of system design, component, and environment representations. System design optimization supports initial implementations of tailorable objective functions based on different measures-of-effectiveness criteria to ensure that system requirements are met.

-- (U) Inserted the Navy-developed Environment/Tool Integrator (ETI) update into the Software Technology for Adaptable Reliable Systems Asset Source for Software Engineering Technology (STARS ASSET) library as a reusable component for government organizations and contractors. This Unix-based product is a windowing framework that provides easy visibility and access to the software tools, reuse libraries, and environments needed at the project level. The ETI can be easily customized to satisfy the unique needs of individual projects. All activities contribute to repeatable, predictable, cost effective system building with focus on command and control applications.

-- (U) Transitioned object-oriented analysis to aid in the design of the Tactical Air Support Module (TASM) that will initially be integrated into the Advanced Field Artillery Tactical Data System (AFATDS). A future transition target is the Joint Maritime Command Information System (JMCIS).

-- (U) Initiated efforts to integrate with the ARPA STARS Boeing demonstration with the goal to provide a full reengineering reuse repository capability.

-- (U) Demonstrated initial prototyping language capabilities to rapidly prototype tactical operations processes with concentration on display of geometrics representing various doctrine.

-- (U) Demonstrated an advanced distributed manufacturing prototype of a future Navy parts and suppy system through a design and manufacturing process in virtual corporate space.

2. (U) FY 1995 PLAN:

- (U) ($930) SHORE FACILITIES MATERIALS supports the shore infrastructure of piers, wharves, and other facilities required by naval logistics and operations, e.g., magazines and tank farms. This year's efforts include:

  -- (U) Continue identifying failure mechanisms in materials used for the repair of Navy piers and wharves. The Navy must maintain a large infrastructure for surge shipping capacity. This infrastructure requires better understanding of the failure of current materials.

- (U) ($9,800) AIRBORNE MATERIALS supports naval aircraft, including airframes, propulsion, and air weaponry. This year's efforts include:

  -- (U) Complete development of environmentally compliant aircraft coating system including a non-chromate (non-toxic) pretreatment process and a low volatile organic (less than 200 gram per liter) water-borne urethane coating. Coatings of this type are needed to meet future environmental restrictions for both air quality and waste disposal.

  -- (U) Complete demonstration of higher efficiency thermal barrier coatings for turbine engines with 100° C temperature increase and improved resistance to mechanical shedding under load. This temperature increase is equivalent to approximately a 25% increase in thermodynamic efficiency in aircraft engines while still using traditional superalloys for turbine blades.

- (U) ($10,200) SEABORNE MATERIALS supports all ship, submarine, and related needs, such as machinery materials, hull coatings, and seaborne weapons materials. This year's efforts include:

-- (U) Continue development of an advanced liner material with enhanced burn-through resistance for the vertical launch system (Standard and Tomahawk missiles). Current polymer liners do not permit multiple launches of advanced missiles using higher energy propellants.

-- (U) Continue demonstration of an anti-fouling release system for biomolecularly derived antifoulants or other antifoulant materials. Release capsules based on self-assembling micro-tubules appear to provide the necessary release rate and long life.

-- (U) Complete demonstration of a lower cost (versus tantalum) tungsten shaped charge liner material for use against multiple threats without degradation in performance.

- (U) ($3,460) MISSILE/SPACE MATERIALS supports naval satellite and tactical ballistic missile needs. This year's efforts include:

-- (U) Complete qualification of a flexible graphite/copper thermal strap, used to conduct heat from internal satellite components tc exterior heat radiators, for use on Navy GEOSAT satellite and its commercial derivative for weight savings and reliability.

- (U) ($20,752) MULTI-MISSION MATERIALS supports certain promising developing technologies, such as biomolecular materials that have wide potential, and materials that provide support to naval systems across a wide spectrum, such as laser eye and sensor protection materials. This year's efforts include:

-- (U) Initiate materials development of materials that can respond fast enough (< one microsecond) to laser radiation to protect the human eye from any agile (tunable) laser threat.

-- (U) Initiate development of advanced composite components for aircraft avionics and sea-based electronic systems based on high-thermal conductivity carbon fibers.

-- (U) Continue development of scandium modified zirconia thermal barrier coating materials that are resistant to the marine environment for both aircraft and ship turbine engine application.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($6,541) RF SOLID STATE DEVICE AND CONTROL COMPONENTS support activities to generate, control, radiate, receive, and process VHF, UHF, microwave, millimeter-wave and sub-millimeter wave power. This year's efforts include:

  -- (U) Initiate the development of silicon FET devices to cover three frequency bands from UHF through L Band. Low distortion, high linearity, continuous wave (cw) performance as well as high power, high efficiency, pulsed performance will be stressed. These devices will support requirements for multi-signal power amplifiers, digital receiver front-end applications as well as requirements for high power, high efficiency pulsed transmitter applications.

  -- (U) Initiate the development of wideband (18-40 GHz) circulators that are compatible with millimeter-wave-power-module (MMPM) requirements for EW applications.

  -- (U) Initiate the development of millimeter wave wideband switches/converters for phased array subsystems and very high dynamic range microwave LNAs with exceptionally high linearity for use in wideband multifunction phased arrays.

  -- (U) Complete development of the 400-1400 MHz adaptive Transmit/Receive (T/R) module for Airborne Early Warning (AEW) radar applications. The adaptive capability provides for improved interference rejection and electronic counter-countermeasure capability, and enhances target detection and track, of low observable targets.

  -- (U) Complete development of AlGaAs/GaAs heterojunction bipolar transistors for active phased array radars for use in high-power, non-gimballed antenna systems required for missile guidance.

  -- (U) Complete development of an L-band monolithic receiver. Current technology at these frequencies (500-1500 MHz) normally requires filter components that are relatively large, while the use of Semiconductor Bulk Acoustic Resonators to implement the filters will reduce the size and permit their use in airborne data links.

- (U) ($16,902) VACUUM ELECTRONICS supports activities to generate and receive microwave, millimeter-wave and sub-millimeter wave power. This year's efforts include:

-- (U) Initiate extension of the MMACE concept to system level design for MPMs through joint ARPA/tri-Service MMPS (Microwave and Millimeter-wave Pilot Site) program. Delivery of a test system to US power tube industry is scheduled for FY95.

-- (U) Initiate development of a 100-W wideband (80-100 GHz) TWT for Air Force and Navy EW applications.

-- (U) Initiate the development of scandate cathodes to provide increased operating life at reduced operating temperature for high power microwave and millimeter wave amplifiers.

-- (U) Initiate the development of new high temperature superconducting (HTSC) materials for beam focusing systems to provide higher magnetic field and reduced power consumption.

-- (U) Continue the development of an MPM capable of producing in excess of 100 watts CW (within C-band) at extremely high efficiencies for use in an airborne antenna conformal to an E-2C. The conformal antenna is required for a Fleet demonstration of the Cooperative Engagement Capability in FY-97.

-- (U) Complete development of the X/Ku-band module for Air Force High Power Stand-Off Jammer.

-- (U) Complete final testing of the high-duty, reduced noise CFA for the AN/SPY-1.

- (U) ($5,462) ELECTRO-OPTICS TECHNOLOGY supports activities to develop infrared focal plane arrays and fiber optics technology for improving existing and future Naval electronic systems, sensor systems, and communications/data systems. This year's efforts include:

-- (U) Initiate program to develop manufacturing processes for selected electro-optic technologies.

-- (U) Demonstrate lower loss optical-microwave links out to 10 GHz and lower loss optical mixers, both by using detectors developed with high saturation currents.

-- (U) Demonstrate optical control of an 8 element linear array with bandwidth from 2 to 18 GHz.

-- (U) Continue development of a 128 x 128 dual-band (3 to 5um and 8 to 12um) infrared focal plane array (IRFPA) with simultaneous coincident signal integration. This approach will eliminate the need for a separate array for each wavelength band which is the current approach. The dual band capability provides for enhanced target detection in infrared missile seekers, infrared search and track, forward looking infrared and threat warning sensor applications.

-- (U) Continue development of adaptive IRFPA with on-chip electronics to enhance the dynamic range to 120 dB and to implement offset nonuniformity correction. Increased dynamic range is required for Background Limited Infrared Performance (BLIP) in long-wave IRFPA's and to enable either mid-wave or long-wave IRFPA's to adapt to varying backgrounds such as cold sky and hot desert.

-- (U) Continue development of GaInSb/InAs superlattice material as an alternative material for higher temperature operation at longer wavelengths. This material has the high quantum efficiency of HgCdTe but with potentially easier fabrication of the layer structures, higher operating temperature and longer cutoff wavelength.

- (U) ($6,265) MICROELECTRONICS supports activities to develop primarily silicon-based technology for low power, high speed, radiation-hard systems applications. This year's efforts include:

-- (U) Initiate a demonstration of high level computer aided design (CAD) and simulations tools for rapid design of radar signal processing systems.

-- (U) Continue development of collocated interference cancellation circuitry for communications, jamming, and electronic intelligence system applications. Cancellation of nearby interfering signals is important for a number of platforms to allow simultaneous receive and transmit operation.

-- (U) Continue development of 3 dimensional Silicon on Insulator (SOI) complimentary metal oxide semi-conductor circuits including Reduced Instruction Set Computer (RISC) processor to implement high density signal processors.

-- (U) Complete the design of a high resolution (16 bit), low speed (100 Kilosamples/sec), low power (1 mW) A/D converter implemented in thin-film silicon-on-sapphire. The Navy requires A/D converters of this type for low-cost, low power deployable sensor systems and SIGINT applications.

- (U) ($2,151) ELECTRONIC AND E/O MATERIALS supports activities to develop substrate materials, thin film materials, processing materials and superconducting device technology for RF components, electro-optics, and microelectronics applications. This year's efforts include:

  -- (U) Initiate techniques for the growth of GaN and SiC substrates by chemical vapor deposition. The goal of this effort is to provide lattice matched substrates for wide bandgap electronic and electro-optical devices. Achievement of this goal will enable blue laser development and will provide the foundation for high power, high frequency device technology.

  -- (U) Initiate development of very narrow bandwidth (less than one percent) high temperature superconducting bandpass filters capable of handling greater than ten watts of incident microwave power without performance degradation.

  -- (U) Continue the growth and characterization of GaSb materials for III-V superlattice infrared focal plane array detectors.

  -- (U) Demonstrate resist materials sensitive to 193 nm wavelength light for sub 0.25 micrometer lithography. This effort, combined with an ARPA effort to develop sub 0.25 um steppers, should ensure that the U.S. will be able to meet the requirements of fine line lithography through the year 2005.

- (U) ($2,400) HIGH PERFORMANCE COMPUTING (HPC) is a broad area focused towards accelerated insertion of new high performance computing resources into the S&T and operational community through partnerships between computer scientists, S&T generic and applications-specific researchers and the program management offices. This year's efforts include:

  -- (U) Perform final laboratory testing prior to at-sea evaluation of commercial HPC hardware (Intel's iWARP and Thinking Machines Corporation's CM200) performing, under real conditions, submarine detection using long-line

towed-array sonar. The specific algorithms parallelized include focussed beamforming, automated detection and tracking, and automated acoustic-contact correlation.

-- (U) Demonstrate the reduced operator workload and enhanced performance enabled by scalable HPC systems. Transition this effort to the New Attack Submarine program, and to planned upgrades to the AN/BSY-2 combat system for the Seawolf submarine and to the SQQ-891 surface-ship system.

-- (U) Continue R&D in applying parallel computers to deliver timely responses to decision makers in a command and control environment, particularly in rapid execution of models to provide vision into alternatives and possible priorities of actions and develop software tools which can automatically translate an engineer's design of a system into affordable, compact portable software on the system's parallel processors.

- (U) ($2,700) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION provides generic technology for a large number of application and mission areas that require reasoning under uncertainty (making maximum use of human cognitive capabilities), and operation of autonomous systems. This year's efforts include:

  -- (U) Demonstrate machine learning of team tactics in simulated tactical air combat, and assess utility for transition to ARPA 6.3 projects in advanced simulation. Extend the Eucalyptus multi-media interface to operate in a distributed environment, and develop response capabilities with natural language generation.

  -- (U) Demonstrate object modeling using innovative range image operators for machine vision, and initiate exploratory development of behavior-based control on Nomadic robots (transitioning results of ONR-sponsored 6.1 research at MIT).

  -- (U) Integrate modules for case based reasoning functions in an advanced testbed.

  -- (U) Complete development of narrowband multimedia terminal.

- (U) ($6,696) ENGINEERING OF COMPLEX SYSTEMS pursues the combination of technologies needed to reliably, cost-effectively produce future, and enhance current, computer-intensive systems, through selection of adequate hardware, software and human resources to perform specified complex missions within their specified performance envelopes. This year's efforts include:

-- (U) Continue development of the DESTINATION prototype with emphasis on refining system design structuring and resource allocation capabilities and building the library of objective functions for design optimization.

-- (U) Continue development of the baseline capabilities for system evaluation and assessment. Complete a statistical model for tactical computer processor utilization based on measurement of the current Aegis computer architecture performance under varying operational scenarios.

-- (U) Continue to develop the Schema Definition Set Design Tool to add additional functionality, prioritizing insertion by user need.

-- (U) Release the initial version of the Systems Reengineering Environment (SRE) with automated capabilities to translate CMS-2 tactical software programs to Ada and software visualization capabilities to support architecture transformation. Complete the integration of the SRE with the ARPA STARS Boeing reuse environment.

-- (U) Enhance and continue measurement of the virtual manufacturing project demonstrator using a networked distributed manufacturing testbed, showing functional correctness and measured economies that can be gained in building mechanical and electrical subsystems; the same process will be used to determine the framework applicability to software reuse, i.e, explicit determination of distribution economies in the analysis and verification of software reuse procedures.

3. (U) FY 1996 PLAN:

- (U) ($1,000) SHORE FACILITIES MATERIALS supports the shore infrastructure of piers, wharves, and other facilities required by naval logistics and operations, e.g., magazines and tank farms. This year's efforts will include:

-- (U) Continue development of long lived materials and application techniques for repair of concrete piers and wharves to extend the life and maintain sealift surge capacity.

-- (U) Complete field trials of high temperature pavements that are resistant to AV-8B exhaust temperatures and velocities.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

- (U) ($8,800) AIRBORNE MATERIALS supports naval aircraft, including airframes, propulsion, and air weaponry. This year's efforts will include:

  -- (U) Continue development of resin transfer molding process model for affordable fabrication of organic-matrix composites for aircraft and missile airframes to achieve 30% less manufacturing cost versus lay-up.

  -- (U) Continue testing of environmentally benign enzymatic paint stripping and cleaning materials and procedures to eliminate the requirement for methylene chloride or mechanical stripping of naval coatings.

  -- (U) Continue diamond material development for infrared domes with a successful 1 mm thick polished 3 in. diameter dome for supersonic missiles.

  -- (U) Continue development of large scale ingot processing of orthorhombic titanium aluminide materials for engine rotors and turbine shrouds capitalizing on the high temperature capabilities and enhanced ductility of the orthorhombic crystal structure and the 40% lower density versus conventional superalloys. Complete demonstration of cast and wrought gamma titanium aluminide in aircraft engine high pressure compressor blades and vanes to replace superalloys for a 40% component weight savings.

- (U) ($9,200) SEABORNE MATERIALS supports all ship, submarine, and related needs, such as machinery materials, hull coatings, and seaborne weapons materials. This year's efforts will include:

  -- (U) Continue demonstration of part-on-call spray forming of ship and submarine high temperature and corrosion resistant alloys by extending the spray-forming process to reactive metals, especially titanium alloys.

  -- (U) Complete development of a new lower strength (65,000 lb/sq-in tensile strength) low allow steel to lower the cost of aircraft carrier construction by elimination of the need for welding preheat and post-welding heat treatment.

  -- (U) Complete development of continuous cooling transformation diagrams for 100,000 pound yield strength high strength low alloy hull steels. These diagrams are needed in the control of welding processes for affordable and quality welds.

-- (U) Complete development of first generation advanced liner material for shipboard vertical launch systems to provide the reload capability even with advanced performance missiles.

- (U) ($2,800) MISSILE/SPACE MATERIALS supports naval satellite and tactical ballistic missile needs. This year's efforts will include:

  -- (U) Complete qualification of oxidation (atomic oxygen) resistant carbon-carbon composite thermal doublers for Navy UHF satellites appropriate to low-earth orbit for a weight savings of 58%.

- (U) ($6,522) MULTI-MISSION MATERIALS supports certain promising developing technologies, such as biomolecular materials that have wide potential, and materials that provide support to naval systems across a wide spectrum, such as laser eye and sensor protection materials. This year's efforts will include:

  -- (U) Continue development of electrically addressable spacial light modulator based on biomolecular precursors that permits electrically controllable and continuous gray scale for flat panel and similar displays unlike current liquid crystal polymers which are effectively bimodal.

  -- (U) Complete validation of the remotely addressable, embedded sensor concept using RF energy to energize sensors in resin-matrix composite materials and transmit sensor information to external receivers eliminating the need for wire attachment.

  -- (U) Complete development of high temperature superconductor wire for motor magnet windings and test in a superconducting motor. High temperature superconductors will permit motor application at liquid nitrogen rather than liquid helium temperatures (77 K (-196° C) vs. 20 K (-253° C)).

- (U) ($6,428) RF SOLID STATE DEVICE AND CONTROL COMPONENTS support activities to generate, control, radiate, receive, and process VHF, UHF, microwave, millimeter-wave and sub-millimeter wave power. This year's efforts will include:

  -- (U) Initiate development of C-band MMIC synthesizers that are needed to implement Unmanned Airborne Vehicles (UAVs) C-band telemetry/data-link systems and C-band high-data-rate communications systems. These data links will provide the necessary data rates at a lower cost than the X-band links needed for higher detail imagery.

-- (U) Initiate development of new high power device structures and substrates for improved efficiency and higher power for CNI and surveillance systems operating in UHF through X-band. High power, high efficiency devices are needed to support the requirement for increased communication capacity and airborne surveillance radar detection.

-- (U) Initiate development of a 94 GHz gyrotron-compatible duplexer that will permit signal control and routing in MMW Synthetic Aperture Radar and Inverse Synthetic Aperture Radar applications.

-- (U) Continue development of InP/InGaAs/InP and InP power heterojunction bipolar transistor (HBTs) for improved active-aperture phased-array radars. These radars are required in very high 'g' environments for hit-to-kill weapons, to reduce sidelobe jamming, and improve target tracking accuracy.

-- (U) Continue development of high power, high conversion efficiency InP impact avalanche transit time (IMPATT) devices at 94 GHz to provide high power and compact sources of millimeter-wave transmit power. The Navy requires MMW sources to implement dual-mode IR/RF seekers with improved probability-of-kill (Pk) in adverse weather and to acquire enemy radars by anti-radiation-missiles during enemy radar radiation shut-down.

-- (U) Continue development of high density three dimensional devices on silicon-on-insulator for shipboard and aircraft communications, radar, and EW systems applications.

-- (U) Continue development of silicon carbide static induction transistor devices and structures that exhibit 10 W of continuous power and air-bridged static induction transistors that exhibit 160 watts of continuous power at S-band frequencies for Navy systems applications such as AEGIS.

-- (U) Continue development of wideband (18-40 GHz) circulators which are compatible with millimeter-wave-power-module (MMPM) requirements for EW applications.

-- (U) Complete demonstration of superdirective array with enhanced frequency coverage to meet the wide bandwidth requirements of anti-radiation missile seekers.

- (U) ($15,864) VACUUM ELECTRONICS supports activities to generate and receive microwave, millimeter-wave and sub-millimeter wave power. This year's efforts will include:

-- (U) Initiate development of a 10 GHz narrow band linear beam amplifier using FEA based gated vacuum field emitters to realize a ten-fold improvement in power density and a near-doubling of efficiency.

-- (U) Continue extension of MPM concept to higher frequencies with the development of MMW (18-40 GHz, 40-W) power modules.

-- (U) Continue development of new cathodes to provide increased operating life and lower noise at reduced operating temperature for high power microwave and millimeter wave amplifiers.

-- (U) Continue development of new high temperature superconducting (HTSC) materials for beam focusing systems to provide higher magnetic field and reduced power consumption.

-- (U) Complete development of manufacturability and cost analysis tools in coordination with the MMACE and MMPS programs.

-- (U) Complete system level design capability for MPMs through joint ARPA/tri-Service MMPS (Microwave and Milimeter-wave Pilot Site) program.

- (U) ($4,600) ELECTRO-OPTICS TECHNOLOGY supports activities to develop infrared focal plane arrays and fiber optics technology for improving existing and future Naval electronic systems, sensor systems, and communications/data systems. This year's efforts will include:

-- (U) Initiate development of cables for mid-IR fibers to be used in EW applications.

-- (U) Continue development of high speed external modulators with emphasis on bandwidths to 60 GHz and lower Vp (lower link losses) for high speed communication applications.

-- (U) Continue development of multiplexing and demultiplexing techniques for strain and acoustic sensors using Bragg gratings.

-- (U) Continue development of embedded sensors in composite materials for distributed sensing and strain testing in a variety of platforms such as submarines, bridges, and roadways.

-- (U) Continue development of laser diode transmitters with 20 GHz bandwidths at the 1.5 micron wavelength for use in high speed analog links for wavelength division multiplexing and wavelength scanning applications in EW systems.

-- (U) Continue development of fiber optic feed for phased array radar systems, especially related to ATD on shipboard ECM transmitter for ship defense.

-- (U) Continue mid-IR fiber development to reduce impurity loss to <.5 dB/m, total loss <1.0 dB/m, and increase mechanical strength to >75 ksi to support Electronic Warfare and hazardous waste detection applications.

-- (U) Complete demonstration of 128 x 128 dual-band (3 to 5um and 8 to 12um) infrared focal plane array (IRFPA) with simultaneous coincident signal integration. This approach will eliminate the current need for a separate array for each wavelength band and the subsequent alignment issue.

- (U) ($6,068) MICROELECTRONICS supports activities to develop primarily silicon-based technology for low power, high speed, radiation-hard systems applications. This year's efforts will include:

-- (U) Continue development of high voltage devices on SOI for liquid crystal display (LCD) drivers and micromechanical actuator drivers, both of which can now be fabricated in SOI materials.

-- (U) Complete demonstration of a 16 bit, 125 megasample/sec analog-digital converter for application to wide bandwidth digital ASW receiver to meet Navy multi-channel acoustic system requirements.

-- (U) Complete development of 100x100 synapse, 100 neuron analog self-learning artificial neural network and transition to 6.3 program entitled "Air Vehicle Diagnostic System" with application to the Time-Stressed Helicopter Rotor Gearbox.

- (U) ($2,205) ELECTRONIC AND E/O MATERIALS supports activities to develop substrate materials, thin film materials, processing materials and superconducting device technology for RF components, Electro-optics, and microelectronics applications. This year's efforts will include:

-- (U) Methods for producing lithographic resists sensitive to 193 nm light will be transferred to industry with a new effort to scale up the process developed in the laboratory to ensure compatibility with semiconductor processing line technology.

-- (U) Continue development of wide bandgap III-V semiconductors such as GaN and AlN which will involve a combination of materials growth, device structure fabrication, and characterization to produce blue lasers and high power, high temperature operation of RF devices.

-- (U) Complete development of reliable electrical contacts for cubic silicon carbide and transfer to industry for development of RF devices.

-- (U) Complete development of techniques for growth of unstrained InGaAs/InAlAs heterostructures on GaAs substrates by means of compositionally graded layers acting as dislocation filters. The devices will be used for secure communications with applications to military and civilian users.

- (U) ($3,400) HIGH PERFORMANCE COMPUTING (HPC) is a broad area focused towards accelerated insertion of new high performance computing resources into the S&T and operational community through partnerships between computer scientists, S&T generic and applications-specific researchers and the program management offices. This year's efforts will include:

-- (U) Complete, demonstrate and provide explicit measurement of a distributed interactive simulation of semi-automated forces using an object-oriented implementation on a heterogeneous network of high-performance computers using an Army- developed language (charm ++), and a Navy-developed (SmartNet) inter-system protocol to prove flexibility, interoperability and performance.

-- (U) Continue application of parallel computers to develop software tools which can automatically translate an engineer's design of a system into affordable, compact portable parallel software.

- (U) ($2,792) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION provide generic technology for a large number of application and mission areas that require reasoning under uncertainty (making maximum use of human cognitive capabilities), and operation of autonomous systems. This year's efforts will include:

-- (U) Demonstrate the application of machine learning techniques for developing more reliable robotic software.

-- (U) Apply speech understanding lessons learned from Eucalyptus to a model for speech control in virtual environments to enhance operator effectiveness.

-- (U) Demonstrate range-based sensing and control in mobile robots, suited to surveillance and other military missions.

-- (U) Assess alternative approaches to the management of large and dynamic case-based memories, integrate model- and case-based reasoning, and explore the novel use of cases viewed as active agents using a strict object-oriented model; these are key issues to making this approach effective in time constrained environments.

- (U) ($5,170) ENGINEERING OF COMPLEX SYSTEMS pursues the combination of technologies needed to reliably, cost-effectively produce future, and enhance current, computer-intensive systems, through selection of adequate hardware, software and human resources to perform specified complex missions within their specified performance envelopes. This year's efforts will include:

-- (U) Upgrade DESTINATION, a software tool for automated specification and exploration of complex processor-intensive systems, including advanced capabilities to perform system level design capture, design optimization, and structuring and restructuring in a coherent, seamless manner. Hierarchial capabilities will allow manipulation of various levels of system design, component, and environment representations. Included are proven tailorable objective functions based on different measures-of-effectiveness criteria to ensure that system requirements are affordable for the projected life of the system. First focus is on surface combatant systems.

-- (U) Configurable release of the Schema Definition Set Design Tool components to support different kinds of databases (e.g., relational, object-oriented, entity-attribute-relationship).

-- (U) Initiate the development of advanced capabilities for the System Reengineering Environment including multi-language capabilities, automated translation of direct code (Assembly language), frameworks for software understanding, metrics to assess reengineering feasibility, architecture transformation methods, and reuse library.

4. (U) FY 1997 PLAN:

- (U) ($1,200) SHORE FACILITIES MATERIALS supports the shore infrastructure of piers, wharves, and other facilities required by naval logistics and operations, e.g., magazines and tank farms. This year's efforts will include:

  -- (U) Complete establishment of criteria for the cathodic protection of Navy pier substructures in the marine splash zone using embedded anodes and metallized zinc systems for 50-75% longer pier life with ship protection from pier cathodic systems.

- (U) ($11,508) AIRBORNE MATERIALS supports naval aircraft, including airframes, propulsion, and air weaponry. This year's efforts will include:

  -- (U) Continue development of a high temperature (greater than 350° C) composite resin that is resistant to marine environments even in the presence of corroding metal unlike bismaleimide resins.

  -- (U) Complete development of first generation hot corrosion resistant ceramic engine components for Navy aircraft turbines. Hot corrosion is the most significant degradative mechanism for aircraft turbine engine in the marine environment.

  -- (U) Complete material and fabrication concept for a switchable (electrically conductive to non-conductive) missile radome to shield internal antennas from RF energy.

  -- (U) Complete transition of conductive polymer composite technology into F414 engine front frame for subsequent production qualification of the engine front frame eliminating the need for additional coatings and coating weight.

-- (U) Complete demonstration of 1500° F nickel superalloy disk capable of functioning with the higher cooling air temperatures of the Phase II Integrated High Performance Turbine Engine Technology demonstration engines.

-- (U) Complete development of an encapsulated, room-temperature storable adhesive for shipboard repair of aircraft, including higher temperature, bismaleimide composites to provide the Navy Fleet with an alternative to the short lived and logistically burdensome adhesives that require continuous cold storage.

- (U) ($11,336) SEABORNE MATERIALS supports all ship, submarine, and related needs, such as machinery materials, hull coatings, and seaborne weapons materials. This year's efforts will include:

-- (U) Continue development of metal-matrix materials for non-magnetic Navy diesel engines for mine hunting and other low magnetic signature applications.

-- (U) Continue documentation and distribution of materials properties of advanced heavy metal underwater warheads including textural effects and required metallurgical processing for optimum performance.

-- (U) Complete development of hydrogen control methods in welding materials and processes to eliminate hydrogen cracking in ship/submarine welded structures.

-- (U) Complete field testing of biofouling and repellents/fungicides/mildew-resists using controlled release from microtubules based on self-assembling biomolecular materials.

- (U) ($3,665) MISSILE/SPACE MATERIALS supports naval satellite and tactical ballistic missile needs. This year's efforts will include:

-- (U) Continue demonstration of improved performance of advanced heatshield materials, especially shape-stable carbon-carbon, for conventional ballistic missile applications for a 50% improvement in ballistic accuracy.

-- (U) Complete Phase II of the Robust Processing Program in which high thermal conductivity carbon fibers are incorporated in metal thermal planes for a 50% increase in heat removal from electronic modules accompanied by a 30% decrease in thermal plane weight.

- (U) ($5,738) MULTI-MISSION MATERIALS supports certain promising developing technologies, such as biomolecular materials that have wide potential, and materials that provide support to naval systems across a wide spectrum, such as laser eye and sensor protection materials. This year's efforts will include:

  -- (U) Continue development of materials that react to laser light for eye and sensor protection of fixed and tunable frequency. No materials currently exist that react fast enough to laser light to protect the human eye so fixed wavelength blocking filters are fielded with consequent loss in general light transmission.

  -- (U) Complete engine durability testing of stabilized zirconia thermal barrier coatings in marine turbine engines that will provide at least 50% greater resistance to vanadate attack from lower grade oils than current zirconia coatings.

- (U) ($7,390) RF SOLID STATE DEVICE AND CONTROL COMPONENTS support activities to generate, control, radiate, receive, and process VHF, UHF, microwave, millimeter-wave and sub-millimeter wave power. This year's efforts will include:

  -- (U) Initiate the development of injection-locked compact solid-state transmitters to provide 250 watts of power at 94 GHz for adverse weather millimeter- wavelength imaging radar seekers to improve tracking accuracy of radar seekers by reducing glint, for anti-ship missile defense against low-observable and conventional anti-ship missiles, and for lightweight yet high power combat identification systems to prevent fratricide in combat in adverse weather.

  -- (U) Initiate the investigation and integration of photonic interconnect/tuning/signal processing technologies with superconducting antenna technologies for missile seeker and aircraft applications.

  -- (U) Continue development of heterostructure power devices, switches and converters for millimeter wave array development of active multiplexers for phased arrays.

  -- (U) Complete the development of wideband circulators for the MMPM for EW applications.

  -- (U) Complete the development of thin-film millimeter wave magnetless circulators.

-- (U) Continue and expand high power device development to encompass high linearity and high efficiency.

-- (U) Complete the development of high dynamic range wide band LNA with very high second and third order intermodulation intercepts.

-- (U) Complete 18-40 FHZ MMIG Drive for MMW Power Module.

- (U) ($17,327) VACUUM ELECTRONICS supports activities to generate and receive microwave, millimeter-wave and sub-millimeter wave power. This year's efforts will include:

-- (U) Initiate advanced electronic power conditioning development exploiting improvements in SiC switches.

-- (U) Initiate development of microwave power module that will cover three frequency octaves to permit the realization of low cost decoys for EW applications.

-- (U) Initiate development of advanced manufacturing analysis tools and linkages for MMACE to reduce by a factor of five the life-cycle cost of EW and radar system components such as the microwave power module.

-- (U) Continue development of new cathodes to provide increased operating life and lower noise at reduced operating temperature for high power microwave and millimeter wave amplifiers.

-- (U) Complete extension of MPM concept to higher frequency with the development of MMW (18-40 GHz, 40-W) power modules.

-- (U) Complete Microwave and Millimeter Wave Advanced Computational Environment (MMACE) framework and basic tool package for helix TWT design and deliver to the U. S. microwave power tube industry.

-- (U) Complete development of an MPM capable of producing in excess of 100 watts CW (within C-Band) at extremely high efficiencies for use in an airborne antenna conformal to an E-2C.

-- (U) Complete development of methodologies, models, and algorithms for the integration of complex design codes into cost vs feature/behavior trade-off analysis and optimization.

- (U) ($5,516) ELECTRO-OPTICS TECHNOLOGY supports activities to develop infrared focal plane arrays and fiber optics technology for improving existing and future Naval electronic systems, sensor systems, and communications/data systems. This year's efforts will include:

  -- (U) Continue development of high-speed, high-dynamic-range photodetectors for optical processing including acousto-optical (AO) channelizers. This effort is directed toward coherent EW signal synthesis processing requirements for systems including AIEWS and updates of the SLQ-32 and ALR-67.

  -- (U) Continue development of 256 x 256 adaptive IRFPA with high dynamic range on-chip electronics to implement on-chip nonuniformity correction and preliminary filtering functions. On-chip nonuniformity corrections and filtering functions improve the dynamic range to allow this IRFPA to operate in differing scenarios and allow compact implementation that is particularly important for missile seekers.

  -- (U) Continue development and testing of multi-element (N<50) in-fiber Bragg grating array for acoustic and strain sensing systems.

  -- (U) Complete demonstration of 128 x 128 adaptive IRFPA with on-chip electronics to enhance the dynamic range to 120 dB and to implement offset nonuniformity correction.

- (U) ($6,963) MICROELECTRONICS supports activities to develop primarily silicon-based technology for low power, high speed, radiation-hard systems applications. This year's efforts will include:

  -- (U) Continue development of adaptive signal processing on a 128 element IRFPA for increased dynamic range and coarse on-chip nonuniformity correction. The enhanced signal processing will allow much greater flexibility in the use of focal plane arrays for FLIRS and IRST applications.

  -- (U) Continue development of low power, silicon germanium, T-gate devices in 30nm thin-film silicon-on-sapphire for application to 6 bit, 20 gigasample/second quantizer for EW/ECM applications.

  -- (U) Complete demonstration of collocated interference cancellation circuitry for communication systems.

-- (U) Complete development of GaAs epitaxial lift-off process to aluminium substrates to implement integrated GaAs circuits on the same alunimum nitride substrate to increase power dissipation and strenghten package.

-- (U) Complete demonstration of low power, low voltage sub 500nm - 250nm silicon germanium devices with T-gate structures in 50nm thick thin-film silicon-on-sapphire. These structures will allow the development of 4 bit, 10 gigasample/sec and 10 bit, 2.5 gigasample/sec analog-digital converters to improve detection of signals in high clutter environments and reduce cost of on-site signal processing in deployable sensor systems.

- (U) ($2,585) ELECTRONIC AND E/O MATERIALS supports activities to develop substrate materials, thin film materials, processing materials and superconducting device technology for RF components, electro-optics, and microelectronics applications. This year's efforts will include:

-- (U) Initiate contractual activity to demonstrate wide bandwidth high temperature superconducting antenna system with improved performance with reduced physical size.

-- (U) Continue substrate development for both wide bandgap materials and narrow bandgap materials. Goals are to develop lattice matched substrates that are semiinsulating as well as substrates that can be doped with n-type and p-type impurities.

-- (U) Complete contractual activity to demonstrate narrow bandwidth, high temperature superconducting bandpass filters capable of handling more than ten watts of incident microwave power.

- (U) ($3,850) HIGH PERFORMANCE COMPUTING (HPC) is a broad area focused towards accelerated insertion of new high performance computing resources into the S&T and operational community through partnerships between computer scientists, S&T generic and applications-specific researchers and the program management offices. This year's efforts will include:

-- (U) Demonstrate a software parallelization tool based on the Processing Graph Method (PGM) which promises dramatic savings in software development for signal-processing applications through the use of a hardware-independent graphical programming method to define processes, a graphical or symbolic hardware description, and automatic mapping between them for best fit, that meets a cost function specific to the specialized needs of a given system. Potential transition targets include the Integrated Undersea Support

Systems (e.g. IUSS-SDS (surveillance and direction system), and the SDS-ADS (advanced Development System), the AN/SQQ-89 sonar sensor program and the ARPA RASSP program. Navy maintenance of the product set is promised.

- (U) ($3,015) ARTIFICIAL INTELLIGENCE AND HUMAN COMPUTER INTERACTION provide generic technology for a large number of application and mission areas that require reasoning under uncertainty (making maximum use of human cognitive capabilities), and operation of autonomous systems. This year's efforts will include:

  -- (U) Demonstrate new capabilities for meteorological forecasting using machine learning; results can be applied to both civilian and military use.

  -- (U) Demonstrate guidance of mobile robot tasks by utilizing a 3D range scanner, and advance the computational efficiency of machine vision through innovative use of data from tripod operators.

  -- (U) Demonstrate the collaborative uncertainty management module within intelligent control.

  -- (U) Initiate work on a mechanical proof system that can support verification of software timing properties within an automated system context.

- (U) ($6,422) ENGINEERING OF COMPLEX SYSTEMS pursues the combination of technologies needed to reliably, cost-effectively produce future, and enhance current, computer-intensive systems, through selection of adequate hardware, software and human resources to perform specified complex missions within their specified performance envelopes. This year's efforts will include:

  -- (U) Develop and demonstrate a sub-system of the AEGIS system using forward and reverse system composition methodology and prototype automation aids for specification and analysis of performance of at least three alternative designs. This will provide a fully integrated, automated environment to support affordable and evolutionary system design methodology for large complex computer-based systems. Tactical decision making, weapons control, and sensor data fusion are primary candidates for application of automated methods for systems architecture formalization and analysis. Tactical computer processor utilization models and non-invasive instrumentation techniques will be employed to evaluate and assess alternative architecture implementations to assure functionality and performance. The goal is to demonstrate a factor of 3 increase in

productivity over conventional design methods. Release Update Systems Reengineering Environment prototype with advanced capabilities including multi-language translation, automated handling of embedded assembly language, software understanding framework, decision metrics, architecture transformation, and reuse library.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	$72,040	$80,867	XXX	XXX
(U) FY 1995 Appropriated:	XXX	$96,534	XXX	XXX
(U) Adjustments from Appropriated/PRESBUDG:	-1,519	$-2,275	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	$70,521	$94,259	$74,849	$86,515

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Adjustments in FY 1994 are for: End-of-Year execution (+81) to reflect below threshold reprogramming; and, TRP Reprogramming action (-1,600). Fund adjustments in FY 1995 are for; Congressional Undistributed Cuts for University Research (-1,000); Consulting Services Support Reduction (-221); Federally Funded Research and Development (-57); Travel (-92) and an assessment for Small Business Innovative Research (-905).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PEs 0601102A, 0601102F, 0601153N (Defense Research Sciences)
(U) PEs 0602105A, 0602102F (Materials Technology)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602234N
PROGRAM ELEMENT TITLE: MATERIALS, ELECTRONICS, AND COMPUTER TECHNOLOGY

(U) PEs 0602705A, 0602709A, 0602204F,0602702F (Electronic Devices Technology)
(U) PEs 0602783A, 0602789A, 0602202F, 0602204F, 0602702F (Computer Technology)
(U) PE 0602303A (Missile Technology)
(U) PE 0602601A (Combat Vehicle and Automotive Technology)
(U) PEs 0602702F, 0602232N (Command, Control and Communications)
(U) PE 0602786A (Logistics Technology)
(U) PE 0602111N (Surface/Aerospace Surveillance & Weapons Technology)
(U) PE 0602121N (Surface Ship Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602314N (Undersea Surveillance & Weapons Technology)
(U) PE 0602323N (Submarine Technology)
(U) PE 0602270N (Electronic Warfare Technology)

(U) This PE adheres to Tri-Service Reliance Agreements on Advanced Materials, Electronic Devices and Computer Technology with oversight provided by the Joint Directors of Laboratories and Joint Engineers. This PE is integrated with the Navy's 6.1, 6.2, and 6.3A PE's shown above and is fully coordinated with efforts in the other-Service PE's.

D. FUNDING PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Electronic Warfare Technology	14,637	17,176	18,341	20,836	22,373	22,939	23,572	24,224	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Navy Electronic Warfare (EW) Science and Technology (S&T) Program addresses identified technology requirements for EW in cooperation with the other Services, placing special emphasis on Naval EW roles in Command and Control Warfare (C2W). This program develops technologies which support the effective utilization of naval force capabilities in the conduct of the Navy's Joint Mission Areas (JMAs) defined by OPNAV (i.e., Joint Strike, Littoral Warfare, Surveillance, Space and Electronic Warfare (SEW)/Intelligence, Deterrence, Maritime Support of Land Forces and Readiness and Shore Training). It is also vitally associated with future joint warfighting capabilities of "maintaining near perfect real-time knowledge of the enemy... " and " to counter the threat of...cruise missiles to the Continental United States (CONUS) and deployed forces". The program is planned jointly in accordance with Tri-Service Reliance agreements which allocate various EW disciplines and their attendant technology development responsibilities between the Army, Air Force and the Navy. As part of the Integrated S&T EW Program, it is subject to review and execution oversight by the Joint Director of Laboratories (JDL) Technology Panel for Electronic Warfare (TPEW).

(U) The emergence of a polycentric strategic environment, the evolving and diversified nature of the threat, and the proliferation of arms and technology have contributed to shifting the focus of conflict to regional and littoral areas. Concurrently, the global arms industry continues to supply increasingly sophisticated sensors and weapons to the world-wide arms market. The heterogenous combination of military and commercial systems dictates the need to develop more advanced EW technologies which will be able to adequately exploit and counter the use of new threats.

(U) The structure and balance of this program are responsive to OPNAV guidance and identified System Command warfighting

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

requirements and needs. The program features the integration of 6.1 and 6.2 programs with 6.3 EW core programs and Advanced Technology Demonstrations (ATD) which can produce prototypes suitable for naval force deployments and demonstrations. Program integration is achieved through the transition and implementation of program products. The program continues to support the Navy's highest priority need, Ship Self-Defense (SSD). It develops EW technologies to counter a range of threats (including multi-spectral/multi-modal sensors and seekers) and spans the entire electromagnetic spectrum by improving threat detection, identification, and location in the battle space. The program transitions new technologies to tactical aircraft (TACAIR), low observable aircraft, surface EW platforms, and Pre-Planned Product Improvement (P3I) programs through developmental upgrades and direct technology insertions.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT 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:

1. (U) FY 1994 ACCOMPLISHMENTS: This project is the primary source of Electronic Combat technology development for the Navy and Marine Corps. It focuses on technology which satisfies surface and aircraft Electronic Combat (EC) requirements. Under the JDL-TPEW this project leads the Tri-Service efforts in simulation/visualization and TACAIR expendables including infrared (IR) and radio frequency (RF) decoys for self-protection. Specific Emitter Identification (SEI) technology was also successfully demonstrated through installation aboard several operational platforms and flown during various regional conflicts abroad.

- (U) ($850) Demonstrated EW effectiveness monitoring system performance during at-sea trials which supports requirements identified in the Advanced Integrated Electronic Warfare System (AIEWS).
- (U) ($850) Conducted at-sea test of EW sensor fusion algorithms demonstrating improved command and control

performance and effectiveness.

- (U) ($850) Performed feasibility demonstrations of a portable universal environment simulator during at-sea testing.
- (U) ($750) Demonstrated the generation of false, credible radar targets using the Van Atta Array modulation concept on an RF decoy.
- (U) ($750) Tested the effectiveness of thin ring millimeter wave (MMW) chaff in full up chaff rounds during at-sea firings against simulated missile threats. Will significantly enhance SSD against RF guided anti-ship crusie missiles (ASCM).
- (U) ($850) Flight tested and demonstrated the effectiveness of the Smart Towed IR Decoy.
- (U) ($800) Demonstrated shipborne MMW receiver/jammer techniques in the laboratory using low power components.
- (U) ($850) Conducted effectiveness testing of the shipborne IR Distraction Decoy during at-sea tests.
- (U) ($650) Carried out Infrared Search and Track (IRST) countermeasures hardware and technique integration during flight tests.
- (U) ($750) Demonstrated the final design of a digitally augmented receiver to be used for advanced signal detection.
- (U) ($900) Performed system testing of the Phase II Microwave Monolithic Integrated Circuit (MMIC) technology (analog) Electronic Support Measures (ESM) receiver.
- (U) ($800) Demonstrated Expert System technology as applied to state-of-the-art ESM systems to enhance signal identification, decision making, and resource allocation/management tasks.
- (U) ($837) Completed fabrication and performed wind tunnel stability testing of Small Ship Compatible Decoy designs.
- (U) ($850) Performed concept demonstration flights of the Laser Tethered Decoy Vehicle model.
- (U) ($850) Developed broadband subsystems including antenna arrays, switching networks, and amplifiers for the Advanced Multimode Active Electronic Countermeasures (ECM) system.
- (U) ($750) Performed both sea and land-based testing of the Small Ship Jammer.
- (U) ($950) Accomplished SEI hardware operational testing to demonstrate design maturity and applicability of the technology base work for transition to 6.3/6.4.

- (U) ($750) Demonstrated Radar Warning/IR Warning receiver fusion feasibility during land tests.

2. (U) FY 1995 PLAN: Continued effort will be made in developing techniques for transition into the AIEWS SLQ-32 replacement system for surface combatants. Improvements and innovations for Ship Self-Defense technology is planned. Increased effort in the area of infrared countermeasures (IRCM) will be initiated in response to the Tri-Service Infrared Countermeasures Program Plan which was developed under the direction of the Office of the Secretary of Defense.

- (U) ($850) Evaluate Doppler difference hardware from received signals and estimate the seeker pointing angle for a determination of ECM effectiveness in real time.
- (U) ($900) Develop and test real time data interfaces for multiple shipboard EW sensors and design a prototype sensor integration system.
- (U) ($950) Refine the portable universal environment simulator design to meet fleet requirements for underway training and EW equipment checkout.
- (U) ($850) Incorporate a multiple tap delay line into the Van Atta Array modulation brassboard providing phase matched pulse stretching of four multiplexed optical signals.
- (U) ($926) Test high powered lasers and conversion systems and develop full scale vehicle requirements of the Laser Tethered Decoy Vehicle concept.
- (U) ($1,000) Fabricate and test a large, planar array for the Advanced Multimode Active ECM system.
- (U) ($950) Investigate the feasibility of using a low altitude decoy concept against advanced IR seekers (new start).
- (U) ($950) Evaluate the Smart Towed IR Decoy for potential use in helicopters (new start).
- (U) ($900) Perform ground test of a MMW jammer using an operational missile system.
- (U) ($950) Optimize the IR Distraction Decoy design and investigate deployment parameters--demonstrate in over-water firings against anti-ship cruise missile simulators.
- (U) ($950) Complete final design of the Rigid Inflatable RF/IR decoy and perform deployment tests using the MK36 launcher.
- (U) ($900) Complete Optical Augmentation (OA) and IRST susceptibility tests.
- (U) ($950) Conduct final Tri-service demonstration of a digitally augmented receiver.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

- (U) ($850) Develop and test technology for an embedded, at-sea team training capability for EW C2 and the Navy Tactical Command System Afloat.
- (U) ($950) Fabricate and test an optimal demonstration vehicle and antenna isolation model for determining vehicle design compatibility.
- (U) ($950) Perform field testing of a full-up automatic SEI system.
- (U) ($950) Field test Radar Warning Receiver/Infrared Warning Receiver (RWR/IRWR) full-up fusion demonstration.
- (U) ($600) Integrate of SEI techniques, Precision ESM, and Combat System Tracks for Littoral Warfare and Joint Strike missions (new start).
- (U) ($400) Demonstrate risk reduction of Long Duration Tethered Electronic Decoy for SSD (new start).
- (U) ($450) Develop anti-ship missile real-time effectiveness measures that correlate ESM and integrated acceleration data from Doppler radar tracks.

3. (U) FY 1996 PLAN: The FY 1996-1997 plan includes increased emphasis on technology which provides increased survivability for surface ships and tactical aircraft against the advancing IR threat. Efforts to increase shipboard sensor and weapons response to satisfy the reduced timelines associated with operations in littoral regions will continue. Programs in the areas of combat identification, precision strike and information dominance will receive added support to assist in the successful accomplishment of the Navy's JMA strategy.

- (U) ($645) Test multipath and navigation correction hardware for Electronic Stabilization.
- (U) ($725) Perform at-sea testing of optical amplifier jammer hardware.
- (U) ($750) Develop and perform land based testing of an autonomous shipboard decoy launch and recovery system (new start).
- (U) ($725) Transition Laser Tethered Decoy Vehicle to AIEWS.
- (U) ($825) Initiate fabrication of a brassboard employing a linear array with a Photonic beam forming network.
- (U) ($825) Test advanced IRCM false targets against foreign anti-ship cruise missiles (ASCM) seekers (new start).
- (U) ($850) Develop optimization algorithm for the soft-kill/hard-kill integration prototype.
- (U) ($700) Demonstrate Optimum Resource Allocation algorithms.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

- (U) ($725) Conduct tests to develop Synthetic Aperture Radar (SAR) and inverse SAR (ISAR) classifiers.
- (U) ($775) Assess requirements for captive carry hybrid simulation tests of advanced ASCM seekers (new start).
- (U) ($625) Perform final hardware configuration test of P-3 pod antenna system.
- (U) ($825) Flight test High Range Resolution (HRR)/ISAR countermeasures hardware.
- (U) ($775) Demonstrate improved Kinematic-Activated Metal Decoy (AMD) against advanced seekers with discrimination capability.
- (U) ($725) Test and analyze effectiveness results of the short pulse laser against the component response model (new start).
- (U) ($771) Complete work necessary to transition the Digital Receiver to AIEWS, ALR-67 Advanced Special Receiver (ASR) and ALQ-99.
- (U) ($750) Demonstrate capability of the Phase III EW/MMIC receiver.
- (U) ($825) Develop miniature SEI extraction and processing hardware for integration into the fullup automated SEI system.
- (U) ($825) Perform analysis of passive emitter location using doppler from helicopter rotors (new start).
- (U) ($825) Investigate navigation strategies using virtual reality (new start).
- (U) ($825) Develop high speed algorithms and networks to link a detailed pulse-by-pulse CRUISE model with a high density signal level model such as the Full Engagement Decoy Simulator (FEDS).
- (U) ($875) Incorporate cloud cover model to the IR predictive code in the CRUISE model.
- (U) ($775) Fabricate and test cellular communications countermeasures system.
- (U) ($650) Assess isolation improvement techniques and analysis methods.
- (U) ($725) Field test compact URD-4 tactical system which is a significant enhancement to the Surveillance JMA.

4. (U) FY 1997 PLAN:

- (U) ($1,075) Demonstrate MMIC Phase III hardware in a MK-36 compatible decoy.
- (U) ($1,175) Develop design requirements for incorporating advanced active multimode countermeasure into AIEWS.
- (U) ($1,175) Fabricate and test onboard MMW jammer breadboard.
- (U) ($1,075) Develop and test a prototype shipboard sensor integration system with real-time interfaces.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

- (U) ($975) Demonstrate new vehicle concept for protection of small radar cross section (RCS) ships.
- (U) ($1,075) Develop a method of launching a shipboard decoy using non-pyrotechnic means (new start).
- (U) ($832) Initiate integration of P-3 specific emmitter identification (SEI) antenna system to identified platforms.
- (U) ($718) Begin preparation for transition of Lumped Line Towed Decoy to TACAIR platforms.
- (U) ($775) Commence transition of HRR/ISAR to the 6.3 Integrated Defensive Electronic Countermeasures (IDECM) program.
- (U) ($775) Transition Polarimeter technology to a proposed Non-Cooperative Target Recognition (NCTR) ATD.
- (U) ($1,111) Fabricate Millimeter Wave Power Module (MMPM) electronically steered array for testing in airborne ECM systems (new start).
- (U) ($1,025) Develop final IR Distraction Decoy design.
- (U) ($1,075) Demonstrate flight certified Smart Towed IR Decoy with tethered interface.
- (U) ($1,075) Evaluate effects of a short pulse laser against IR seekers (new start).
- (U) ($1,075) Transition EW/MMIC Receiver to AIEWS, ALR-67 ASR.
- (U) ($1,250) Conduct anechoic chamber tests of integrated miniature SEI with MMIC receiver and antenna.
- (U) ($1,050) Develop 7-channel fiber-optic antenna remoting system (new start).
- (U) ($1,275) Fabricate 16-channel optical brassboard for use in followup receiver testing.
- (U) ($1,075) Develop high speed algorithms to attempt real-time simulation of IR/RF scenarios.
- (U) ($1,175) Develop enhanced detailed sea surface model for use in clutter simulation and modeling tests (new start).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	$14,729	$18,095		
(U) FY 1995 Appropriated:		$18,095		
(U) Adjustments from Appropriated/ FY 1995 PRESBUDG:	-92	-919		
(U) FY 1996/97 PRESBUDG Submit:	$14,637	$17,176	$18,341	$20,836

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: In FY 1994 the decrease id from end of year adjustments to reflect below threshold reprogrammings (-92). In FY 1995 the decrease reflects Congressional undistributed reductions for University Research (-815), travel (-25) and an assessment for Small Business Innovative Research (-79).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) RELATED RDT&E PROGRAMS:

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602270N
PROGRAM ELEMENT TITLE: Electronic Warfare Technology

This PE adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the JDL and is associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0602204F (Aerospace Avionics)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0605604A (Survivability and Lethality Analysis)

This program is also closely associated with the following Navy PEs:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0603270N (Advanced Electronic Warfare Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Undersea Warfare Surveillance Technology*	53,953	49,648	51,182	53,966	58,185	61,702	63,354	65,057	CONT.	CONT.

* FY 1994 and FY 1995 reflects FY 1996 S&T restructure. Funding moved to 0101224N and 0602633N.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Work under this program element (PE) is focused on advanced development of Undersea Warfare technologies in support of three of the "Top 5" Future Joint Warfighting Capabilities endorsed by Joint Chiefs of Staff as they apply to the undersea target, namely: (a) maintaining near perfect real-time surveillance of an enemy's undersea forces and communicating that knowledge to joint forces in near-real-time; (b) developing a range of tactical Anti-Submarine Warfare (ASW) capabilities that could be employed at the lower end of the full range of military operations with minimum risk of casualties or collateral damage to friendly forces; and (c) developing a robust world-wide capability for detecting and localizing undersea threats, including diesel-electric submarines in littoral waters, in decisive conflict with minimal risk of casualties or collateral damage to friendly forces. Projects support the development of technologies associated with undersea target detection, classification, localization, and tracking relating to the Joint Mission Areas (JMAs) of Joint Littoral Warfare, Joint Strike, Joint Surveillance, and Maritime Support of Land Forces. Specifically:

(u) Joint Littoral Warfare includes research and technology issues associated with 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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

tactical control and active sonar and deployable surveillance systems for indication and warning.

(u) Joint Strike includes research and technology issues associated with reliable undersea target detection and tracking to enable the application of precision offensive military force. Programs include sensors and undersea arrays to provide robust shallow water surveillance and reconnaissance capabilities, and sensors to detect undersea threats to the surface battleforce.

(u) Joint Surveillance includes research and technology issues associated with maintaining a timely tactical picture of the undersea battlespace to enable allied force power projection and sea control. Programs include development of acoustic and non-acoustic sensors, arrays, sonobuoys and fusion of multi-sensor data into a reliable tactical picture.

(U) Maritime Support of Land Forces includes research and technology issues associated with reliable undersea target detection and tracking, enabling joint battleforce sustainability. Programs include the entire spectrum of technology development undertaken in support of other JMAs.

(U) It should be noted that success in each JMA addressed above requires effective detection, classification, localization and tracking of enemy movements in the undersea battlespace.

(U) These efforts support the naval portion of the Joint Warfare Strategy as expressed in "Forward...From the Sea". Programs in this PE are primarily service (Navy) unique.

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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

(u) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (u) FY 1994 ACCOMPLISHMENTS:

- (u) ($41,311) ACOUSTIC SENSOR TECHNOLOGY:

(u) Completed:

-- (u) development and testing of a Towed Vertically Directive Source utilizing a spectra and epoxy resin composite tow body to reduce weight and a [redacted] acoustic array to reduce high-angle reverberation in preparation for FY 1995 joint tests with North Atlantic Treaty Organization (NATO) Supreme Allied Commander Atlantic Undersea Research Centre (SACLANTCEN).

-- (u) design and development of a five-line, multi-dimensional, tactical, towed array (enabling technology for a dramatic improvement in passive detection, classification, and localization of diesel-electric submarines in shallow water).

-- (u) performance evaluation of statistical acoustic classification clues using [redacted] sea-test data--enabling technology for a neural-net based, [redacted] echo classifier that has promise for successfully illuminating a shallow water basin in search of small submarines.

-- (U) a comprehensive performance trade-off study identifying promising technologies for improving helicopter dipping sonar hardware performance in shallow water operations.

-- (U) an evaluation of manufacturing technology requirements to lower the formulation costs of an innovative acoustic source material (Terfenol-D).

-- (u) integration testing of a 250-channel adaptive cross-channel device aimed at detecting and classifying [redacted] emanating from a diesel-electric submarines with a very low probability of false alarm.

-- (U) testing of pressure-tolerant electronics, lightweight power cable, and fiber-optic telemetry components of an acoustic array capable of being rapidly deployed on the ocean floor.

(u) Conducted:

-- (u) joint sea test with Australia to evaluate technology for exploiting accurate in-situ environmental measurements

-- (u) an at-sea test to demonstrate the performance of volumetric and planar receiver arrays developed to support a series of sea trials assessing an autonomous, airborne, [redacted] acoustic search concept.

(U) Demonstrated:
-- (U) a vertical-line deployable array (enabling technology for a low cost, surveillance system).
-- (U) a micro-machined two channel accelerometer (enabling technology leading to development of a wide area, Maritime Patrol Aircraft-deployed, passive acoustic array).

(U) Developed:
-- (U) multi-ping clustering and active adaptive beamforming reverberation suppression algorithms (enabling technology for bistatic activation of towed and fixed surveillance receivers at).
-- (U) signal processing techniques to separate components of an echo caused by distinct physical mechanisms of the hull structure (enabling technology for improved active sonar classification performance).
-- (U) algorithms which exploit the Doppler detection capability demonstrating the high payoff potential for detecting small diesel-electric submarines in shallow water.
-- (U) the physical configuration and completed a packaging study for both a line array and a planar array, candidate configurations for an air-deployed surveillance receiver positioned on the ocean floor.

• (U) ($12,642) NON-ACOUSTIC SENSOR TECHNOLOGY:

(U) Completed:
-- (U) design of a linear, flexible, non-acoustic node for a deployable distributed array (enabling technology for a wide area search capability, i.e., rapidly deployable from a surface ship).
-- (U) a comprehensive final report made as part of Ice Exercise-91.
-- (U) a final report on the Low Grazing Angle radar sea clutter measurements made in FY 1993.
-- (U) a final report on comprehensive measurements of submarine made during FLEX-91. Measured active and passive magneto-hydrodynamics phenomenon signals were not in conflict with theory.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

(U) Demonstrated:
-- (U) a brassboard version of a vector magnetometer with a over other non-superconducting magnetometers.
-- (U) detection of a submarine from a surface ship in shallow water, providing a capability to increase probability or detection
-- (U) compensation of aircraft magnetic and geomagnetic noise using data from the Fiscal Year 1993 field test and newly developed compensation algorithms,

(U) Initiated:
-- (U) a project to demonstrate the feasibility of "next generation" airborne periscope detection radar. The goal will be to increase operating altitude

2. (U) FY 1995 PLAN:

• (U) ($39,520) ACOUSTIC SENSOR TECHNOLOGY:
(U) Conduct:
-- (U) cooperative shallow water active classification sea test with NATO's SACLANTCEN (gathering real world, shallow water, diesel-electric submarine target-in-the-environment and environmental data needed to develop active classification algorithms and benchmark active sonar developments).
-- (U) at-sea test of a high power acoustic transducer using Lead Magnesium Niobate (PMN) driver and hybrid electromechanical drive electronics to evaluate an ability to double the energy density of current //Surveillance Towed Array Sonar System acoustic sources.
-- (U) evaluation of advanced source technologies in harsh, shallow water environments to validate airborne autonomous anti-submarine warfare rapid search and localization performance capabilities.
(U) Demonstrate:
-- (U) a tri-axial micro-machined directional hydrophone (enabling technology leading to development of a wide-area, Maritime Patrol Aircraft-deployed, passive acoustic array).
-- (U) performance improvements of conventional and adaptive beamforming employing a tactical multi-

dimensional towed array in a shallow water exercise conducted in a Mediterranean area of great tactical interest.

-- (U) improved active sonar detection performance associated with an air-deployed sonobuoy utilizing a new slotted cylinder projector, high density power electronics, and lithium thermal batteries.
-- (U) detailed design requirements for a wideband acoustic projector to provide a breakthrough in effectiveness of a helicopter dipping sonar conducting an area search for diesel-electric submarines operating in shallow water.
-- (U) improved sonar operator performance in detecting and classifying diesel-electric submarines using at-sea recorded data processed through an adaptive cross-channel processor designed to reduce operator loading by eliminating most false alarms.
-- (U) a small diameter, battery powered linear flexible electro-optic node to enable development of an acoustic array capable of being deployed by a small unmanned underwater vehicle.
-- (U) airborne deployment of a horizontal line array.
-- (U) volumetric and planar array implementations of an autonomous airborne acoustic search concept employing expendable high-power light-weight sources.

(U) Develop:

-- (U) a set of overarching active acoustic array design guidelines based on current analytical models implemented in a user-friendly computer environment.

(U) Complete:

-- (U) development of multi-ping clustering and active adaptive beamforming reverberation suppression algorithms at (enabling the use of current tactical platforms in a multistatic operational concept).
-- (U) advanced acoustic simulation and decision theory development in support of an innovative neural-net approach to identification or reacquisition of targets in densely cluttered regions (enabling technology for a , wide area, active search of a littoral environment).
-- (U) fabrication of a scale-model submarine (enabling technology for improved active sonar classification performance).
-- (U) determination of the optimal set of features necessary to enable single-ping classification of submarine target echoes when employing incoherent impulsive acoustic sources in an active sonar system.

- (U) ($10,128) NON-ACOUSTIC SENSOR TECHNOLOGY:
  (U) Demonstrate:
  -- (U) a low-temperature, thin-film, superconducting gradiometer with
  -- (U) a Lithium Niobate Lyot optical filter that will enable operation of Lidar systems in daylight
  -- (U) deployment of a magnetic reference sensor from an aircraft alone to effectively compensate for geomagnetic noise, currently a significant source of clutter in

  (U) Complete:
  -- (U) final report on magnetic noise compensation for airborne magnetic systems.
  -- (U) report on shallow water submarine Probability of detection and false alarm rate as a function of will be documented.

  (U) Initiate:
  -- (U) a project to demonstrate the feasibility of lidar technology to detect and classify periscopes from a surface ship after cueing by a radar. The goal is to reduce surface ship periscope detection false alarm rate to

3. (U) FY 1996 PLAN:

- (U) ($40,820) ACOUSTIC SENSOR TECHNOLOGY:
  (U) Initiate:
  -- (U) development of critical technology for low cost autonomous deployable surveillance systems which use a commercial cellular phone satellite network for data transmission.
  -- (U) development of optical depth and heading sensors to support low cost all-optical array designs for towed and deployable applications.

  (U) Conduct:
  -- (U) sea trial to evaluate tactical surface ship , multidimensional towed array.
  -- (U) lab test evaluation of a wide range of candidate formulations of PMN transducer elements.
  -- (U) sea trial to evaluate improved optical towed array sensors and telemetry.

-- (U) cooperative shallow water active classification sea test with North Atlantic Treaty Organization's SACLANTCEN to further develop active classification algorithms and benchmark active sonar developments.

(U) Demonstrate:
-- (U) technology of a fiber-optic cabled deployable array of increased bandwidth, sensor count and type, and reduced cost per channel.
-- (U) rapidly air-deployed glider for horizontal line array deployment.
-- (U) application of signal discrimination techniques used in biologic echolocation sonars to anti-submarine warfare active sonar systems.
-- (U) a state-of-the-art acoustic classifier capable of combining echo structure clues with clues based on plausible target tracks.

(U) Complete:
-- (U) development of active and passive sonar integration concepts for processing and display of multistatic operations.
-- (U) characterization of third generation PMN formulations.
-- (U) a simulation model for the acoustic, hydrodynamic, and hydroacoustic performance characteristics of a deployable expendable single-line vertical array.

(U) Transition:
-- (U) algorithms to PE 0603504N which provide the capability to adaptively process signals across receiver array beams for accurate passive sonar detection and classification of the quiet threat.

• (U) ($7,640) NON-ACOUSTIC SENSOR TECHNOLOGY:
(U) Conduct:
-- (U) a field test of airborne detection submarines, enabling technology for detection of submarines in regions with high geologic noise.
-- (U) field test of linear, flexible, distributed non-acoustic array (enabling technology for a shallow water search capability rapidly deployable from a surface ship).

(U) Demonstrate:
-- (U) a dual mode Digicon detector utilizing the avalanche photodiode developed in FY 1993

- (U) ($2,722) DATA FUSION TECHNOLOGY:
(U) Demonstrate:
-- (U) advanced scene generation and automated assessment capability. The intent is to completely fuse information on the natural and man-made environments

4. (U) FY 1997 PLAN:

- (U) ($42,800) ACOUSTIC SENSOR TECHNOLOGY:
(U) Demonstrate:
-- (U) bi-static activation of a passive, deployable, distributed array with a deployable source.
-- (U) rapid air deployment and operation of an integrated, glider-deployed, bottomed, horizontal, line array system.
-- (U) lower cost lighter weight submarine hull array sensor technology.
-- (U) real-time capability to process data from multiple receiver arrays for both active and passive signals for autonomous target association and automatic operator alerting.
-- (U) advanced adaptive multidimensional beamforming techniques for active detection using a multi-line towed array receiver system.
(U) Transition:
-- (U) algorithms for explosive source active classification and false alarm rejection to the Extended Echo Ranging system, PE 0603254N.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

- (U) ($8,041) NON-ACOUSTIC SENSOR TECHNOLOGY:
  (U) Complete:
  -- (U) final report on analysis of data from the field test of airborne detection from submarines.
  (U) Demonstrate:
  -- (U) coherent processor and electronically steered phased array antenna for airborne periscope detection radar (enabling technology to allow extension of the periscope detection radar operating envelope
  -- (U) lidar for shipborne periscope detection and identification (enabling technology for an lidar periscope detection system
- (U) ($3,125) DATA FUSION TECHNOLOGY:
  Initiate:
  -- (U) development of software for situation assessment to aid in resource optimization

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	106,854	92,765	XXX	XXX
(U) FY 1995 Appropriated:	XXX	93,765	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-52,901	-44,117	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	53,953	49,648	51,182	53,966

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602314N
PROGRAM ELEMENT TITLE: Undersea Warfare Surveillance Technology

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Funds in FY 1994 were transferred to the Advance Research Projects Agency for the Technology Reinvestment Program by direction of DoD ($-10,204K); funds were transferred to PE 0101224N and PE 0602633N due to PE restructuring ($-45,720K); and funding also reflects an end-of-year execution adjustment ($3,023K). For FY 1995, funds reflect a comparability restructuring adjustment ($-41,019K), and congressional undistributed for university research ($-2,777K), Consulting Services ($-225K), FFRDC ($-23K), and travel ($-73K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED ACTIVITIES:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602435N (Oceanographic and Atmospheric Technology)
(U) PE 0603747N (Undersea Warfare Advanced Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Mine Countermeasures, Mining and Special Warfare Technology	23,347	37,475	43,384	44,303	46,256	52,702	54,119	55,587	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides technologies for U.S. naval mines, Mine Countermeasures (MCM), Special Warfare, and Explosive Ordnance Disposal (EOD) equipment. It is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capabilities by developing technologies to employ a range of capabilities (MCM, EOD, Special Warfare) more suitable to actions at the lower end of the full range of military operations which allow achievement of military objectives (Power Projection from the Sea) with minimal casualties and collateral damage. The particular emphasis of the PE is on addressing the urgent technology needs for Shallow-Water (SW) and Surf-Zone (SZ) MCM. Efforts are part of an integrated Department of Navy Science and Technology (S&T) process, recently initiated by the Office of Naval Research. 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. The MCM and Mining components concentrate on the development of technologies for mine detection, avoidance, neutralization and clearance, and offensive mining. The Special Warfare and EOD technology components concentrate on the development of technologies for tidal/shoreline obstacle detection and clearance, insertion and covert operations, special boat operations, and ordnance neutralization.

(U) MCM Technology: Third-world nations have the capability to procure, stockpile and deploy all types of mines in all water depths. The Commonwealth of Independent States possesses the world's largest stockpile of mines, many having sophisticated performance characteristics. "Desert Storm" demonstrated that the U.S. Navy needs to counter the projected third-world mine threat. Advanced technologies are needed to rapidly detect and neutralize all mine types, especially in the SW and SZ regions. The Department of Defense (DoD) S&T Strategy has identified SZ and SW MCM as major MCM Thrusts. The SZ MCM Thrust will develop and perform critical technology demonstrations of distributed explosives, weapon deployment, and minefield obstacle clearance and breaching technologies. The SW MCM thrust supports an in-stride mine reconnaissance and hunting capability that detects minefields and locates individual mines in SW. Advanced very shallow-water (VSW) acoustic/non-acoustic sensors, real time processing, and remote platform technologies will be developed and integrated. Both thrusts include high search rate sensor technologies integrated with advanced remote platform technologies for conducting rapid mine reconnaissance operations using best combinations of available resources.

RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

(U) Mine Technology: The need for improved mine technologies has diminished 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 Navy maintains its "critical mass" effort and capabilities in mine sensors, environment, and systems performance analysis technology. Emphasis will be placed on potentially high pay-off advanced target detection sensors and low cost mine system concepts with 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 (SEAL) mission of pre-invasion detection for clearance/avoidance of mines and obstacles in the VSW and 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 the EOD needs addresses the Navy's Joint Service and interagency responsibilities in EOD, including that required to counter and neutralize Special Improvised Explosive Devices (SIED). The technologies developed are required for locating, rendering safe, and disposing of Unexploded 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 SIED incidents. These technologies are expected to transition to the Joint Services EOD Program or the DoD Technical Response Group.

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

RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($11,647) SW MCM:
  - (U) High Area Rate Reconnaissance: Completed towed testing of Toroidal Volume Search Sonar (TVSS) from a small surface vessel. Completed development of the experimental Side-Looking Sonar (SLS), including fabrication of the arrays, fiber glass tow body, and sonar controller hardware/software modifications.
  - (U) Signal/Image Processing: Developed acoustic image processing algorithm capable of a 50% reduction in false alarms per target detected for anti-invasion minefields in high clutter environments.
  - (U) Underwater Electro-Optic Sensors: Continued optical identification sensor development for use in SW.
  - (U) Anti-Mine Projectile: Initiated effort to demonstrate the feasibility of using a supercavitating projectile as an anti-mine munition for rapid airborne mine clearance. Conducted perpendicular water entry, reactant material, and sand penetration tests.

- (U) ($3,000) SZ MCM:
  - (U) SZ Mine Neutralization: Conducted lab tests to determine the dynamic behavior of wet sand as a function of porosity and saturation. Validated and transitioned Distributed Explosive Technology (DET) array hydrocode development and explosive formulation to Explosive Neutralization Advanced Technology Demonstration (EN-ATD), PE 0603782N.
  - (U) Standoff Deployment: Enhanced the rocket Deployment Computer Model used to predict rocket deployment of DET. Conducted proof-of-concept tests for Magic Carpet deployment concept and transitioned it to EN-ATD. Investigated Thunder Road deployment concept (air dropped bomb based approach) for applicability to EN-ATD.
  - (U) Flying Sword: Continued development of large scale Explosively Formed Projectile (EFP) warhead.

- (U) ($3,100) MINING:
  - (U) Mine Sensors: Continued preparation for at-sea technology demonstration of acoustic and electromagnetic sensors for Littoral Sea Mine (LSM) application. Verified approach for LSM to counter surface targets in SW by using high frequency sonar to discriminate ships from the water surface.
  - (U) Mine Support Technology: Determined the probability of detection and probability of false alarm for Identify Friend or Foe underwater acoustic message transmissions and continued neural network target classification algorithm development for bottom mine target detecting devices.

- (U) ($5,600) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Developed shock mitigation technology components for NSW high speed boats. Completed technology assessment for carbon dioxide (CO_2) sensing.
  - (U) Mission Support Technology: Incorporated real-time correlator and spectral processing with AN/PQS-2A hand-held sonar for improved mine detection in VSW. Developed prototype clandestine underwater electro-optic near ultraviolet (UV) imaging system for mine identification.
  - (U) Response to IED/SIED Incidents: Demonstrated water jet of micro-explosives for boring through ordnance casings. Developed autonomous work package for EOD underwater vehicle containing controller, navigation, and "target" classification sections. Continued development of diver handheld acoustic imaging capability for VSW operations.
  - (U) Neutralization of Underwater Ordnance: Demonstrated SIED interior examination with serpentine robotic arm. Tested ability of single suit/obscurant to circumvent detection by anti-intrusion sensors.

2. (U) FY 1995 PLAN:

- (U) ($20,825) SW MCM:
  - (U) High Area Rate Reconnaissance: Reconfigure TVSS as a helicopter dipping sonar for mine detection/classification in shallow water. Conduct sea test of long-range SLS for detection of bottom and close tethered mines from unmanned undersea vehicle (UUV).
  - (U) Detection/Classification/Identification Sensors: Conduct laboratory test of SW/VSW high-resolution, motion-compensated synthetic aperture side scan sonar for detection/classification/identification of bottom mines in very shallow water.
  - (U) Signal/Image Processing: Demonstrate acoustic image processing algorithm capable of a 50% reduction in false alarms per target detected for anti-invasion minefields in high clutter environments.
  - (U) Underwater Electro-Optic Sensors: Demonstrate optical mine identification sensor in SW from UUV.
  - (U) Magnetic Sensors: Design experimental nitrogen-cooled superconducting gradiometer for detection/classification of buried mines.
  - (U) Anti-Mine Projectile: Demonstrate stable supercavitating projectile dynamics through air, oblique water entry, and underwater. Continue surrogate mine detonation tests to quantify candidate projectile reactant materials.
  - (U) Hamlet's Cove: Initiate effort to explore multi-source data fusion methods to detect obstacles, mines and mine laying activities before hostilities.

RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

- (U) ($7,400) SZ MCM:
  - (U) SZ Mine Neutralization: Conduct mine vulnerability testing of available threat mines to update kill criteria and expand threat mine database. Develop a multi-phase model in a coupled hydrodynamic/ structural code for simulation of explosive shock propagation through wet sand. Survey techniques to accurately measure explosive shock pressures in wet sand.
  - (U) Standoff Deployment: Continue investigating alternative DET array deployment concepts. Conduct proof-of-concept tests for Thunder Road deployment concept.
  - (U) Flying Sword: Demonstrate single plate EFP technology for surf zone environment. Design dual plate EFP warhead for underwater obstacle clearance.
  - (U) Overhead Laser Image Detection and Ranging (LIDAR) Technology: Develop high speed image processing algorithms for airborne minefield reconnaissance.
  - (U) Power Blade: Assess effectiveness of power blade technology to clear anti-invasion mines on the beach.

- (U) ($2,700) MINING:
  - (U) Mine Sensors: Complete at-sea technology demonstration of acoustic and electromagnetic sensors for Littoral Sea Mine application. Develop advanced gradient influence sensor for detecting targets in shallow water high wave noise environments.
  - (U) Mine Support Technology: Continue testing reliability of underwater acoustic message transmissions. Complete a neural network target classification algorithm for bottom mine target detecting devices. Develop mine control firing algorithms using fuzed multiple influence sensor data.

- (U) ($6,550) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Conduct laboratory tests of shock mitigation technology components for NSW high speed boats. Develop prototype diver rebreather incorporating carbon-dioxide separator.
  - (U) Mission Support Technology: Assess echo backscatter technique to enhance hand held sonar's classification capability. Conduct laboratory tests of prototype clandestine underwater near UV imaging system for mine identification.
  - (U) Response to IED/SIED Incidents: Demonstrate significantly increased jet velocity of a linear shape charge for UXO render safe procedures. Test and transition autonomous work package for EOD underwater vehicle containing controller, navigation, and "target" classification sections. Demonstrate diver handheld acoustic imaging sonar capability for VSW operations.
  - (U) Neutralization of Underwater Ordnance: Develop a controlled test bed for assessing robotic arm performance. Develop multi suit/obscurants to circumvent detection by anti-intrusion sensors. Conduct experiments to identify method for bypassing anti-intrusion sensors used for IEDs.
  - (U) Clearance of Improved Conventional Munitions: Assess technology for removing UXO from area using

subsumptive robotic techniques. Use small robots to mimic natural gathering behavior.

3. (U) FY 1996 PLAN:

- (U) ($23,584) SW MCM:
  - (U) High Area Rate Reconnaissance: Conduct at-sea testing of TVSS reconfigured as a helicopter dipping sonar for mine detection/classification in shallow water. Integrate TVSS and SLS in a small diameter underwater vehicle.
  - (U) Detection/Classification/Identification Sensors: Conduct sea tests of SW/VSW, low frequency (LF) and high frequency (HF) Synthetic Aperture Sonar (SAS) including beamforming and motion compensation technology developments.
  - (U) Signal/Image Processing: Evaluate effectiveness of using resonance signal processing algorithms (using acoustic backscatter returns from mines) for mine classification. Conduct data fusion sea tests with a total field magnetometer and SAS on a small diameter underwater vehicle.
  - (U) Underwater Electro-Optic Sensors: Complete sea tests of laser-enhanced electro-optic sensors to identify sea mines in turbid, murky littoral waters.
  - (U) Magnetic Sensors: Begin fabrication of a field deployable nitrogen-cooled superconducting gradiometer.
  - (U) Hamlet's Cove: Develop and evaluate algorithms which exploit multisource data fusion methods for obstacle and minefield surveillance.
  - (U) Marine Mammals: Develop a mammal neural network target classifier for incorporation into acoustic response monitor which collects a mammal's mine detecting characteristic activities and correlates them with the location of a minefield.

- (U) ($8,500) SZ MCM:
  - (U) SZ Mine Neutralization: Continue mine vulnerability testing of available mines to update kill criteria and develop analytical models to simulate effectiveness of buried mines in wet sand. Continue multi-phase model development to simulate explosive shock propagation through wet sand. Develop improved techniques for accurately measuring explosive shock pressures in wet sand.
  - (U) Standoff Deployment: Conduct critical component and initial full-scale testing of Thunder Road, providing an alternative approach to delivery which does not require a Naval craft. Continue investigating other alternatives.
  - (U) Flying Sword: Conduct full-scale underwater test of dual plate EFP warhead against SZ obstacles.
  - (U) Overhead LIDAR Technology: Refine airborne laser based image processing algorithms for detection of anti-invasion minefields in high clutter environments. Accomplish an 80% false alarm rate reduction. Develop high frame rate camera for rapid, wide area coverage rate airborne minefield detection systems.

- (U) Obstacle Clearance: Investigate alternative for clearing obstacles in the SZ, and conduct proof-of-concept tests for the most promising concepts.

• (U) ($3,100) MINING:
- (U) Mine Sensors: Complete integrated sensor (acoustic/magnetic/electric/pressure) data analysis of LSM demonstration data set and update processing algorithms for SW diesel-electric submarines. Test advanced gradient influence sensor and determine the ability to detect targets in SW high wave noise environments.
- (U) Mine Support Technology: Develop advanced processing techniques for detecting/localizing all surface targets, including fast patrol boats. Develop reliability underwater message transmission technique for remote control applications. Transition advanced neural network classification and mine control firing algorithms using fuzed multiple influence sensor data to 6.4 Mine Improvements program.

• (U) ($8,200) SPECIAL WARFARE/EOD:
- (U) Mission Mobility Technology: Test and demonstrate a full-scale NSW high speed boat shock mitigation system. Transition the (CO_2) membrane scrubber and sensor technology to the existing Fleet Diving System (Mk-16) Product Improvement Program. Fabricate and test an underwater Low Probability of Detection (LPD)/Low Probability of Identification (LPI) Reacquisition Marker.
- (U) Mission Support Technology: Complete and transition prototype near UV imaging system for mine identification. Develop portable multispectral reconnaissance imager using an optical parametric amplifier laser. Develop an NSW underwater standoff obstacle clearance capability.
- (U) Response to IED/SIED Incidents: Complete high velocity linear shaped charge for UXO render safe procedures. Provide real time, high resolution images of underwater targets using HF acoustics.
- (U) Neutralization of Underwater Ordnance: Assess robotic arm performance using controlled test bed. Complete experiments to identify method for bypassing anti-intrusion sensors used for IEDs.
- (U) Clearance of Improved Conventional Munitions: Demonstrate ability to remove UXO from area using subsumptive robotic techniques. Develop standoff method for safing electronically safed/armed fuzing.

4. (U) FY 1997 PLAN:

• (U) ($24,288) SW MCM:
- (U) High Area Rate Reconnaissance: Conduct at-sea tests of long range TVSS integrated with real aperture SLS in a small diameter underwater vehicle.
- (U) Detection/Classification/Identification Sensors: Optimize and transition LF & HF SAS design based on analysis of at-sea tests.

- (U) Signal/Image Processing: Conduct data fusion sea tests with integrated total field magnetometer, SAS, and electro-optic sensors on a small diameter underwater vehicle.
- (U) Underwater Electro-Optic Sensors: Optimize electro-optic sensor based on analysis of at-sea tests.
- (U) Magnetic Sensors: Complete fabrication of field deployable nitrogen-cooled superconducting gradiometer for the detection of buried mines. Conduct dock-side operability testing in small diameter underwater vehicle prior to at-sea tests.
- (U) Hamlet's Cove: Demonstrate capability to use multi-source data fusion algorithms to identify locations of obstacles and mines.
- (U) Marine Mammals: Complete development of a mammal neural network target classifier for incorporation into acoustic response monitor which collects a mammal's mine detecting characteristic activities and correlates them with the location of a minefield.
- (U) SW Mine Neutralization: Develop neutralization concepts for sea mines in amphibious assault areas.

• (U) ($8,600) SZ MCM:
- (U) SZ Mine Neutralization: Develop database of mine neutralization criteria (pressure, impulse, and energy) for threat mines through testing and analysis. Validate multi-phase coupled code model for simulation of explosive shock propagation through wet sand and use results to update SZ mine neutralization analytical model. Complete development of improved techniques for accurate shock pressure measurements.
- (U) Standoff Deployment: Complete full-scale testing of Thunder Road for deploying distributed explosive arrays and transition to PE 0603782N. Conduct proof-of-concept testing of promising alternative delivery concepts.
- (U) Overhead LIDAR Technology: Demonstrate airborne image processing algorithms for detection of anti-invasion minefields in high clutter environments. Conduct lab demonstration of high frame rate (> 3,000 frames/sec) camera for rapid, wide-area coverage rate airborne minefield detection systems.
- (U) Obstacle Clearance: Continue investigating alternatives for clearing obstacles in the SZ and transition mature technology concepts to PE 0603782N.

• (U) ($3,100) MINING:
- (U) Mine Sensors: Develop Bi-Static active target motion analysis and motion compensation models for moored LSM with low cost mobile warheads and transition LSM technology to PE 0603782N. Complete measurement of target advanced gradient signatures, complete theory and performance model development, and arrive at feasibility decision for continuing this technology.
- (U) Mine Support Technology: Verify in the lab advanced processing techniques for detecting/localizing all surface targets and transition effort to PE 0603782N for field testing. Demonstrate reliable

communications between a ship and mine at-sea, providing Identify Friend or Foe and remote control capabilities.

- (U) ($8,315) SPECIAL WARFARE/EOD:
  - (U) Mission Mobility Technology: Complete and transition high speed boat shock mitigation system. Complete and transition LPD/LPI Reacquisition Marker to U.S. Special Operation Command.
  - (U) Mission Support Technology: Complete and transition portable multispectral imager prototype. Demonstrate NSW underwater standoff obstacle clearance capability.
  - (U) Neutralization of Underwater Ordnance: Conduct laboratory demonstration of method for identifying underwater SIEDs through use of biological sensor to recognize secondary emissions.
  - (U) Clearance of Improved Conventional Munitions: Conduct laboratory demonstration of standoff method for safing electronically-safed/armed fuzing.
  - (U) General Tool Improvement: Prepare and complete laboratory experiments to identify environmentally safe methods for disposal of explosives in field environments.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	23,675	34,710	XXX	XXX
(U) FY 1995 Appropriated:	XXX	37,710	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-328	-235	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	23,347	37,475	43,384	44,303

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Funding changes in FY 1994 due to end-of-year execution adjustments ($-328K). FY 1995 funding changes to reflect congressional undistributed reductions for: Federally Funded Research and Development Centers ($-31K); travel ($-49K); and an assessment for Small Business Innovative Research ($-155K).

(U) Schedule: No change.

RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602315N
PROGRAM ELEMENT TITLE: Mine Countermeasures, Mining and Special Warfare Technology

(U) Technical: No Change.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- (U) This program has strong ties to the PE's listed below:

  (U) PE 0601153N (Defense Research Sciences)
  (U) PE 0602131M (Marine Corps Landing Force Technology)
  (U) PE 0602233N (Readiness, Training and Environmental Quality Tech)
  (U) PE 0602314N (Undersea Surveillance and Weapons Technology)
  (U) PE 0602435N (Oceanographic and Atmospheric Technology)
  (U) PE 0603502N (Undersea Warfare and MCM Development)
  (U) PE 0603555N (Sea Control and Littoral Warfare Technology Demonstration)
  (U) PE 0603654N (Joint Service EOD Development)
  (U) PE 0604654N (Joint Service EOD Development)
  (U) PE 1160401BB (Special Operation Technology Development)
  (U) PE 1160402BB (Special Operation Advanced Technology Development)
  (U) PE 0603782N (Shallow Water MCM Demonstrations)

- (U) This program adheres to Tri-Service Reliance Agreements on EOD with coordination provided by the Joint Directors of Laboratories.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

(U) COST (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
N/A Oceanographic and Atmospheric Technology	43,854	53,304	45,526	47,280	49,797	55,603	58,216	61,471	CONT	CONT

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) provides the fundamental programmatic instrument by which basic environmental research is transformed into technology developments that provide new or enhanced warfare capabilities. This PE also provides environmental technologies that form the general environmental technical base on which all systems development and advanced technology depend.

(U) This PE provides for ocean and atmospheric 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 battlefield environment, (2) environmental needs of regional warfare, (3)providing the on-scene commander the capability to exploit the environment to tactical advantage, and (4) atmospheric research related to detection of cruise missiles and weapons of mass destruction.

(U) This PE provides environmental support for 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 (SW) acoustics and multiple-influence sensors for undersea surveillance and weapon systems, and environmental influences on mine countermeasure (MCM) systems.

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

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

(U) These efforts support the Joint Warfare Strategy "Forward...From the Sea." This program adheres to Tri-Service Reliance Agreements on Environmental Sciences with oversight provided by the Joint Directors of Laboratories. 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 U.S. Air Force under the Reliance program in the Environmental Sciences categories of Lower Atmospheric Sciences and Ocean Sciences.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT 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:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($18,934) ENVIRONMENTAL SUPPORT FOR UNDERSEA SURVEILLANCE AND WEAPONS
  - (U) Used experimental data to identify system and environmental factors relevant to the improvement of active acoustic system performance in adverse environments:
    -- (U) Evaluated discriminants for surface/volume-reverberation-limited areas;
    -- (U) Upgraded active acoustics model to provide predictive capability.
  - (U) Validated Time-Dependent Parabolic-Equation SW acoustic propagation model up to 400 Hertz, and made a preliminary assessment of detection improvements by correlation of acoustic/non-acoustic sensors; these efforts will advance the ability to detect quiet submarines in coastal waters.
  - (U) Developed physics-based, full-spectrum ambient noise source functions that describe dominant environmental noise sources as a first step toward dealing with those aspects of the noise field that make difficult the detection of transient signals emitted by submarines.
  - (U) Constructed and tested an expendable mooring for ocean sensors that will allow determination of the oceanographic environment in coastal regions, primarily for acoustic surveillance.
  - (U) For improved torpedo guidance and control (G&C), determined the time/frequency/spatial correlation character of high-frequency SW surface-reverberation to allow incorporation of acoustic energy that has interacted with the boundaries; validated false target and bistatic bottom scattering strength models.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

- (U) ($14,239) ENVIRONMENTAL SUPPORT FOR MCM SYSTEMS
  - (U) Conducted field tests to measure optical parameters in coastal regions, and employed Coastal Zone Color Scanner Sensor data in coastal areas to support optical methods in MCM; measured high-frequency acoustics in sediments and developed a performance model for buried mine detection.
  - (U) For the MCM Tactical Environmental Data System (MTEDS), demonstrated sea floor classification system for mine burial prediction, demonstrated airborne electro-magnetic system capability for use in MTEDS, completed integration of environmental sensor hardware/software, and design database architecture; conducted assessment of environmental effects on MCM tactical decision aids.
  - (U) Developed sensors and unmanned underwater vehicle technology to enable determination of the fine-scale aspects of the environment critical to MCM.

- (U) ($6,515) OCEAN AND ATMOSPHERIC PREDICTION
  - (U) Performed tests of the global eddy-resolving ocean model to determine the effect of different data assimilation schemes; this effort will lead to the initial development of the global forecast system.
  - (U) Developed turbulent mixing and thermodynamic models for inclusion in the Mediterranean Sea layered model; this will provide a higher resolution of near-surface thermal structure.
  - (U) Completed preliminary data assimilation techniques for the mesoscale system along with data quality controls; such techniques will control the influence of observational data used in making atmospheric forecasts.

- (U) ($4,166) ENVIRONMENTAL INFLUENCES ON EM/EO SYSTEMS
  - (U) Incorporated rough-surface models into EM/EO propagation assessment systems to enable EM/EO models to deal with the complex ocean-land surface transition in coastal regions.
  - (U) Developed and evaluated refractivity sensing and interference techniques, both ground-based and satellite, with emphasis on coastal regions where variable conditions can have a significant influence on EM/EO systems.

2. (U) FY 1995 PLAN:

- (U) ($15,170) ENVIRONMENTAL SUPPORT FOR UNDERSEA SURVEILLANCE AND WEAPONS
  - (U) Construct/validate empirical characterizations of bottom/volume and surface scattering to advance capabilities in low-frequency active acoustics; conduct tests of a low-frequency active acoustics model for

SW regions to support undersea surveillance system design and performance estimates.
- (U) Conduct preliminary investigation of the spatial/temporal nature of coastal ocean variability and assess the expected impact on acoustic variability and undersea surveillance acoustic systems; use as the basis for planning a FY 1996 experiment.
- (U) Evaluate the accuracy of computation of the non-adiabatic acoustic propagation terms (energy and time-spread) in strongly sloping environments.
- (U) Continue developments to construct a physics-based full-spectrum ambient noise predictive capability to permit noise cancellation/noise adaptation techniques in full-spectrum processing.
- (U) Focus on bottom aspects of SW scattering in torpedo G&C; use new data to increase the robustness of a feature model for classification of false-targets for improved torpedo performance assessment.

• (U) ($25,459) ENVIRONMENTAL SUPPORT FOR MCM SYSTEMS
- (U) Continue development of an optical data base using Coastal Zone Color Scanner data (and, if available, Sea-Viewing Wide-Field-of-View Sensor data) in coastal waters to support optical methods in MCM; fully instrument a towed-body in preparation for measurements to test high-resolution acoustic imaging algorithms for MCM in SW environments.
- (U) Complete MTEDS prototype tactical decision aid software, system documentation and prototype assembly for at-sea demo in FY 1996; complete initial MCM environmental sensitivity analyses for determining tactical improvements attainable from improved environmental descriptions.
- (U) Develop instrumentation to measure gas distribution within surf zone sandy sediments, which is an environmental characteristic that significantly affects the acoustic interaction of acoustic waves with the bottom, especially the intense blast waves that offer a means of clearing buried mines.
- (U) Characterize a coastal ocean site in terms of environmental factors that affect optical MCM systems as a basis for developing a general means of characterizing littoral optical environments.
- (U) Develop semi-empirical acoustic and optical models to account for the effects of bubbles on acoustic and optical MCM systems.
- (U) Conduct a high-frequency acoustic spatial/temporal coherence experiment in SW to gather data on environmental limitations to high-resolution MCM sonar systems, such as real and synthetic aperture sonar systems.
- (U) Develop environmental sensors utilizing optical, acoustic, electromagnetic, and chemical technologies to provide a basis for remote semi-autonomous underwater oceanographic and environmental measurements, primarily with application to MCM.

- (U) Exploit remote-sensing techniques for all aspects of littoral warfare, especially MCM.

- (U) ($8,350) OCEAN AND ATMOSPHERIC PREDICTION
  - (U) Continue development of methods aimed at a global ocean prediction system, including nested regional and tactical scale components;
    -- (U) develop models to take advantage of massively parallel computers
    -- (U) extend the Mediterranean Sea model to include air-sea interaction effects
    -- (U) develop a limited-area coastal modeling testbed to evaluate coastal models, which will be essential for real-time prediction of the operational environment in regional warfare settings.
  - (U) Increase emphasis on atmospheric prediction capability for coastal strike warfare through the incorporation of aerosols and other visibility parameters into the mesoscale system.
  - (U) Pursue development of a Coupled Ocean-Air Mesoscale Prediction System (COAMPS) that will allow sub-kilometer resolution and that will exploit the computer power expected in the mid-1990s; studies using COAMPS will provide better physical parameterizations for the Navy Operational Regional Atmospheric Prediction System (NORAPS).
  - (U) Apply artificial intelligence and neural network techniques to extract atmospheric parameters of tactical importance from remotely-sensed data.

- (U) ($4,325) ENVIRONMENTAL INFLUENCES ON EM/EO SYSTEMS
  - (U) Complete measurements on the variability of coastal atmospheric refractivity and evaluate its significance for EM systems used to detect sea-skimmers.
  - (U) Initiate electro-optical performance assessment in coastal environments through the measurement of atmospheric properties that influence EO transmission.

3. (U) FY 1996 PLAN:

- (U) ($15,009) ENVIRONMENTAL SUPPORT FOR UNDERSEA SURVEILLANCE AND WEAPONS:
  - (U) Validate a mid-frequency (1-10 kHz) state-of-the-art, bistatic active acoustic performance model for continental shelf and slope regions as a contribution to undersea acoustic surveillance.
  - (U) Transition a mid-frequency reverberation-suppression technique (Principal Components Inverse Method) to the Space and Naval Warfare Systems Command; this enables mathematical characterization of the acoustic components of the reverberation in near real-time.

- (U) Use measurements to assess ocean bottom influences on transient and broadband detection capabilities in SW regions; this directly supports efforts in detecting transients emitted by quiet targets.
- (U) Perform numerical testing and field testing of stochastic acoustic formalisms aimed at enabling complex SW environments to be treated without a complete deterministic description.
- (U) Develop full-spectrum source models for surf, shrimp, fish and earthquake contributions and develop full-spectrum noise clutter statistics to advance the detection capabilities of full-spectrum processing.
- (U) Incorporate ocean focusing techniques using measured environmental data into signal processing algorithms to eliminate directional noise and other sources of interference to provide a robust tracking capability in the littoral environment.
- (U) Develop a detector/classifier which exploits the nonlinear character of broadband signals by simultaneously using nonlinear and chaotic methods to improve detection performance and increase detection/classification ranges, especially for the "quiet" submarine in littoral regions.
- (U) Conduct a joint oceanographic-acoustic field experiment to determine the significance of the variability of coastal oceans for undersea acoustic surveillance.
- (U) Revise the SW environmental false target model to include bottom features to advance torpedo G&C in SW; validate a bistatic bottom scattering strength model.

• (U) ($16,870) ENVIRONMENTAL SUPPORT FOR MCM SYSTEMS:
- (U) Transition bottom sediment scattering and penetration models and associated data bases to the MCM community to improve the capability to predict environmental effects on MCM acoustic systems.
- (U) Demonstrate the use of remotely-sensed optical properties in predicting the performance of MCM optical systems; conduct optical characterization of a coastal ocean site for support of optical MCM systems.
- (U) Complete documentation of MTEDS and its transition to the MCM community; this system will enable the on-scene commander to have critical environmental data available for tactical improvements.
- (U) Complete a major field experiment to characterize migration, scour and burial of mines on a steep beach.
- (U) Develop a rapid, three-dimensional seismoacoustic scattering model in support of statistical algorithms to characterize littoral sediments for prediction of both geoacoustic and shock wave interaction with sediments.
- (U) Perform preliminary tests and modification of bubble and acoustic scattering measurement systems in SW to enable determination of the effect of bubbles on acoustic and optical MCM systems.
- (U) Use the tactical oceanography simulation laboratory to provide environmental fields for amphibious

warfare and special operations warfare simulations at Cherry Point, N.C.
- (U) Develop expendable, low-cost tide sensor technology and initiate development of sensor fusion procedures for littoral warfare applications.

- (U) ($8,967) OCEAN AND ATMOSPHERIC PREDICTION:
  - (U) Evaluate data assimilation techniques for the North Atlantic basin for inclusion in a large-scale ocean forecast system to be implemented by the year 2000.
  - (U) Deliver an ocean forecast system for operational testing and subsequent use aboard Navy ships.
  - (U) Demonstrate three-dimensional visualization methods applicable to real-time situations in shipboard environments as a means of improving the utility of ocean forecasts.
  - (U) Demonstrate an ocean forecast model for the Yellow Sea - an area of operational interest.
  - (U) Deliver a global ocean high-resolution eddy-resolving model for testing and operational evaluation; this represents a key step toward the goal of achieving a global ocean prediction system.
  - (U) Develop new initialization methods for all atmospheric prediction models to enhance continuous assimilation of unconventional data.
  - (U) Convert atmospheric prediction models to massively parallel processing machines to take advantage of their potential for greatly increased computational speed.
  - (U) Continue atmospheric modeling of aerosols and improved non-hydrostatic model parameterization.
  - (U) Further develop artificial intelligence and neural network techniques to extract atmospheric parameters of tactical importance from remotely-sensed data.

- (U) ($4,680) ENVIRONMENTAL INFLUENCES ON EM/EO SYSTEMS:
  - (U) Transition the full vertical extent version of the radio physical optics model that incorporates terrain effects; this model will enable better performance assessments in complex ocean-land coastal regions.
  - (U) Complete demonstration of the determination of atmospheric moisture profiles using Global Positioning Satellite signals of opportunity; this will be an important advance in the ability to easily determine atmospheric moisture, which influences the performance of all weapon and sensor systems using EM propagation.
  - (U) Deliver algorithm to estimate height of surface trapping layer above the ocean surface from remotely-sensed data; this will provide a breakthrough in the ability to estimate a critical environmental characteristic that affects the detection of sea-skimming missiles.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET

DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

4. (U) FY 1997 PLAN:

- (U) ($15,070) ENVIRONMENTAL SUPPORT FOR UNDERSEA SURVEILLANCE AND WEAPONS:
  - (U) Transition a bottom-scattering strength algorithm, good down to low grazing angles, that will enable bottom scattering to be accurately incorporated in Navy models that support undersea surveillance systems.
  - (U) Develop and validate an environmentally-based method for clutter control in SW to advance the capabilities of underwater active acoustic detection techniques.
  - (U) Evaluate deterministic acoustic predictions of the influence of ocean fronts and horizontal refraction on slopes to determine the significance of such features for underwater surveillance systems.
  - (U) Conduct a field test of predictions based on stochastic propagation formalisms to determine whether the stochastic approach can adequately represent acoustic conditions in harsh SW environments.
  - (U) Perform an assessment of the impact of noise on full-spectrum processors (frequencies up to 5 kHz), which offer a means of exploiting nontraditional signals emitted by submarines.
  - (U) Demonstrate in a littoral environment narrowband and broadband internode processing for a multi-node surveillance array that accounts for differential target Doppler; this capability will allow greater node separation and a lower cost for a given area coverage.
  - (U) Derive semi-empirical relationships linking acoustic variability with ocean variability.
  - (U) Extend the SW scattering function model used in torpedo G&C to muddy bottoms; update the time, frequency and spatial coherence models using trial data.

- (U) ($18,480) ENVIRONMENTAL SUPPORT FOR MCM SYSTEMS:
  - (U) Conduct further towed-body measurements to assess the spatial variability of high-frequency acoustic properties relevant to MCM operations in coastal areas.
  - (U) Use remote-sensing techniques to extend optical characterizations for MCM systems to high interest areas outside the continental U.S.; evaluate surface effects on optical MCM system performance.
  - (U) Conduct experiment to demonstrate the environmentally enhanced performance of magnetic MCM systems.
  - (U) Make an identification of the fluid flow parameters critical to the surf/swash zone mine/sediment interaction and develop an initial empirical model for the interaction.
  - (U) Complete the preliminary development of a three-phase constitutive model for sands to advance the environmental base on which explosive techniques of mine clearance will depend.
  - (U) Conduct the first joint oceanographic and acoustic field test at a SW site to determine the influence

of bubbles on acoustical MCM systems.
- (U) Transition tactical decision support functions to produce worldwide surf statistics, real-time surf data and amphibious vehicle operability data.
- (U) Conduct a major clutter experiment to support the development of high-resolution (real and synthetic aperture) sonar systems for MCM.
- (U) Implement moored, low-cost mini-Acoustic Doppler Current Profiler technology to enable an affordable means of monitoring current structures in littoral regions.
- (U) Complete a littoral warfare environmental simulation capability including high-resolution circulation, wave, tidal and acoustic models in the tactical oceanographic simulation laboratory and support coastal simulations for joint undersea warfare.

- (U) ($9,038) OCEAN AND ATMOSPHERIC PREDICTION:
  - (U) Deliver ocean forecast models for the South China Sea and the Sea of Okhotsk, both areas of special operational interest, for operational testing and evaluation.
  - (U) Demonstrate a coastal tide prediction model capable of assimilating water level data and ocean current measurements; tide prediction is an essential environmental capability for successful littoral operations.
  - (U) Demonstrate the "nesting" of high-resolution coastal ocean models into regional ocean models; nesting of ocean prediction models is the central paradigm being followed in the creation of an ocean prediction scheme that will provide the necessary coverage and detail for military operations.
  - (U) Continue development of completely coupled air-ocean modeling schemes; such schemes are needed to account for the effect of the atmosphere on ocean characteristics and of ocean conditions on the atmosphere, particularly in coastal regions where complex interactions are possible.
  - (U) Demonstrate new ensemble forecasting methods for atmospheric prediction as a means of yielding not only a forecast but a likely range of possibilities.
  - (U) Provide standards for incorporation of atmospheric parameters in Navy simulators.
  - (U) Develop synthetic atmospheric environments for use in Navy training, systems testing, and tactical simulations.

- (U) ($4,692) ENVIRONMENTAL INFLUENCES ON EM/EO SYSTEMS:
  - (U) Extend the Navy aerosol model into the ocean surface layer (below 10m) which plays a critical role in the detection of sea-skimming missiles.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET DATE: February 1995

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602435N
PROGRAM ELEMENT TITLE: Oceanographic and Atmospheric Technology

- (U) Develop a model of cloud edge effects to reduce false alarm rates in infra-red detection systems.
- (U) Deliver an airborne hybrid radio propagation model to improve EM propagation prediction for airborne platforms.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	46,978	44,965	XXX	XXX
(U) FY 1995 Appropriated:	XXX	56,065	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-3,124	-2,761	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	43,854	53,304	45,526	47,280

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: The funding change in FY 1994 is due to TRP reprogramming ($-2,200K) and an end-of-year execution adjustment ($-924K). In FY 1995 funding change arises due to reductions associated with congressional undistributed for university research ($-2,536K) and travel ($-64K). Minor adjustments are made in FY 1995 due to the FY 1995 assessment for Small Business Innovative Research ($-161K).

(U) Schedule: The exploratory development efforts that would have been carried out in FY 1994 for the $3124K will, for the most part, be performed at a later time but not to the extent originally planned, as explained in the following paragraph. The $11.1M congressional plus-up in FY 1995 is for the National Acoustics Center ($1M) and a cost-effective remote semi-autonomous underwater oceanographic and environmental measurement capability ($10.1M) This increase will not impact the schedule of the base program.

(U) Technical: There are two aspects to the technical changes that have been made in the program. One change involves a reduction in FY 1994 of efforts in support of anti-submarine warfare, necessitated by the funding reduction. A second change in the program deals with a restructuring of the developmental efforts to meet the

environmental needs posed by Joint Littoral Warfare and Joint Strike Warfare. This PE consists of a broad range of environmental technologies that support all the Joint Mission Areas/Support Areas with emphasis on Joint Littoral Warfare and Joint Strike Warfare. Changes have been made in the program from what was reported in the FY 1995 Congressional RDDS. The changes consist of an increase in efforts that support MCM and Strike Warfare and a decrease in efforts that support ASW. Because of the significant role of MCM in Joint Littoral Warfare, the Office of Naval Research convened a review committee for the purpose of reviewing the needs in the MCM area and putting together an integrated MCM science and technology plan. High-level representatives from several external Navy commands participated in the review committee along with scientists from Navy labs, universities, and private industry. One significant finding of the review was the dramatic need for additional environmental support for the many MCM developments underway. Consequently, the FY 1995 plan for this PE was modified to partially meet some of the needs identified by the MCM review committee. A more modest change is an increase in Atmospheric Prediction to support Strike Warfare. The congressional plus-up of $11.1M in FY 1995 is for special purposes ($1M for the "National Acoustics Center" and $10.1M for a "cost-effective remote semi-autonomous underwater oceanographic and environmental measurement capability") that would not otherwise be pursued.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) RELATED RDT&E:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602101F (Geophysics)
(U) PE 0602314N (Undersea Surveillance and Weapons Technology)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602633N (Undersea Warfare Weapon Technology)
(U) PE 0602784A (Military Engineering Technology)
(U) PE 0603207N (Air/Ocean Tactical Applications)
(U) PE 0603785N (Combat Systems Oceanographic Performance Assessment)
(U) PE 0604218N (TESS ENG)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
UNDERSEA WEAPONS AND COUNTERMEASURES TECHNOLOGY	39,066	32,606	35,582	35,521	37,903	40,970	42,078	43,229	CONT.	CONT.

FY 1994 and FY 1995 reflect FY 1996 S&T restructure. Funding moved from Program Element (PE) 0602314N.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses on undersea warfare in support of future Joint Warfighting Capabilities endorsed by the Joint Chiefs of Staff; namely: (1) developing a range of tactical Anti-Submarine Warfare (ASW) capabilities that could be employed at the lower end of the full range of military operations with minimum risk of casualties or collateral damage to friendly forces, and (2) developing a robust world-wide capability for neutralizing undersea threats in decisive conflict, also with minimal casualties or collateral damage. Projects support the development of technologies associated with undersea target neutralization, force unit survival and undersea tactical control relating to the Joint Mission Areas (JMAs) of: Joint Littoral Warfare, Joint Strike, Strategic Deterrence, and Strategic Sealift/Protection. Specifically:

(u) Joint Littoral Warfare is concerned with dominating the undersea battlespace to enable timely execution of joint/combined operations and to ensure joint force sustainability. Programs address improved shallow-water operation, tactical control, torpedoes, torpedo countermeasures and

(U) Joint Strike concerns the application of precision offensive military force. Programs address new explosives for enhanced target damage effectiveness, and sensors and countermeasures to detect and neutralize undersea threats to the surface battleforce.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

(U) Strategic Deterrence concerns preserving our nuclear deterrent capability and developing an enhanced conventional warfare ballistic missile capability. Programs address improved SSBN self defense weapons.

(U) Strategic Sealift/Protection concerns reliable undersea target neutralization to enable joint battleforce sustainability. Programs address the entire spectrum of technology development undertaken in support of other JMAs.

(U) Success in neutralizing of undersea threats to both submarines and surface ships not only requires successful detection, classification, localization and tracking but also must culminate in an effective weapon which removes the threat and denies use of the battlespace to the enemy.

(U) These efforts support the naval portion of the Joint Warfare Strategy as expressed in "Forward...From the Sea." While this program's components are primarily service (Navy) unique, explosives and warheads programs are jointly planned and monitored with the Army and Air Force under the Reliance process through the Joint Directors of Laboratories Technical Panel on Conventional Air/Surface Weaponry.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the EXPLORATORY DEVELOPMENT 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:

1. (U) FY 1994 ACCOMPLISHMENTS

- (U) ($10,503) GUIDANCE AND CONTROL (G&C):
  --(U) Continued evaluation of the

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

Guidance & Control Advanced Technology Demonstration (ATD) (PE 0603792N).
--(U) Evaluated the use

--(U) Obtained in-water Guidance & Control acoustic data against a to validate digital simulation target models for new shallow water detection, classification, and terminal homing algorithms.
--(U) Demonstrated a shallow water undersea acoustic communication rate capability of 5 kbps at 1 nautical mile between a tactical-sized unmanned undersea vehicle and a stationary platform.
--(U) Conducted a hydrostatic test of a 21-inch diameter low signature, lightweight (33% lighter than aluminum) composite hull to 600 pound per square inch.

- (U) ($4,382) THERMAL PROPULSION:
  --(U) Completed in-water testing of the hydrogen-oxygen (HYDROX) closed-cycle propulsion system in a diameter vehicle to demonstrate feasibility of the MK 48 advanced capability (ADCAP) speeds and endurance in a torpedo.
  --(U) Fabricated lab-scale wick combustor, fuel vessel, oxidant, and control subsystems as an energy source for a Stirling engine; and operated the wick combustor continuously for 75 hours to demonstrate feasibility of the technology for extended endurance for undersea weapons and unmanned undersea vehicles (UUV).

- (U) ($10,664) ELECTRIC PROPULSION:
  --(U) Demonstrated in the laboratory a quiet, high efficiency counter rotating permanent magnet motor for torpedoes.
  --(U) Conducted in-water hydrodynamic validation tests of the Tethered Remotely Operated Vehicle (TROV) for

  --(U) Completed the development of the critical components of the electrolyte management replenishment system for the aluminum primary torpedo battery.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602633N DATE: February 1995
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

--(U) Completed performance and shock testing of the rechargeable lithium 100 Amp hours (Ah) battery for the Naval Special Warfare Swimmer Delivery Vehicle.
--(U) Completed the hydrodynamic model of a tactical-sized undersea vehicle for the development of a nonlinear adaptive autopilot controller.
--(U) Completed the design and fabricated the components for a compact (8-inch diameter), quiet, high efficiency, tunnel thruster for a tactical-sized undersea vehicle.
--(U) Completed the design and fabricated the components for a thrust vectored pump jet propulsor for a tactical-sized undersea vehicle.

- (U) ($8,507) TORPEDO AND ACOUSTIC COUNTERMEASURES:
  --(U) Demonstrated the feasibility of a with a high-speed stored chemical energy propulsion system, an advanced propulsor with control surface designs and a control augmentation for hydrodynamic stability, and autonomous control to .
  --(U) Accelerated investigations to solve and initiated joint in-water experiments with PMO 427.
  --(U) Completed development of signal processing techniques using for providing real-time extraction of parameters of intercepted threat signals. Completed a combination of signal processing with to provide an in-situ capability to classify threat torpedoes.

- (U) ($960) COMBAT CONTROL:
  --(U) Designed and analyzed a model for shallow water detection and tracking to resolve ambiguities resulting from the high-clutter, ambiguous path acoustic environment.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

- (U) ($4,050) WARHEADS AND EXPLOSIVES:
  --(U) Transitioned tough, flexible, high-shock-energy explosive to Explosive Neutralization ATD (PE 0603555N); this explosive system incorporates an energetic binder that augments performance of the high solids-filled composition and is capable of withstanding high shear during rocket launch, as required by the ATD to support Mine Countermeasures (MCM) capabilities in shallow water.

2. (U) FY 1995 PLAN:

- (U) ($10,026) GUIDANCE & CONTROL:
  --(U) Evaluate shallow water detection and classification algorithms using data obtained against a submarine; implement these algorithms in real-time, and perform an in-water detection/classification test using the algorithms.
  --(U) Evaluate use of processing and signals to enhance detection and imaging of submarines and false targets in the highly time-varying littoral, countermeasure environment.
  --(U) Continue development of torpedo counter-countermeasure algorithms to enhance performance against jammers and decoys where scattering from the ocean's surface and bottom limit performance of algorithms previously developed for deep-water scenarios.
  --(U) Complete development, in-water tests and evaluation of a 1600-element, high-resolution polymer array, a torpedo conformal array, and a broad bandwidth array to obtain a database for use in detection, imaging and terminal homing evaluation.
  --(U) Demonstrate a high data rate communication link for unmanned undersea vehicles in shallow water with data transmitted at 20 kilobytes per second to a range of 3 nautical miles.
  --(U) Demonstrate a velocity-aided, inertial navigation system for a tactical-sized unmanned undersea vehicle which will reduce the drift rate error to 0.082 nautical miles per hour.

- (U) ($4,030) THERMAL PROPULSION:
  --(U) Demonstrate in a laboratory environment, a one-hundred hour endurance, 21-inch diameter unmanned undersea

vehicle wick combustor energy system, which will include: fuel vessel, oxidant, and control subsystems.
--(U) Complete in-water tests of the HYDROX very high-energy density, underwater thermal power source.
--(U) Complete fabrication and testing of a scale-model, low-cost, Stored Chemical Energy Propulsion System boiler for the MK50 torpedo.

- (U) ($6,280) ELECTRIC PROPULSION:
  --(U) Conduct land based demonstration of electric power plant for torpedoes consisting of high power/energy density aluminum silver oxide battery and efficient high power alternating current axial field motor.
  --(U) Demonstrate low cost multi-cell aluminum hydrogen peroxide battery for a torpedo propulsion system.
  --(U) Demonstrate higher performance, low cost mixed metal oxide cathodes for rechargeable undersea vehicle batteries.
  --(U) Complete development and demonstrate the launch and recovery of a TROV from a SSN 688 submarine.
  --(U) Complete fabrication and water tunnel testing of the thrust vectored pump jet propulsor for improved hydrodynamic performance of tactical-sized undersea vehicles.
  --(U) Complete modeling and development of the low-speed adaptive nonlinear autopilot controller for a tactical-sized undersea vehicle.
  --(U) Award a contract for the fabrication of a 600 Ah lithium/cobalt oxide rechargeable replacement battery for the Naval Special Warfare Swimmer Delivery Vehicle.

- (U) ($7,140) COUNTERWEAPON AND COUNTERMEASURES:
  --(U) Conduct performance tests of a
  --(U) Develop technologies for effective
  --(U) Develop algorithms for

- (U) ($1,500) COMBAT CONTROL:
  --(U) Demonstrate the localization, tracking, and fusion algorithm which will provide tracking of all contacts, including weapons, in a cluttered environment.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602633N DATE: February 1995
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

- (U) ($3,630) WARHEADS AND EXPLOSIVES:
  --(U) Transition a pressable explosive formulation for a to the Insensitive Munitions Advanced Development Program.
  --(U) Demonstrate and transition an aluminized composite underwater explosive formulation with 50% greater relative bubble energy than PBXN-103 for the heavyweight torpedo and for ship self defense.
  --(U) Transition first generation fluid/structure hydrocode for mine countermeasures and torpedo defense applications to PMO 427 and PMO 407.

3. (U) FY 1996 PLAN:

- (U) ($10,403) GUIDANCE & CONTROL:
  --(U) Conduct in-water test of shallow water countermeasure algorithms and demonstrate

  --(U) Conduct in-water demonstration of

  --(U) Perform at-sea test of a

  --(U) Develop and demonstrate advanced signal processing technologies for a 21-inch diameter unmanned undersea vehicle which includes: acoustic communications, adaptive noise cancellation, beam steering, advanced data compression techniques, and forward error correction coding.
  --(U) Complete fabrication and testing of a lightweight, low-signature hull for a 21-inch diameter tactical-sized unmanned undersea vehicle.

- (U) ($4,500) THERMAL PROPULSION:
  --(U) Conduct laboratory tests of HYDROX chemical hydrogen and oxygen gas generators for a 21-inch diameter torpedo.
  --(U) Conduct brassboard combustor and engine testing of an environmentally-benign torpedo propellant replacement for Otto Fuel II.
  --(U) Complete design, fabrication, bench testing, and test-vehicle integration of a low-cost HYDROX thermal

power plant for use in torpedo exercise runs.
--(U) Conduct laboratory tests of a complete, long-endurance (100 hour), wick Combustor, Rankine-Engine power source for unmanned undersea vehicle applications.
--(U) Complete candidate fuel cell combustion testing and conduct engine tests using environmentally-benign fuel.

- (U) ($6,600) ELECTRIC PROPULSION:
  --(U) Complete the development of the Electrolyte Management System for the high power/energy density aluminum fueled torpedo battery.
  --(U) Evaluate and test new mixed metal-oxide cathode materials for an undersea vehicle rechargeable battery.
  --(U) Complete the fabrication and water tunnel testing of the quiet variable ballast system and the quiet tunnel thrusters for a tactical-sized 21-inch diameter unmanned undersea vehicle.
  --(U) Demonstrate the thrust-augmented pump jet propulsor in-water on a tactical-sized undersea vehicle.
  --(U) Complete shock, performance testing, and evaluation of 600 Ah rechargeable lithium/cobalt oxide undersea vehicle propulsion battery module for the SEAL Swimmer Delivery Vehicle.
  --(U) Demonstrate in-water an adaptive non-linear autopilot controller on a tactical-sized 21-inch diameter test vehicle that will provide stable vehicle operation for advanced mine countermeasure (MCM) and surveillance sensors in energetic shallow water environments.

- (U) ($7,579) COUNTERWEAPON AND COUNTERMEASURES:
  --(U) Incorporate

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

--(U) Conduct land-based and at-sea evaluation of integrated advanced _

--(U) Conduct an analysis and assessment of proven torpedo defense technologies suitable for common application in other torpedoes.
--(U) Initiate transfer of technology designs, drawings, and data into the submarine torpedo defense (SMTD) system (PMO 415).
--(U) Complete development of the multi-beam torpedo rapid automatic classification system (MTRACS) to enable full use of combined submarine towed and spherical array data for torpedo classification and localization.
--(U) Conduct laboratory demonstrations of real-time capable algorithms for parameter extraction, decision logic, and signal generation for smart acoustic countermeasures.

- (U) ($2,500) COMBAT CONTROL:
  --(U) Transition platform torpedo-defense tactical decision aids for employment and off-board sonobuoy employment to the Joint Tactical Control Advanced Development Program's Advanced Development Model.
  --(U) Demonstrate algorithms that automatically recommend platform maneuvers and countermeasures, along with the cluttered environment tracking algorithm and transition the algorithms to the Submarine Defensive Warfare System (AN/WLY-1).
  --(U) Demonstrate algorithms for maneuvering, contact tracking and multi-stage association and transition to the Joint Tactical Control Advanced Development Program. Develop and demonstrate environmental decision support capability for acoustic contact management data fusion.
  --(U) Complete development of a set of decision aids which reduce false alarms in the tactical scene through the use of advanced multiple-hypothesis pruning techniques and transition to the Joint Tactical Control Advanced Development Program's Advanced Development Model.
  --(U) Complete development of a tactical decision aid that displays the theoretical lower bound of target tracker performance and assists in planning ship maneuvers and sensor deployments to support target tracking and transition to the Joint Tactical Control Advanced Development Program's Advanced Development Model.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

- (U) ($4,000) WARHEADS AND EXPLOSIVES:
  --(U) Develop and transition a deformable explosive formulation for that has a 30% higher energy than SW5 and is resistant to 50 Kilobar of shock pressure.
  --(U) Transition advanced damage mechanism for ASW to the PEO/Undersea Warfare Torpedo Program.
  --(U) Continue development and transition to the PEO/Undersea Warfare Torpedo Program a first generation computational capability to predict submarine vulnerability.

3. (U) FY 1997 PLAN:

- (U) ($10,321) GUIDANCE & CONTROL:
  --(U) Conduct shallow water demonstration of the

  --(U) Conduct in-water tests of a

  --(U) Conduct in-water technology demonstration of the shallow water target detection and classification algorithms, new sensor processing and environmentally adaptive signal processing.
  --(U) Develop the capability of real time, acoustic data transmissions of imaging sensors, such as, sidescan sonar and laser scan systems from a tactical-sized unmanned undersea vehicle.
  --(U) Demonstrate in-water a robotics mine neutralization capability from a tactical-sized unmanned undersea vehicle.

- (U) ($4,500) THERMAL PROPULSION:
  --(U) Transition candidate environmentally-benign propellant technologies for the replacement of Otto Fuel II to the MK46, MK48, and MK48 ADCAP torpedoes.
  --(U) Conduct in-water tests of a low-cost exercise version of the HYDROX underwater thermal power source.
  --(U) Complete laboratory tests of the wick-Rankine, unmanned undersea vehicle long-endurance power plant and initiate test vehicle integration.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

--(U) Conduct laboratory tests of a low-cost common heavyweight and lightweight torpedo propulsion system.

- (U) ($6,600) ELECTRIC PROPULSION:
  --(U) Integrate and perform a land-based torpedo propulsion test of an aluminum hydrogen peroxide battery and electrolyte management system.
  --(U) Fabricate and performance test a low cost, safe, mixed metal oxide cathode rechargeable battery for undersea vehicle applications.
  --(U) Integrate and demonstrate in-water the low-speed, adaptive, non-linear control autopilot model for a 21-inch diameter undersea vehicle.
  --(U) Fabricate 600 Ah lithium/cobalt oxide batteries for an undersea vehicle propulsion system demonstration.

- (U) ($7,600) COUNTERWEAPON AND COUNTERMEASURES:
  --(U) Complete development and evaluation of

  --(U) Initiate integration of

  --(U) Transition open architecture Commercial Off-the-Shelf processor hardware and common and torpedo guidance and control software modules in to the Advanced Technology Demonstration of Anti-Torpedo Torpedo for surface and submarine applications (PE 0603792N).
  --(U) Conduct testing of smart, adaptive algorithms to demonstrate an effective acoustic torpedo countermeasure capability.

- (U) ($2,500) COMBAT CONTROL:
  --(U) Demonstrate an algorithm that provides both a qualitative and quantitative assessment of ownship survivability based upon the selected tactic and transition to the Submarine Defensive Warfare System (AN/WLY-1).
  --(U) Transition the active/passive multi-sensor tracking and the multi-stage association algorithm with ambiguity processing to the Joint Tactical Control Advanced Development Program.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

--(U) Transition the ADCAP postlaunch guidance decision aid to the Joint Tactical Control Advanced Development Program.
--(U) Transition platform torpedo-defense tactical decision aids for acoustic countermeasure employment and avoidance/evasion maneuvers to the Joint Tactical Control Advanced Development Program's Advanced Development Model.
--(U) Transition a new track-to-track data fusion algorithm to augment the existing measurement-to-track fusion algorithms in a multi-hypothesis tracker/correlator to the Joint Tactical Control Advanced Development Program's Advanced Development Model.

- (U) ($4,000) WARHEADS AND EXPLOSIVES:
  --(U) Develop new composite explosive formulations based upon
  for enhanced underwater warhead applications.
  --(U) Transition robust in-wake fuzing concept to Surface Ship Torpedo Defense Joint Program Office.
  --(U) Transition methodology for assessing torpedo defense systems to Surface Ship Torpedo Defense Joint Program Office.

B. (U) PROGRAM CHANGE SUMMARY

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	0	0	0
(U) FY 1995 Appropriated:	0	0	0	0
(U) Adjustments from PRESBUDG:	+39,066	+32,606		
(U) FY 1996/97 PRESBUDG Submit:	39,066	32,606	35,582	35,521

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

(U) CHANGE SUMMARY EXPLANATION:

(U) FUNDING: (U) Fund adjustments for FY 1994 are the result of: Comparability Adjustment from PE 0602314N (+37,220) and End-of-Year Execution (+1,846) to reflect Below Threshold Reprogrammings. FY 1995 adjustments are the result of Comparability Adjustment from PE 0602314N (+34,319); Congressional undistributed cuts for University Research (-1,665); and Travel (-48).

(U) SCHEDULE: Not applicable.

(U) TECHNICAL: Not applicable.

(U) RELATED ACTIVITIES:

(U) PE 0101224N (SSBN Security and Survivability Program)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0602435N (Ocean and Atmospheric Technology)
(U) PE 0603609N (Conventional Munitions)
(U) PE 0603747N (Undersea Warfare Advanced Technology)
(U) PE 0603792N (Advanced Technology Transition)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602633N
PROGRAM ELEMENT TITLE: UNDERSEA WARFARE WEAPON TECHNOLOGY

DATE: February 1995

This program adheres to Tri-Service Reliance Agreements on Conventional Air/Surface Weaponry--in particular, in the areas of guidance and control and of explosives--with oversight provided by the Joint Directors of Laboratories. Work is fully coordinated with efforts in accordance with the ongoing Reliance joint planning process with the following PEs:

(U) PE 0602602F (Conventional Munitions)
(U) PE 0602624A (Weapons and Munitions Technology)
(U) PE 0603226E (Experimental Evaluation of Major Inovative Technology (EEMIT))
(U) PE 0603601F (Conventional Weapons Technology)
(U) PE 0603609F (Insensitive Munitions Advanced Development)

(U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R0446 Maritime Avionics Subsystems and Technology (MAST)	0	9,827	0	0	0	0	0	0	0	9,827
R0447 Weapons Advanced Technology	5,857	3,986	9,300	14,579	18,678	20,082	21,647	22,235	CONT.	CONT.
W2014 Integrated High Performance Turbine Engine Technology (IHPTET)	7,992	7,949	7,782	9,798	10,130	11,280	11,616	11,962	CONT.	CONT.
R2152 Advanced Short Takeoff and Vertical Landing (ASTOVL) Demonstrator	11,061	0	0	0	0	0	0	0	0	11,061
W2185 Advanced Anti-Radiation Guided Missile (AARGM)	12,360	4,335	0	0	0	0	0	0	0	26,278
TOTAL	37,270	26,097	17,082	24,377	28,808	31,362	33,263	34,197	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) demonstrates concepts for future air platforms and surface/air weapons employed in Naval Warfare. The demonstrated concepts support the Joint Warfare Strategy "Forward...from the Sea" and relate to the Joint Mission Areas of Joint Strike Warfare, Littoral Warfare, and Joint Surveillance. Projects in this PE are jointly planned in the Reliance process with the Air Force and Army through panels of the Joint Directors of Laboratories.

(U) Joint Strike technology issues relevant to this PE include surgical lethality, platform survivability and affordability and increased Naval gunfire range and accuracy. Littoral Warfare technology issues relevant to this PE include air battlespace dominance, expeditionary forces air support, ship self-defense and increased Naval gunfire range and accuracy. Joint Surveillance technology issues relevant to this PE include platform mission endurance and survivability.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

There were four projects in the PE:

(U) Maritime Avionics Subsystems and Technology (MAST): A new start, multi-faceted program maturing integrated modular avionics concepts coordinated endeavors towards common avionics. Focused on Congressionally mandated scaleable, open, fault tolerant and common avionics architecture along with multifuncion sensors and subsystems. Program thrusts addressed either Navy-specific applications or technological areas where the Tri-Services have agreed on a Navy lead.

(U) Weapons Advanced Technology: Demonstrates emerging sub-system/component level weapons concepts identified in PE 0602111N which promise affordable and significant performance improvements to both existing and next generation Naval air and surface launched weapons.

(U) Integrated High Performance Turbine Engine Technology (IHPTET): Provides experimental engine testing to demonstrate readiness for entering engineering development of new gas turbine engine technologies. IHPTET is a tri-service program in which each service contributes established shares of 6.2 and 6.3 funding and laboratory resources to meet specified goals of doubling thrust-to-weight ratio and halving fuel consumption by the year 2003 (relative to a 1987 baseline).

(U) Advanced Anti-Radiation Guided Missile: Demonstrated advanced missile/seeker technologies to support a helicopter mounted missile with capabilities comparable to HARM.

(U) Advanced Short Takeoff and Vertical Landing (ASTOVOL) Technology: Management and Funding of this program was transferred to Joint Advanced Strike Technology Program (JASTP), PE 0603800N, in FY 1995.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R0447 Weapons Advanced Technology	5,857	3,986	9,300	14,579	18,678	20,082	21,647	22,235	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project has been renamed and expanded. The project was originally named Electromagnetic Radiation Source Elimination (ERASE). This renamed project includes the elements contained in the original ERASE program while providing additional risk reducing demonstrations of emerging weapon guidance & control, ordnance, propulsion and airframe sub-system/component level technologies identified in Exploratory Development which promise affordable performance improvements to existing and next generation Navy air and surface launched weapons. The elements of this project address the Joint Mission Area (JMA) requirements for increased capabilities in the surgical lethality of weaponry (Strike JMA), increased ship self-defense capabilities (Littoral Warfare JMA) and increased accuracy and range for Naval gunfire support (Strike and Littoral JMAs). Included in this project is a focused thrust for both emitter location and defense suppression missile technologies, the requirements for which are documented in the Navy's Strike Warfare Master Plan and Conventional Munitions Plan.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($2,100) Passive Radio Frequency (RF) targeting:
  - (U) Initiated:
    - -- (U) Verification tests of passive ranging algorithms.
    - -- (U) Low frequency field flight tests, analyzed data and documented results.
    - -- (U) Test of candidate low band antennas.
    - -- (U) Fabrication of integrated low frequency system.
  - (U) Continued:
    - -- (U) Integration of low frequency targeting system for test and evaluation.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology
PROJECT NUMBER: R0447
PROJECT TITLE: Weapons Advanced Technology

- (U) ($3,757) Advanced Anti-Radiation Missile Guidance Demonstration (AAGD):
  - (U) Initiated:
    - -- (U) Anti-Radiation Homing (ARH) receiver fabrication and testing.
    - -- (U) Software design for terminal sensor processing.
    - -- (U) ARH Processor ADA software code generation.
  - (U) Completed:
    - -- (U) Conformal antenna fabrication.
    - -- (U) ARH receiver design for hardware fabrication.
    - -- (U) ARH processor architecture for processor design.

2. (U) FY 1995 PLAN:

- (U) ($1,585) Passive RF targeting:
  - (U) Complete:
    - -- (U) Low-frequency field flight tests, analyze data and document results.
    - -- (U) Fabrication of integrated low frequency system.
    - -- (U) Verification tests of passive ranging algorithms.
    - -- (U) Tests of candidate low band antennas.
    - -- (U) Integration of low frequency targeting system for test and evaluation.

- (U) ($2,401) AAGD:
  - (U) Initiate:
    - -- (U) Integration of ARH receiver and terminal sensor design.
    - -- (U) Bench and anechoic chamber testing of integrated RF receiver and conformal antenna.
    - -- (U) Integration of digital signal processor with ARH receiver.
    - -- (U) Procurement and fabrication of ARH processor.
    - -- (U) Terminal sensor processing design.
    - -- (U) Analysis of operational improvements (and risks) to be gained from the use of a narrow beam, high gain active attenna array to increase the sensitivity of current ARH missile seekers and potential new capabilities (i.e., an active Synthetic Aperature Array (SAR) model.

- (U) Continue:
  -- (U) ARH processor ADA software development.
  -- (U) Software design for terminal sensor processing.
  -- (U) ARH receiver fabrication and testing.

3. (U) FY 1996 PLAN:

- (U) ($3,309) AAGD:
  - (U) Initiate:
    -- (U) Development of aimpoint selection and sensor fusion processor specifications.
    -- (U) Development of flight test plan.
    -- (U) ARH Software Code Generation and Fabrication.
  - (U) Continue:
    -- (U) Integration of ARH and terminal sensor.
    -- (U) Bench and Anechoic Chamber Testing of Integrated RF Receiver and Conformal Antenna.
    -- (U) Design of ARH wideband active phased array.
    -- (U) Integration of digital signal processor with ARH receiver.
  - (U) Complete:
    -- (U) ARH receiver fabrication and testing.
    -- (U) Procurement and fabrication of ARH processor.
    -- (U) Terminal sensor processing design.
    -- (U) ARH processor ADA software development.
    -- (U) Software design for terminal sensor processing.

- (U) ($3,300) Adaptive Mission and Flight Control for Cruise Missiles:
  - (U) This new task represents the Navy portion of a Joint Air Force/Navy effort to develop a flight weight brassboard real-time guidance and control system using a laser detection and ranging seeker under development by the Air Force and a mission planning system based on technologies developed under PE 0602111N, Air and Surface Weapons, to demonstrate the following capabilities for future cruise missiles: immediate launch on coordinates capability, inflight decision making, on-board target identification, precise aimpoint selection,

battle damage indication and in-flight coordinated attack and targeting flexibility against fixed, relocated or mobile targets.

- (U) Initiate:
  -- (U) Development of a data base of laser detection and ranging images.
  -- (U) Flight testing laser detection and ranging devices over typical cruise missile flight profiles.
  -- (U) Extending current solid state laser detection and ranging sensor capabilities by providing variable resolution for increased frame rates, direct control of field of view and increased device power.
  -- (U) Development of mission planning procedures and software for strike planning, targeting and neural network training.

- (U) ($2,691) Advanced Multi-Mode Ordnance System:
  - (U) This new start will demonstrate a multiple-mode ordnance system that will optimize lethal effects for above surface and sub-surface targets within the same warhead. The overarching technology to be demonstrated for future cruise missile, Stand-off Land Attack Missile, Joint Stand-off Weapon applications involves the use of a flying plate, explosively formed projectile, or shaped charge as a light weight precursor penetrator followed by a unitary warhead which may utilize incendiary or bi-metallic explosive formed projectiles mounted over its case length.

  - (U) Initiate:
    -- (U)Design of large diameter explosively formed projectiles.
    -- (U) Analysis of selected methods of reactive material encapsulation for explosively formed projectiles.
      -- (U) Trade-off design studies for multi-mode fuzing and safe-arm devices.
      -- (U) Encapsulation and performance demonstrations of reactive materials.
      -- (U) Development and validation, with available data, of computer codes for high velocity impact.

4. (U) FY 1997 PLAN:

- (U) ($3,740) AAGD:
  - (U) Initiate:
    -- (U) Analysis of integrated RF receiver and conformal antenna bench and anechoic chamber test data.

-- (U) Fabrication of ARH wideband active phased array.

- (U) Continue:
  -- (U) Design and develop an aimpoint selection processor to integrate multiple sensor inputs.
  -- (U) Integration of ARH and terminal sensor.

- (U) Complete:
  -- (U) Design of ARH wideband active phased array.
  -- (U) Flight test plan.
  -- (U) ARH Software Code Generation and Fabrication.
  -- (U) Bench and Anechoic Chamber Testing of Integrated RF Receiver and Conformal Antenna.
  -- (U) Integration of digital signal processor with ARH receiver.

• (U) ($4,500) Adaptive Mission and Flight Control for Cruise Missiles:
  - (U) Initiate:
    -- (U) Design of common aperture for a dual mode laser detection and ranging/imaging IR seeker.
    -- (U) Design and fabrication of a flight test hardware pod.
    -- (U) Design and fabrication of the flight test hardware pod interface with the F/A-18 test aircraft to be used during flight test.

  - (U) Continue:
    -- (U) Development of the data base of laser detection and ranging images.
    -- (U) Development of Mission Planning procedures and software for strike planning, targeting and neural network training.
    -- (U) Flight testing of laser detection and ranging devices using the flight profile of potential transition weapons candidates.
    -- (U) Extending current solid state laser detection and ranging sensor capabilities by providing variable resolution for increased frame rates, direct control of field of view and increased device power.

• (U) ($3,500) Advanced Multi-Mode Ordnance System:
  - (U) Initiate:

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: R0447
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

-- (U) Development of multi-mode fuzing and safe-arm concepts based on results of design studies.
-- (U) Small scale, high velocity penetration tests to validate computer codes.
-- (U) Design of tests for Explosively Formed Projectile (EFP) penetration testing through weapon forward end and earth/concrete.

- (U) Complete:
-- (U) Design of large diameter EFP.
-- (U) Analysis of selected methods of reactive material encapsulation for explosively formed projectiles.
-- (U) Tradeoff design studies for multi-mode fuzing and safe-arm device.
-- (U) Encapsulation and performance demonstration of reactive material and explosively formed projectiles.
-- (U) Development and validation, of computer code for high velocity impact.

• (U) ($2,839) Water Barrier Defense:
- (U) This is a new task that will demonstrate the effectiveness of using hybrid Water Activated Munition™/high explosive formed waterbarriers to defeat the debris and fragmentation from Anti-Ship Cruise Missiles damaged at short range by other shipboard defense systems (such as Phalanx) and to defeat intact Anti-Ship Cruise Missiles that have penetrated outer layers.

- (U) Initiate:
-- (U) Optimizing the warhead design developed under PE 0602111N.
-- (U) Round configuration analysis, including attitude control, trajectory accuracy requirements, retardation requirements, water entry and nose shape analysis.
-- (U) Perform experiments to determine the timing and spacing sequences of round delivery to produce the optimum water barrier.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: R0447
PROJECT TITLE: Weapons Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	5,132	13,218	XXX	XXX
(U) FY 1995 Appropriated:	XXX	4,527	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	+725	-9,232	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	5,857	3,986	9,300	14,579

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 increase is due to end of year execution update (+725). FY 1995 decrease reflects congressional action (-8,691) and congressional undistributed cuts for university research (-523) and travel (-18).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601152N (In House Lab Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602111N (Surface/Aerospace Surveillance and Weapons Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: R0447
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: Weapons Advanced Technology

(U) PE 0602602F (Conventional Munitions)
(U) PE 0603238N (Precision Strike and Air Defense Technology Demonstrations)
(U) PE 0603609N (Conventional Munitions)
(U) PE 0603601F (Advanced Weapons)
(U) PE 0207133F (F-16 Squadrons)
(U) PE 0203730A (Chaparral Missile)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
W2014 Integrated High Performance Turbine Engine Technology (IHPTET)	7,992	7,949	7,782	9,798	10,130	11,280	11,616	11,962	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project covers the Navy share of the demonstrator engine portion of IHPTET, ensuring that unique Navy design and operational requirements are met. Full scale integrated technology demonstration is essential to transition technologies from exploratory development through advanced development and into system demonstration/validation. Without technology demonstrators, system acquisition cost/schedule risk would have an unacceptably higher level or programs would settle for less operational capability. As a result, development schedules could increase by as much as four to five years. A strong and viable U.S. propulsion program also provides a dual-use benefit to our country by enhancing our competitiveness in the international commercial engine market. This long term project coordinated through Reliance, will provide for the future needs in air battlespace dominance and expeditionary forces support (Littoral Joint Mission Area (JMA)), increased platform mission endurance (Joint Surveillance JMA) and provide technology for increased affordability and platform survivability (Strike JMA). The program funds three demonstrator engine classes. Each engine class has specific performance goals that are divided into three phases with the ultimate goal of doubling propulsion capability by the year 2003. Phase I of the missile/expendable engines class has been completed. This phase was an Air Force funded program identified as the Expendable Turbine Engine Technology (ETEC) program. The phase goals of each engine class are listed as follows and are referenced to a 1987 baseline:

(U) Fighter/attack (Joint Technology Demonstrator Engine [JTDE]): Allison Gas Turbine Division, General Electric Aircraft Engines (GE), Pratt and Whitney (PW).

- (U) Phase I - 1993: +30% thrust/weight (T/W), +100 ^{0}F combustor inlet temperature (CIT), +300 ^{0}F turbine inlet temperature (TIT) with subtasks in: Hollow metal matrix composite (MMC) fan blades, high work turbine, advanced metals, advanced mode controls.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: IHPTET

- (U) Phase II - 1997: +60% T/W, +200 ^{0}F CIT, +600 ^{0}F TIT with subtasks in: Advanced aerodynamic fan, vaneless turbine, intermetallics, optic controls and survivability features and hollow MMC fan blades.
- (U) Phase III - 2003: +100% T/W, +400 ^{0}F CIT, +900 ^{0}F TIT with subtasks in: Composite fan, minimum cooling, special attachments, ceramics and magnetic bearings.

(U) Turboprop/shaft (Joint Turbine Advance Gas Generator [JTAGG]): GE and Garrett Engine Division, Lycoming (LYC), Allied Signal Propulsion Division (AE).

- (U) Phase I - 1993: +40% power/weight (P/W), -20% specific fuel consumption (SFC), +300 ^{0}F TIT with subtasks in: High work turbine and advanced titanium.
- (U) Phase II - 1997: +80% P/W, -30% SFC, +600 ^{0}F TIT with subtasks in: High pressure ratio compressor, advanced cooling, electric engine concepts and static ceramic composites.
- (U) Phase III - 2003: +120% P/W, -40% SFC, +1000 ^{0}F TIT with subtasks in: Three dimensional aerodynamic design, rotating ceramics, pulse surge protection.

(U) Missile/expendable engines (Joint Expendable Turbine Engine Concepts [JETEC]): Allison Gas Turbine Division, Garrett Engine Division, Teledyne Ryan Aeronautics (TRA), Williams International (WI).

- (U) Phase I - 1991: +35% thrust/airflow (Fn/Wa), -20% SFC, +1100 ^{0}F CIT, +500 ^{0}F TIT, -30% Cost. Completed by Air Force under ETEC.
- (U) Phase II - 1997: +70% Fn/Wa, -30% SFC, +1200 ^{0}F CIT, +900 ^{0}F TIT, -45% Cost with subtasks in: Ceramic bearings, ceramic composite turbine, carbon-carbon exhaust nozzle, low profile combustor, Low observable (LO) propfan blades.
- (U) Phase III - 2003: +100% Fn/Wa, -40% SFC, +1400 ^{0}F CIT, +1400 ^{0}F TIT, -60% Cost with subtasks in: Ceramic composite compressor, air bearings, carbon-carbon turbine and static structures, Organic Matrix Composite (OMC) fan stages, carbon-carbon vectoring nozzle.

(U) Each engine company utilizes at least two engine builds or demonstrator tests within each Phase to demonstrate the performance goals. The JETEC Phase II goals are divided into demonstrating SFC and Cost for a subsonic demonstrator and Fn/Wa, CIT, TIT and Cost for a supersonic demonstrator.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603217N
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology

PROJECT NUMBER: W2014
PROJECT TITLE: IHPTET

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:
   - (U) ($2,221) Initiated:
     - (U) Phase II JTAGG: Design of subsonic patrol/rotary wing Phase II demonstrator engine with 80% P/W and 30% SFC improvements.
     - (U) Phase II JETEC: Design of supersonic Phase II demonstrator engine at end of fiscal year.
   - (U) ($5,271) Continued:
     - (U) Phase II JTDE: Fabrication and assembly of Pratt and Whitney (PW) and General Electric (GE) Phase II demonstrator engines.
     - (U) Phase II JETEC: Fabrication and assembly of Teledyne Ryan Aeronautics (TRA) and Williams International (WI) subsonic demonstrator engines.
   - (U) ($500) Completed:
     - (U) Phase I JTAGG: GE/AE and LYC Phase I demonstrator 2 tests. Demonstrated 25% fuel burn and 60% power-to-weight improvement over baseline.

2. (U) FY 1995 PLAN:
   - (U) ($683) Initiate:
     - (U) Design and down select for initial supersonic demonstrator engine for specific thrust increase of 75%.
   - (U) ($7,266) Continue:
     - (U) Phase II JTDE: Fabrication and assembly of PW and GE demonstrator #1 engine.
     - (U) Phase II JTAGG: Design of Phase II gas generators for subsonic patrol/rotary wing aircraft.
     - (U) Phase II JETEC: TRA demonstrator #1 engine test. First step towards demonstrating 30% decrease in cost for subsonic expendable applications.

3. (U) FY 1996 PLAN:
   - (U) ($7,782) Continue:
     - (U) Phase II Joint Technology Demonstrator Engine: Continue fabrication and assembly of PW and GE Phase II demonstrator engines.
     - (U) Phase II Joint Turbine Advance Gas Generator: Continue design and fabrication of Phase II gas generators for subsonic patrol/rotary wing aircraft.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: IHPTET

- (U) Phase II Joint Expendable Turbine Engine Concepts (Subsonic): TRA and WI #2 engine test to demonstrate Phase II subsonic expendable engine goals.
- (U) Phase II Joint Expendable Turbine Engine Concepts (Supersonic): Design and assembly of Phase II supersonic expendable demonstrator engine.

4. (U) FY 1997 PLAN:
   - (U) ($500) Initiate:
     - (U) Phase III Joint Expendable Turbine Engine Concepts (Supersonic): Review proposals and award contract for expendable engine Phase III demonstrators.
   - (U) ($9,298) Continue:
     - (U) Phase II Joint Technology Demonstrator Engine: GE or PW Phase II engine demonstrator test.
     - (U) Phase II Joint Turbine Advance Gas Generator: Phase II gas generator demonstrator test.
     - (U) Phase II Joint Expendable Turbine Engine Concepts (Subsonic): TRA and WI complete Phase II expendable engine demonstration test.
     - (U) Phase II Joint Expendable Turbine Engine Concepts (Supersonic): Phase II supersonic expendable demonstrator engine test.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	8,117	8,354	XXX	XXX
(U) FY 1995 Appropriated:	XXX	8,354	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-125	-405	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	7,992	7,949	7,782	9,798

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603217N PROJECT NUMBER: W2014
PROGRAM ELEMENT TITLE: Air Systems and Weapons Advanced Technology PROJECT TITLE: IHPTET

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 funding decrease is due to end of year execution update (-125). FY 1995 decrease reflects congressional undistributed cuts for university research (-244), travel (-11) and assessment for Small Business Innovative Research (-150).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not Applicable.

(U) RELATED RDT&E:

(U) PE 0601152N (In House Lab Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0601102F (Defense Research Sciences)
(U) PE 0601102A (Defense Research Sciences)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics & Computer Technology)
(U) PE 0602203F (Aerospace Propulsion)
(U) PE 0602211A (Aviation Technology)
(U) PE 0603202F (Aircraft Propulsion Subsystem Integration)
(U) PE 0603216F (Advanced Turbine Engine Gas Generator)
(U) PE 0603003A (Aviation Advanced Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603238N
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2145 Precision Strike and Air Defense Advanced Technology	26,800	37,170	64,502	67,423	61,440	50,610	43,801	45,007	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses science and technology resources in the areas of Precision Strike and Air Superiority/Defense in support of the Joint Chiefs of Staff's (JCS's) top five Joint Warfighting Capabilities and the following Joint Mission Areas: Joint Strike, Joint Littoral Warfare, Strategic Deterrence and Strategic Sealift/Protection.

(U) The Global Surveillance and Communications area, transferred to Program Element (PE) 0603794N for FY 1995, developed and demonstrated the capability to provide the tactical user with theater of operations, near-real-time precision targeting information, sensor-to-shooter target updating, and Battle Damage Assessment generated from multiple existing high-altitude resources.

(U) Precision Strike integrates surveillance and targeting capabilities developed in the Global Surveillance area with high-speed processing and precision weapons for rapid response against high-value, short-dwell targets over extended ranges. The Navy Tactical Missile System (NATACMS) provides a demonstration launch of a Navy variant of the Army Tactical Missile System (ATACMS) from a ship in support of the Navy's Surface Fire Support mission.

(U) The Air Superiority and Defense area develops and demonstrates all-weather, day/night engagement capabilities against manned aircraft, cruise missiles (including supersonic sea-skimmers), helicopters and tactical ballistic missiles that will be employing stealth and countermeasures. The Cruise Missile Defense Advanced Concept Technology Demonstration (CMD ACTD), Phases I and II, demonstrates that an AEGIS ship using an airborne sensor partner can provide greatly expanded air defense capabilities by engaging low altitude cruise missiles beyond surface based radar horizons. The Airship Demonstration assesses the potential contribution that airships could make to the airborne component of the ship self defense/cooperative engagement capability, over-the-horizon (OTH) targeting and surveillance, and other relevant mission areas. The Mobile Offshore Base Project will demonstrate the feasibility of a forward positioned Strike Platform in

geographical areas where surrounding non-aligned countries desire to maintain their sovereignty.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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) FY 1994 ACCOMPLISHMENTS:
   - (U) ($800) STUDIES AND SIMULATIONS: Continued studies and simulations in support of new ATD starts and evaluated future technology options.
   - (U) ($3,000) REAL TIME SUPPORT FOR POWER PROJECTION (Transfers to PE 0603794N in FY 1995): Initiated prototype system design. Demonstrated OC-312 155/640 Mega Bits Per Second shipboard local area network for real-time processing of tactical data inputs. Demonstrated real-time flow of information to/from aircraft inflight. Completed multifunction mission planning demonstration in laboratory setting.
   - (U) ($5,000) PRECISION SIGNAL INTELLIGENCE TARGETING SYSTEM (Transfers to PE 0603794N in FY 1995): Performed initial live fire precision targeting demonstration in conjunction with United States Special Operations Command JCS exercise. Developed correlation algorithms, concept of operation, target characterization and classification methodologies.
   - (U) ($18,000) NATACMS: Initiated ship systems modifications. Completed studies and simulations of Navy-unique issues of adapting NATACMS to fire from a ship. Defined requirements for ship systems and missile modifications.

2. (U) FY 1995 PLAN:
   - (U) ($217) STUDIES AND SIMULATIONS: Continue studies and simulations in support of new ATD starts and evaluate future technology options.
   - (U) ($4,650) NATACMS: Complete ship systems modifications, complete shipboard system integration and conduct demonstration firing and document the results.
   - (U) ($25,700) MOUNTAIN TOP/PHASE I OF CMD ACTD (Continued effort from FY 1994, funding in PE 0603792N): Initiate design and integration studies for airborne platform prototype and modify SM-2 missiles to be used in test. Integrate and conduct mountain top test of Advanced Research Projects Agency (ARPA) surveillance radar

sensor suite, MK-74 Missile Fire Control System and Cooperative Engagement Concept (CEC) against low flyers. Install CEC units on the mountain top and in designated AEGIS ship and complete ship's training. Complete all planning for live fire demonstration.

- (U) ($6,603) AIRSHIP DEMONSTRATION (Continued Effort From FY 1994 Funding in P.E. 0603755N/Assessment of potential contribution of airships to airborne components of ship defense): Continue operational evaluations of the Airship as an advanced sensor platform. Demonstrate operations of Airship as a potential airborne component of Cooperative Engagement Capability for ship defense. Demonstrate Specific Emitter Identifier (SEI) for combat ID. Demonstrate an advanced sensor for cruise missile detection. Continue operations demonstrating Airship Platform in the Littoral.

3. (U) FY 1996 PLAN:

- (U) ($14,743) MOBILE OFFSHORE BASE (New start will transfer ARPA developed technology to the U.S. Navy for continued development and technology demonstration): Begin using ARPA developed critical technologies for Mobile Offshore Base components. U.S. Navy will initiate sub-scale tests of the complete system to demonstrate and determine risks associated with full scale construction.
- (U) ($49,759) PHASE I ($18,629) AND PHASE II ($31,130) OF CMD ACTD (Continued Effort From FY 1994 Funding in P.E. 0603792N and FY 1995 Funding in P.E. 0603238N).
  - (U) Phase I (Mountain Top) Activities: Complete final captive seeker sea clutter data collection, and Navy SM-2 live missile firings against OTH target drones using data from the mountain top sensor suite. Complete Army simulated missile firings at OTH target drones using data from the mountain top sensor suite. Prepare required reports. Complete Phase I of the CMD ACTD.
  - (U) Phase II Activities: Initiate design, development, and integration efforts for Phase II airborne platform. Begin Phase II ACTD planning efforts covering systems requirements review/design and Phase II missile seeker/fuze design and development. Design tests for airborne sensors against airborne targets. Develop installation plans for surveillance radar, fire control/illuminator radar capability and data link sensor suite in an airborne platform. Develop Phase II captive seeker sea/land data collection test plan and Phase II live fire demonstration plan. Continue Joint Navy/Air Force/Army/BMDO/ARPA Phase II CMD ACTD design and integration studies.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advance Technology PROJECT NUMBER: R2145 PROJECT TITLE: Precision Strike and Air Defense Advance Technology

4. (U) FY 1997 PLAN:

- (U) ($485) STUDIES AND SIMULATIONS: Continue studies and simulations in support of FY 1998 ATD new starts and evaluate future technology options.
- (U) ($4,513) MULTI-SENSOR PRECISION TARGETING (MSPT): Begin Flight program data collection and qualification of aircraft for integrating flight tests. Modify F/A-18 Operational Flight Program (OFP) and begin testing at Naval Air Warfare Center (NAWC), Weapons Division, China Lake, CA Avionics Laboratory. Complete design of aircraft hardware and software modifications and warfighting payoff studies.
- (U) ($9,975) MOBILE OFFSHORE BASE: Continue assessment and testing to evaluate overall system risks for transition to FY 1998 or FY 1999 formal Navy Acquisition Program.
- (U) ($49,975) PHASE II OF CMD ACTD (Joint Navy/Air Force/Army/BMDO/ARPA Program): Continue design, development, integration and planning efforts begun in FY 1996 to support OTH engagement of cruise missiles. Install surveillance radar, fire control/illuminator radar, and data link sensor suite in an airborne platform. Design tests for airborne sensor suite against airborne targets. Develop captive seeker sea/land data collection test plans and develop live fire demonstration plan. Complete Joint Phase II CMD ACTD design and integration studies for airborne platform.
- (U) ($2,475) Shared Aperture Advanced Technology: This new task will demonstrate a shared Radio Frequency (RF) aperture with the ability to simultaneously act as a common/shared antenna for multiple RF emitters (such as: radar, communication, ESM, or ECCM) for primary use on surface ships. Additionally, this task will demonstrate a shared electro-optic/infrared (EO/IR) aperture for primary use on military aircraft with potential surface ship applications. Initiate establishment of system requirements and performance specifications. Perform design studies for both the RF and EO/IR shared aperture array antennas. Conduct simulations and time-line analyses of each aperture type to verify combined sensor performance. Fabricate brassboard array components for design studies verification testing.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N PROJECT NUMBER: R2145
PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advance Technology PROJECT TITLE: Precision Strike and Air Defense Advance Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	29,607	32,961	XXX	XXX
(U) FY 1995 Appropriated:	XXX	40,061	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-2,807	-2,891	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	26,800	37,170	64,502	67,423

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year Execution Update (+3,193) and TRP reprogramming (-6,000). FY 1995 changes due to University Research (-1,753), Consulting Services Support (-280), Federally Funded Research Development Center (-762), travel (-46) and an assessment for Small Business Innovative Research (-50).

(U) Schedule: Shared Aperture Program delayed one year. Additional funding in FY 1997 will accelerate CMD ACTD one year.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603238N PROGRAM ELEMENT TITLE: Precision Strike and Air Defense Advance Technology

PROJECT NUMBER: R2145 PROJECT TITLE: Precision Strike and Air Defense Advance Technology

(U) PE 0602111N (Air and Surface Weapons Technology)
(U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
(U) PE 0602122N (Aircraft Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0603006A (C3 Advanced Technology)
(U) PE 0603226E (Experimental Evaluation of Innovative Technologies)
(U) PE 0603238F (Air Defense/Precision Strike Technology Demo)
(U) PE 0603245F (Advanced Flight Technology Integration)
(U) PE 0603270N (Advanced Electronic Warfare Technology)
(U) PE 0603401F (Advanced Spacecraft Technology)
(U) PE 0603563N (Ship Concept Advanced Design)
(U) PE 0603601F (Conventional Weapons Technology)
(U) PE 0603726F (C3I Subsystem Integration)
(U) PE 0603755N (Ship Self Defense/Cooperative Equipment Capability)
(U) PE 0603772A (Advanced Tactical Computer Science and Sensor Technology)
(U) PE 0603794N (C3 Advanced Technology)
(U) PE 0604866C (Patriot Risk Reduction Mitigation)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
E2194 Electronic Warfare Advanced Technology	6,645	7,709	7,664	9,185	10,436	10,619	10,894	11,179	CONT.	CONT.
U2090 Functional Recognition & Response	5,972	6,759	6,868	7,659	7,974	8,173	8,406	8,648	CONT.	CONT.
TOTAL	12,617	14,468	14,532	16,844	18,410	18,792	19,300	19,827	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Advanced Electronic Warfare Technology (AEWT) is the Navy's continuing, core Advanced Technology Development program for Electronic Warfare (EW) and is oriented to demonstrate and transition EW technology in cooperation with the other Services, placing special emphasis on Naval EW applications of Command and Control Warfare. This program continues to develop technologies which support the effective employment of naval force capabilities in the conduct of the Navy's Joint Mission Areas as defined by the Chief of Naval Operations (CNO) (i.e., Joint Strike, Littoral Warfare, Surveillance, Surface Electronic Warfare/Intelligence, Deterrence, Maritime Support of Land Forces and Readiness & Shore Training). P.E. 0603270N is managed at the Office of Naval Research (ONR) by the same office that directs P.E. 0602270N (Navy EW Technology) and provides the vast majority of projects to this program for demonstration and potential transition to full scale development. The ONR program manager is also a principal of the Joint Director of Laboratories

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(JDL) Technology Panel for EW which oversees and coordinates Tri-Service 6.2 & 6.3A EW programs. Consequently, this program is planned jointly in accordance with Tri-Service Reliance agreements which allocate various EW disciplines and their attendant technology development responsibilities between the Army, Air Force and the Navy. As part of the Integrated Science and Technology EW Program, it is subject to the review and execution oversight of the JDL. AEWT is responsive to CNO guidance and the Systems Commands' warfighting requirements and needs. It develops EW technologies to counter a broad range of electromagnetic threats and is linked to future joint warfighting capabilities of "maintaining near perfect real-time knowledge of the enemy..." and "to counter the threat of...cruise missiles to the Continental United States and deployed forces."

(U) The program transitions new technologies to Tactical Air, low observable aircraft, surface EW platforms, and Pre-planned Product Improvement programs (including multi-spectral/multi-modal sensors and seekers). This is done by improving threat detection, identification, location and response through developmental upgrades and direct, advanced technology insertions. Currently, AEWT consists of two projects:

(U) E2194 - Electronic Warfare Advanced Technology: A continuation of efforts initiated under the Integrated Navy Electronic Warfare System program. Efforts have been streamlined and focused from prior years into a continuing core program aimed at reducing the integration risk of advanced EW systems and to facilitate the transition of high-payoff EW technologies into the Fleet.

(U) U2090 - Functional Recognition & Response: Develops algorithms and techniques to recognize emitters by measuring and analyzing their observable, radar function parameters. Uses nondevelopmental item or develops hardware (as required) to implement Functional Recognition demonstrations and assess overall operational improvement to extant capabilities.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
E2194 Electronic Warfare Advanced Technology	6,645	7,709	7,664	9,185	10,436	10,619	10,894	11,179	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The program transitions new technologies to Tactical Air, low observable aircraft, surface Electronic Warfare (EW) platforms, and Pre-planned Product Improvement programs (including multi-spectral/multi-modal sensors and seekers) by improving threat detection, identification, location and response through developmental upgrades and direct, advanced technology insertions.

(U) This is a continuation of efforts initiated under the Integrated Navy Electronic Warfare System program. Efforts have been streamlined and focused from prior years into a continuing core program aimed at reducing the integration risk of advanced EW systems and to facilitate the transition of high-payoff EW technologies into the Fleet.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($3,900) Fabricated advanced Ultraviolet Missile Approach Warning System (UV MAWS). Conducted MAWS background/clutter data collection and live fire flights.
- (U) ($1,660) Designed and fabricated miniature laser warning sensors. Began Laser Warning Sensor (LWS)/UV sensor integration.
- (U) ($769) Integrated MAWS with AN/ALE-47 countermeasures dispenser and Countermeasures Response Optimization software.

- (U) ($316) Completed development of Navy unique dispensing hardware for the Advanced Strategic and Tactical Expendables decoys.

2. (U) FY 1995 PLAN:

- (U) ($4,041) Complete integrated UV MAWS, LWS and AN/ALE-47 suite performance demonstration with baseline processor (RAH-66/Commanche data processing module).
- (U) ($2,032) Design, fabricate and test integrated UV/laser (single aperture) sensor.
- (U) ($1,636) Initiate integration of MAWS and directed infrared countermeasures hardware and software.

3. (U) FY 1996 PLAN:

- (U) ($3,500) Conduct lab and flight tests of integrated MAWS, LWS, ALE-47, ALE-50, BOL and Advanced Expendables. Complete "FISHEYE" LWS prototype and effectiveness demonstration.
- (U) ($1,087) Validate algorithms for passive MAWS missile identification and time to impact.
- (U) ($1,600) Conduct advanced countemeasures effectiveness analysis.
- (U) ($1,477) Continue integration of Army developed/directed energy countermeasures with warning/response suite.

4. (U) FY 1997 PLAN:

- (U) ($3,600) Complete passive missile identification and time-to-impact demonstration.
- (U) ($2,561) Initiate integration of passive missile identification and tailored-response effectiveness demonstration.
- (U) ($1,224) Demonstrate advanced countermeasures techniques against ASTE tier 3 threats.
- (U) ($1,800) Conduct feasibility demonstration of directed energy countermeasures.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: E2194
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Electronic Warfare Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 PRESIDENT'S BUDGET:	6,729	7,856	XXX	XXX
(U) FY 1995 Appropriated:	XXX	7,856	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-84	-147	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	6,645	7,709	7,664	9,185

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: The FY 1994 fund ajustment is for end-of-year execution (-84) to reflect below threshold reprogramming. The FY 1995 fund adjustments are for: Congressional Undistributed Cuts for University Research (-136); and Travel (-11).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: E2194
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Electronic Warfare Advanced Technology

(U) RELATED RDT&E:

This Program Element (PE) adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the Joint Director of Laboratories and is associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602270N (Electronic Warfare Technology)
(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0603217N (Air Systems and Weapons Advanced Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0604223A (Commanche)

D. SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
U2090 Functional Recognition & Response	5,972	6,759	6,868	7,659	7,974	8,173	8,406	8,648	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

The Specific Emitter Identification (SEI) technology developed in this program significantly enhances the ability to quickly and accurately perform Combat Identification (ID) and support the Joint Mission Areas as defined by the Chief of Naval Operations (i.e., Joint Strike, Surveillance, Surface Electronic Warfare/Intelligence, etc.).

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($900) Delivered AN/SLQ-32 Functional ID Algorithms to SLQ-32, ALR-66, ALR-67, ALR-76 and ALQ-99 programs.
- (U) ($922) Performed at-sea and field tests of Functional ID with Generic Countermeasures (CM) and towed decoy system.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition Response

- (U) ($950) Demonstrated at-sea Functional ID algorithm with improved Decoy Deceptive Electronic Countermeasures Integration Generic CM for AN/SLQ-32.
- (U) ($750) Integrated Air Functional ID with Generic CM.
- (U) ($950)

- (U) ($700) Developed and tested generic Electronic Countermeasures (ECM) responses against threat systems using an integrated suite of the ALQ-126B, Active Airborne Electronic Decoy (AAED), and ALE-39.
- (U) ($800) Tested robust CM techniques against multi-mode/Infrared tracking/homing subsystems (AAR-5) and FLYCATCHER and defined the requirements for the development/optimization of onboard/offboard ECM against advanced cruise missile threats.

2. (U) FY 1995 PLAN:

- (U) ($750)

- (U) ($809) Demonstrate at-sea, Generic CM assessment capability in response to ECM applications for AN/SLQ-32.
- (U) ($750) Integrate counter-terminal and counter-targeting techniques package into the AN/SLQ-32 Digital Radio Frequency Memory Unit.
- (U) ($575) Design a generic ship EW system including subsystem requirements and transition path for AN/SLQ-32 ships.
- (U) ($750) Insert Functional ID capability into the ALQ-99 jammer system.
- (U) ($750) Integrate advanced onboard ECM techniques with ALE-39/47 and the Integrated Towed Decoy (ITD) and demonstrate the incorporation of coherent ECM against imaging and polarization diverse threats.
- (U) ($775) Integrate generic threat assessment module into Naval Tactical Command System-Afloat.
- (U) ($750) Integrate Advanced Tactical EW Environment Simulator into the Central Target Simulator.
- (U) ($850) Continue field and at-sea testing of systems containing advanced SEI techniques and functional ID algorithms.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition Response

3. (U) FY 1996 PLAN:
- (U) ($800) Develop generic hardware for inserting improved Functional ID capability into existing receiver systems.
- (U) ($861) Fabricate and test the integrated suite consisting of chaffem, ITD and Expert System technology against advanced coherent threats.
- (U) ($700) Modify AAED hardware and conduct tests against imaging radars and radars with polarization diversity/ Non-Cooperative Target Recognition.
- (U) ($757) Extend ITD hardware to operate in the Millimeter Wave (MMW) range through the development and integration of a MMW optical link.
- (U) ($850) Demonstrate active and passive methods of countering Proformal links.
- (U) ($900)
- (U) ($800)

- (U) ($700) Demonstrate artificial intelligence techniques for Generic CM, Functional ID and UMOP.
- (U) ($500) Continue field testing of advanced UMOP and SEI techniques into existing receiver and surveillance systems.

4. (U) FY 1997 PLAN:

- (U) ($1,100) Demonstrate Functional ID system for generic hardware.
- (U) ($1,009) Complete flight tests and evaluate results using the optimized chaff (ALE-39/47), Expert system and AAED integrated suite against surrogate Micro Wave and MMW threats at China Lake.
- (U) ($1,300) Test coodinated onboard jamming and towed decoy using fiber optic link.
- (U) ($950) Demonstrate Shipboard sensor fusion hardware.
- (U) ($1,000)
- (U) ($1,300)

- (U) ($1,000

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition Response

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 PRESIDENT'S BUDGET:	6,100	6,943	XXX	XXX
(U) FY 1995 Appropriated:	XXX	6.943	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-128	-184	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	5,972	6,759	6,868	7,659

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: In FY 1994 the funding decrease was due to end-of-year execution (-128). FY 1995 adjustments reflect Congressional Undistributed Cuts for University Research (-120), travel (-9), and an assessment for Small Business Innovation Research (-55).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603270N PROJECT NUMBER: U2090
PROGRAM ELEMENT TITLE: Advanced Electronic Warfare Technology PROJECT TITLE: Functional Recognition Response

(U) RELATED RDT&E PROGRAMS: This PE adheres to Tri-Service Reliance Agreements on EW with oversight and coordination provided by the JDL and is associated with efforts that are being pursued under the following Army and Air Force PEs:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0602270A (Electronic Warfare Technology)
(U) PE 0602270N (Electronic Warfare Technology)
(U) PE 0603270A (Electronic Warfare Technology)
(U) PE 0603270F (Electronic Combat Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

(U) COST (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2224 Ship and Submarine Hull, Mechanical and Electrical (HM&E) Advanced Technology	15,532	15,792	15,051	17,124	17,678	19,098	19,448	18,055	CONT.	CONT.
S1848 Gas Turbine Engine Technology	3,000	2,974	2,935	3,095	3,309	3,469	3,572	3,679	CONT.	CONT.
S2259 Intercooled Recouperated (ICR) Engine	0	41,500	25,558	31,791	59,678	8,255	0	0	166,782	166,782
TOTAL	18,532	60,266	43,544	52,010	80,665	30,822	23,020	21,734	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides for surface ship and submarine hull, mechanical, and electrical system core technology developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff; namely, to promptly engage regional forces in decisive combat on a global level.

(U) There are three projects: ICR Engine (S2259), Gas Turbine Engine Technology (S1848) and Ship and Submarine HM&E Advanced Technology (R2224). Products from this PE will improve the effectiveness and operational efficiency of all Navy ship and submarine platforms in all Joint Mission Areas. All naval platforms inherently require mobility, efficiency, reliability, and availability as a primary requirement for Naval Warfare. This program directly supports the Readiness, and Support and Infrastructure Joint Mission Area in the area of sustainability and supports Joint Strike, Joint Littoral, Joint Surveillance, Joint Surface Electronic Warfare, Strategic Deterrence, and Maritime Support for Land Forces, and Strategic Sealift relative to reduced signatures and increased survivability.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

(U) COST (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2224 Ship and Submarine Hull, Mechanical and Electrical (HM&E) Advanced Technology	15,532	15,792	15,051	17,124	17,678	19,098	19,448	18,055	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Ship and Submarine Hull, Mechanical, and Electrical (HM&E) Advanced Technology is a FY 1996 new project created due to the restructuring of Program Element (PE) 0603555N, Project R2142. The project develops and demonstrates technological improvements for HM&E systems in support of present and future surface ship and submarine platforms. The project improves overall platform performance (stealth, survivability, mobility, efficiency, reliability and availability) and reduces maintenance, overhaul, and life cycle costs.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($15,532) Advanced Vibration Reducer (AVR):
  - (U) Completed fabrication and acceptance testing of AVR system hardware and software.
  - (U) Propulsor refurbishment completed and shaft delivered to Land Based Test Facility.
  - (U) Initiated ship installation studies and Temporary Alteration (TEMPALT) preparation.
  - (U) Software Audit completed.

2. (U) FY 1995 PLAN:

- (U) ($15,792) AVR:
  - (U) Conduct Land Based Test Facility testing of AVR System to support FY 1996 at-sea evaluation.
  - (U) Complete ship installation studies and TEMPALT preparation.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

PROJECT NUMBER: R2224
PROJECT TITLE: Ship and Submarine HM&E Advanced Technology

3. (U) FY 1996 PLAN:

- (U) ($15,051) AVR:
  - (U) Install AVR system on a SSN 688 Class Submarine (includes 56 day dry-docking plus four week dockside grooming).
  - (U) Conduct first sea trial. The following data will be taken for post trial analysis and system optimization:
    - -- (U) Collect structural data.
    - -- (U) Demonstrate basic AVR functions.
    - -- (U) Measure transfer functions.

4. (U) FY 1997 PLAN:

- (U) ($17,124) AVR:
  - (U) Conduct second sea trial.
    - -- (U) Demonstrate system performance against Advanced Technology Demonstration goals.
    - -- (U) Evaluate system control configurations.
  - (U) Conduct third sea trial. Continue system evaluation and demonstrate system performance against Sound Surveillance System.
  - (U) Initiate documentation of system design and reporting of system performance data.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

PROJECT NUMBER: R2224
PROJECT TITLE: Ship and Submarine HM&E Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	0	XXX	XXX
(U) FY 1995 Appropriated:	XXX	XXX	XXX	XXX
(U) Adjustments from Appropriated/PRESBUDG:	+15,532	+15,792	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	15,532	15,792	15,051	17,124

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 fund adjustments are for: End-of-Year Execution (+750) to reflect below threshold reporgramming and Comparability Adjustment (+14,782). FY 1995 fund adjustments are for: Comparability Adjustment (+17,113); Congressional Undistributed Cuts for University Research (-324); Federally Funded Research and Development Centers (-23); Travel (-24); and, an assessment for Small Business Innovative Research (-950).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY:

(U) RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0602233N (Readiness, Training and Environmental Quality)
- (U) PE 0602234N (Materials, Electronics, and Computer Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

PROJECT NUMBER: R2224
PROJECT TITLE: Ship and Submarine HM&E Advanced Technology

- (U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
- (U) PE 0603502N (Surface and Shallow Water Mine Countermeasures)
- (U) PE 0603513N (Shipboard System Component Development)
- (U) PE 0603514N (Personnel/Ship Survivability)
- (U) PE 0603553N (Surface Anti-Submarine Warfare)
- (U) PE 0603561N (Advanced Submarine Systems Development)
- (U) PE 0603563N (Ship Concept Advanced Design)
- (U) PE 0603564N (Ship Preliminary Design and Feasibility Studies)
- (U) PE 0603569E (ARPA S&T Program)
- (U) PE 0603573N (Advanced Surface Machinery Systems)
- (U) PE 0604558N (New Design SSN Development)
- (U) PE 0604561N (SSN-21 Developments)
- Under the Tri-Service Reliance Agreement, the Navy has the lead for this Navy-unique program.

D. SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technolgy

(U) COST (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
S1848 Gas Turbine Engine Technology	3,000	2,974	2,935	3,095	3,309	3,469	3,572	3,679	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Gas Turbine Engine Technology project develops and demonstrates technology which directly transitions to the fleet to address current fleet gas turbine engine system problems in reliability and safety. The project also continuously upgrades the performance of current fleet gas turbines and develops technology for application on future gas turbines in areas such as efficiency.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($1,600) LM2500:
  - (U) Initiated development of power turbine magnetic bearings.
  - (U) Continued testing of new turbine airfoil coatings and blade enhancements.
  - (U) Continued study of fuel efficient/low nitrous oxide (NOx) emissions developments.

- (U) ($700) 501:
  - (U) Completed testing of prototype equipment monitoring system.
  - (U) Completed and validated the vibration prediction model.

- (U) ($700) TF40B:
  - (U) Initiated testing of the new seal and bearing design to evaluate performance, Meantime Between Failures (MTBF), and life cycle costs.
  - (U) Initiated testing of the new designed limiter to allow continued operation without engine shutdown.
  - (U) Completed demonstration of compressor coatings and continued service testing of improved combustor and turbine coatings to reduce maintenance and life cycle costs.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION DATE: SEPT 1994

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROJECT NUMBER: S1848
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology PROJECT TITLE: Gas Turbine Engine Technology

2. (U) FY 1995 PLAN:

- (U) ($1,674) LM2500:
  - (U) Finalize power turbine magnetic bearings design and procure test hardware.
  - (U) Complete testing of new turbine airfoil coatings and blade enhancements.
  - (U) Continue fuel study of efficient/low NOx emission developments.
  - (U) Initiate design effort for Full Authority Digital Engine Control (FADEC).
  - (U) Initiate design effort for condition monitoring system.

- (U) ($700) 501:
  - (U) Investigate feasibility of utilizing recuperation to reduce fuel consumption.
  - (U) Initiate insulated fuel nozzle design.
  - (U) Initiate development of new first stage turbine blade material and seal.

- (U) ($600) TF40B:
  - (U) Complete demonstration of turbine coatings to reduce maintenance and life cycle costs.
  - (U) Complete testing of the new seal and bearing design to evaluate performance, MTBF, and reduce life cycle costs.
  - (U) Complete testing of new designed limiter to allow continued operation without engine shutdown.
  - (U) Initiate improved axial compressor aero performance.

3. (U) FY 1996 PLAN:

- (U) ($1,585) LM2500:
  - (U) Field test condition monitoring system.
  - (U) Field test fuel reduction device.
  - (U) Bench test power turbine magnetic bearings.
  - (U) Continue Full Authority Digital Engine Control (FADEC) design efforts.

- (U) ($700) 501:
  - (U) Investigate use of magnetic bearing generator set development.
  - (U) Continue improved fuel nozzle efforts.
  - (U) Modify combustor based on computational fluid dynamics work in conjunction with fuel nozzle.
  - (U) Continue development of new first stage turbine blade material and seal.

- (U) ($650) TF40B:
  - (U) Continue design efforts on axial compressor aero performance.
  - (U) Initiate improved high pressure turbine aero performance.
  - (U) Complete compressor coating design effort.
  - (U) Complete high pressure turbine coating development.

4. (U) FY 1997 PLAN:

- (U) ($1,745) LM2500:
  - (U) Complete condition monitoring system.
  - (U) Start design effort on improved axial compressor aero performance.
  - (U) Engine test power turbine magnetic bearings.
  - (U) Complete FADEC design efforts.

- (U) ($700) 501:
  - (U) Bench test magnetic bearing generator set.
  - (U) Field test improved fuel nozzle.
  - (U) Field test of modified combustor based on computational fluid dynamics work.
  - (U) Field test of new first stage turbine blade material and seal.

- (U) ($650) TF40B:
  - (U) Bench test axial compressor aero performance.
  - (U) Continue design effort of improved high pressure turbine aero performance.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION DATE: SEPT 1994

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROJECT NUMBER: S1848
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology PROJECT TITLE: Gas Turbine Engine Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	3,394	3,152		
(U) FY 1995 Appropriated:		3,152		
(U) Adjustments from Appropriated/PRESBUDG:	-394	-178		
(U) FY 1996/97 PRESBUDG Submit:	3,000	2,974	2,935	3,095

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustment in FY 1994 is for End-of-Year execution (-394). Fund adjustments in FY 1995 are for Congressional Undistributed Cuts for University Research (-54); Travel (-4); and, an assessment for Small Business Innovative Research (-120).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY:
(U) RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
- (U) PE 0602122N (Aircraft Technology)
- (U) PE 0602234N (Materials, Electronics, and Computer Technology)
- (U) PE 0603573N (Advanced Surface Machinery Systems)

D. SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship and Submarine HM&E Advanced Technology

(U) COST (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
S2259 ICR Engine	0*	41,500	25,558	31,791	59,678	8,255	0	0	0	166,782

*FY 1994 Accomplishments can be found under PE 0603573N, Project S1314.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Prior to FY 1995, ICR Gas Turbine Engine was funded under PE 0603573N, Advanced Surface Machinery (ASM) Programs. The ICR Gas Turbine Engine is a 26,400 horsepower (with 10% growth margin to 29,040 horsepower) engine designed as a next generation marine gas turbine. ICR will significantly reduce life cycle fuel cost, provide a minimum impact alternative to increase range, and lead to environmental emissions compliance.

(U) A contract for ICR Advanced Development (AD) with an option for Full Scale Development was awarded to Westinghouse Electric Corporation in December 1991. The ICR is derived from the Rolls-Royce RB211 aircraft engine and through the introduction of an intercooler, recuperator, and variable area nozzles achieves a 30% propulsion fuel savings when compared to the LM2500. The RB211 is a modern commercial aircraft engine with over 2000 engines delivered to date and production projected well into the next century.

(U) The ICR engine began full scale system testing on 15 July 1994 at Pyestock, United Kingdom (U.K.). Development testing will include a total of fifteen different engine builds which will conclude in FY 1996. First engine build testing was completed on 15 September and achieved 80% of rated power. The second engine build was installed on 29 November. The engine achieved 100% power with the recuperator included on 21 December.

(U) Initial ship installation is targeted for a FY 1997 pilot ship with planned Fleet introduction in FY 2000 DDG51 Class Ships. A cooperative Agreement between the Royal Navy and US Navy was signed by Under Secretary of Defense for Acquisition and Technology, USD(A&T), on 21 June 1994 for in-kind and cash contributions to the ICR program. Negotiations are nearin

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROJECT: S2259
PROGRAM ELEMENT TITLE: Ship & Shore HM&E Advanced Technology PROJECT TITLE: ICR Engine

completion for a Cooperative Program with the French Navy. These Cooperative Programs enable the ICR program to be rephased, accelerating the planned fleet introduction. In February 1994, the USD(A&T) approved an engine Pre-Planned Product Improvement (P3I) for the DDG51 class to improve fuel efficency and ensure environmental compliance. A decision implementing the P3I will be made by Assistant Secretary of the Navy (RD&A) in 1997.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS: Not Applicable.

2. (U) FY 1995 PLAN:

- (U) ($41,500) ICR: Continue ICR development testing of the full scale engine hardware and software at the Pyestock U.K. test facility. Alternating builds of the first and second engine will be extensively instrumented for various strainguage, thermal paint and performance tests including a 50-hour endurance test. Analysis of test results and the stripping and inspection of one engine will be done concurrently with testing the other engine. Design review Number 3 scheduled for mid-1995 will be primarily a decision point for order of long lead material for the qualification test engine, but will also provide sufficient data to enable a propulsion decision by the Common New Generation Frigate (CNGF) Joint Program Office which is considering ICR for the CNGF. Complete the ICR tactical design effort which is necessary before manufacturing the qualification test engine. Deliver additional development test hardware needed to maintain the aggressive engine build and test schedule. Continue efforts related to ICR integrated logistics support and Computer Aided Logistics Support implementation.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603508N
PROGRAM ELEMENT TITLE: Ship & Shore HM&E Advanced Technology

PROJECT: S2259
PROJECT TITLE: ICR Engine

3. (U) FY 1996 PLAN:

- (U) ($25,558) ICR: Complete ICR system development testing at the Pyestock test facility, including noise and vibration trials enclosure cooling and ventilation tests, exhaust emissions survey, performance demonstration, and 500-hour endurance test. Design Review Number 4 will be held prior to the start of last development engine test, i.e., the 500-hour endurance test. Complete the analysis of all development test results including engine strips and inspections and issue final test reports. Conduct design review Number 5 after completion of the 500-hour endurance test to validate that the ICR is a ship-ready system and approve the start of the qualification testing phase.

4. (U) FY 1997 PLAN:

- (U) (31,791) ICR: Deliver and install the qualification test engine at the Pyestock test facility. Conduct the majority of the 3000 hour endurance test during this fiscal year completing in the following fiscal year. Order long lead material for the remaining engines. Begin manufacture of engine hardware for these engines which can be used for ship integration testing. Prepare for ship integration testing of the ICR engine at the land-based site on a pilot ship.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	0	XXX	XXX
(U) FY 1995 Appropriated:	0	0	XXX	XXX
(U) Adjustments from Appropriated/PRESBUDG:		41,500	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	0	41,500	25,558	31,791

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603508N PROJECT: S2259
PROGRAM ELEMENT TITLE: Ship & Shore HM&E Advanced Technology PROJECT TITLE: ICR Engine

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustments in FY 1995 are for: Shipbuilding PE Restructure (+41,900) and an assessment for Small Business Innovative Research (-400).

(U) Schuedule: Not applicable.

(U) Technical: Not applicable

C. (U) OTHER PROGRAM FUNDING SUMMARY: (Dollars in thousands)

	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
(U) SCN Line (To Be Determined (TBD))	0	0	0	0	0	0	51,900	40,699	TBD	TBD

(U) Related RDT&E:

(U) PE 0603573N (Advanced Surface Machinery Programs)
(U) PE 0603721N (Environmental Protection)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICTION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
C2223 Marine Corps Advanced Technology	26,944	24,333	25,896	26,738	28,706	30,887	31,711	33,769	CONT.	CONT.

(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 being addressed in this program element (PE) are Reconnaissance Standoff Mine Detection for surf zone and ashore; Mine Neutralization; Chemical/Biological Defense capability for Marine personnel and material; Advanced Infantry and Vehicle Mounted Weapon Systems; application of computer technology and advanced command and control architectures to Battlefield Electronic Support Systems and Command and Control systems; protection from, and tactical employment of, emerging laser weapons; and alternative electric very high power/low weight propulsion drive-trains and armor/armament for future vehicles. This is an ongoing program to develop and demonstrate advanced technologies and system concepts in a quasi-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 Science and Technology Project Reliance agreements and the Joint Chiefs of Staff Joint Warfare Capabilities. Specifically this PE directly supports the following capabilities: to promptly engage regional forces in decisive combat on a global basis, and to maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near real-time. 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.

1. (U) COMBAT ELEMENT (CE) TECHNOLOGY: This area develops and demonstrates technologies and concepts to enhance the Command, Control, Communications and Computers (C4I); Electronic Warfare; Sensors and Electronic Devices; and Modeling and Simulation capabilities of the CE. These ATDs permit the rapid, accurate capture and dissemination of friendly and enemy essential elements of information, permitting greater situational awareness and control of forces. CE also addresses reconnaissance,

surveillance, target acquisition, IDENTIFICATION FRIEND OR FOE (IFF), and streamlined communications involved in command and control (C2) of supporting arms and units in amphibious/maneuver operations. Ongoing ATDs are: C2 IN THE YEAR 2000 (C2-2000), which will improve the joint interoperability of current and future MAGTF C4I systems by making them operable within the Global Command and Control System (GCCS); FORWARD OBSERVER/FORWARD AIR CONTROLLER (FO/FAC) and OUTRIDER, which both expand the target acquisition capabilities of forward deployed ground forces and enhance the control of supporting fires to ensure first round destruction; and ADVANCED DISTRIBUTED SIMULATION and VIRTUAL PROTOTYPING TECHNOLOGY, which will be employed to improve user involvement in ATDs.

2. (U) GROUND COMBAT ELEMENT (GCE) TECHNOLOGY: This area develops and demonstrates technologies and concepts to enhance the GCE's abilities to locate, close with, and destroy the enemy. The principal objectives are to improve tactical mobility and survivability, lethality, and training readiness in order to facilitate the Marine Corps-unique Operational Concept, Operational Maneuver from the Sea (OMFTS). Major focus areas are: MOBILITY, which develops technologies for an all electric family of combat and tactical vehicles, incorporating electric armor, electric suspension, electric survivability suites, and electric guns; and MINE COUNTERMEASURES (MCM), which encompasses mobility and survivability, develops technologies to detect mines, minefields, and countermeasure mines rapidly, at safe standoff and fully integrated with the GCE. GCE also addresses: NEUTRALIZATION of advanced, hardened, and off/route, smart mines, regardless of fuzing; and FIRE SUPPORT, which develops weapons technologies focusing on electro-magnetic guns (JOINT CANNON CALIBER ELECTRO-MAGNETIC GUN (JCCEMG)), directed energy target acquisition/ countermeasure systems, and lightweight weapons and armors based on innovative design and advanced materials. Emphasis is placed on reducing the Marine's Combat load, while enhancing survival.

3. (U) AVIATION COMBAT ELEMENT (ACE) TECHNOLOGY: This area develops and demonstrates improved close air support capability, enhancing the survivability of assault support helicopter-borne operations, and new technologies to define the air defense posture of the forward battlespace. Other ACE areas of focus are: DETECTION and IDENTIFICATION of low flying threat remotely piloted vehicles, rotary and fixed wing aircraft; and enhanced lethality and responsiveness of CLOSE AIR SUPPORT/ CLOSE IN FIRE SUPPORT, which will enable improved support of OMFTS. Technologies to improve in-flight and landing zone (LZ) survivability, situational awareness, and suppression of enemy forces in the vicinity of the LZ will also be developed.

4. (U) COMBAT SERVICE SUPPORT ELEMENT (CSSE) TECHNOLOGY: This area develops and demonstrates technologies to enhance the CSSE's ability to provide combat service support to the MAGTF for both traditional and emerging OMFTS Amphibious Operations. Mission Areas emphasized are: SUPPLY, which addresses an operationally reliable, cost effective warehousing system with in-transit/total asset visibility of supplies and equipment for peacetime and expeditionary supply support and demonstrates functional seabasing and selective off-load capabilities through platform design; MAINTENANCE, which addresses reduction of

down time on ground equipment through prognostics, self-diagnostics, reliability centered maintenance, interchangeability/ commonality of parts and components, and improved mobile and seabased maintenance facilities; TRANSPORTATION, which addresses improvements in cargo handling and transportation means available for ship-to-shore movement of supplies and equipment; reduction in tare and delivery time through improved packaging techniques and materials; EXPEDITIONARY ENGINEERING, which addresses enhanced mobility, flexibility, and capability of deliberate engineer equipment available to expeditionary forces; HEALTH SERVICES, which addresses enhancement of capability through use of modular medical facilities; and SERVICES, which addresses improvements in water production, bulk liquid distribution, and mobile electric power. Utilizing a systematic approach called ADVANCED AMPHIBIOUS LOGISTICS TECHNOLOGY, ATDs will address all functions of Combat Service Support.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

PROJECT NUMBER: C2223
PROJECT TITLE: Marine Corps Advanced Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($1,413) ADVANCED COUNTERMEASURES SYSTEM (ACS): (formerly titled Distributed Explosive Mine Neutralization System (DEMNS)) Conducted system demonstration. Prepared Level A specification. Finalized Milestone I documentation, Warhead Design, Testing, and Fabrication of Test hardware. Transitioned program to PE 0603612M, Marine Corps Mine/Countermeasures Systems, Project C2106, ACS.

- (U) ($1,228) OFF/ROUTE SMART MINE CLEARANCE (ORSMC): (formerly titled Wide Area Mine Clearance (WAMC)) Began ATD (joint with Army). Developed concepts of employment. Investigated candidate neutralization technologies. Initiated design and analysis efforts. Continued efforts with signature duplication software and surrogate threat emulator.

- (U) ($2,769) JOINT AMPHIBIOUS MINE COUNTERMEASURES (JAMC): Began ATD. Developed concepts of employment. Integrated explosive/electromagnetic/mechanical mine neutralization technologies with remotely operated platform. Conducted Preliminary Design Review. Designed and initiated fabrication of hardware. Conducted Critical Design Review. Coordinated efforts with COUNTERMINE TOP LEVEL DEMONSTRATION (TLD) and integrated efforts in the JOINT SURF ZONE MINE COUNTERMEASURES (JSZMCM) sub-project under this PE.

- (U) ($5,056) COASTAL BATTLEFIELD RECONNAISSANCE AND ANALYSIS (COBRA): (formerly discussed under JOINT STANDOFF MINE DETECTION SYSTEM (SOMD)) Preliminary technology transitioned from Exploratory Development (PE 0602131M, Marine Corps Landing Force Technology). Completed Developmental Test 0 (DT 0) planning. Completed design of enhanced sensor. Conducted trade-off studies. Initiated sensor fabrication. Completed airborne testbed. Evaluated algorithms for image processing. VEHICLE AND HAND HELD MINE DETECTION PROJECT: Completed Design Studies and awarded contract for Prototype Equipment (joint with Army).

- (U) ($1,714) TEAM TARGET ENGAGEMENT SIMULATOR (TTES): Fabricated a testbed for the evaluation of the dynamic synthetic environment under development. Conducted extensive subject matter expert evaluations involving a comparative assessment which established a behavioral representation baseline. Initiated contract efforts to support development of the computer controlled hostile and dynamic micro-terrain. Explored Forward Observer

training capacities.

- (U) ($3,900) JCCEMG: Completed component design (joint with US Army). Fabricated and tested components of compulsator and launcher, and integrated launch package. Performed additional in-house parallel barrel, launch, and launch package testing. Conducted single shot testing of the integrated launch package.

- (U) ($818) ADVANCED SYSTEMS FOR AIR DEFENSE (ASAD): Conducted field test of passive Electronic Support Measure (ESM) and acoustic sensor against low flying rotary and fixed wing aircraft. Refined low cost alternative ESM sensor. Discontinued high-end ESM sensor due to inadequate technology performance.

- (U) ($2,682) C2-2000: Completed study of 32 MAGTF C4I systems for their ability to be migrated into the GCCS. Began transition of selected systems into the GCCS Common Operating Environment (COE).

- (U) ($1,573) FO/FAC: Made source selection and awarded prototype design/fabrication contract. Increased scope of contract to provide additional hardware for Joint Rapid Force Projection Initiative (RFPI) involvement with the Army. Completed preliminary design of Brass Board hardware.

- (U) ($12) AMPHIBIOUS ASSAULT NETWORKING TECHNOLOGY (AANT): The AANT program was terminated and substituted with the Army's Message Handling System (MHS) based on the MHS becoming an integral portion of the Joint Maritime Commanders Information System (JMCIS) Unified Build. This funding was expended to evaluate MHS and to close-out (document and provide for equipment disposition of) the AANT program. Finalized AANT software specifications and transitioned technology to Marine Corps Systems Command Director for C4I.

- (U) ($500) THIRD ECHELON TEST SET (TETS): Completed basic design of Lightweight Automated Portable tester and transitioned to PE 0206624M, Marine Corps Combat Services Support, Project C0076, Combat Services Support.

- (U) ($356) SURVIVABILITY SYSTEM FOR AMPHIBIOUS VEHICLES: (formerly titled Chemical/Biological Defense) Evaluated small, catalytic oxidation filtration technology as collective protection for amphibious vehicles. Reduced Marine Corps involvement, in accordance with Project Reliance guidelines. The Army is the lead service.

- (U) ($1,676) OUTRIDER: (formerly shown under Joint Tactical Directed Energy Warfare (JOINT TDEW) Technology)

Conducted Early Technical Demonstration of the Combat Protection System, emphasizing the target hand-off capability while providing electro-optic countermeasures to protect tube-launched, optically sighted, wire guided crew while the missile was in flight.

- (U) ($2,585) 21ST CENTURY LAND WARRIOR (21CLW): (formerly shown under Joint Armor/Anti-Armor Technology sub-project) Conducted trade-off studies addressing the down-sizing and integration of man-portable subsystems applicable to the survivability, situation awareness, communication and lethality of the dismounted infantryman. Initiated Joint Generation II Soldier ATD contract with Motorola Corporation, Scottsdale, Arizona. Salient innovation is treating the soldier/marine and the respective small unit as an integrated system.

- (U) ($662) JSZMCM: Initiated modeling and simulation efforts to integrate the respective JAMC ATD with the Navy's Shallow Water MCM (SWMCM) program. Initiated fabrication of component hardware.

2. (U) FY 1995 PLAN:

- (U) ($1,113) ORSMC: Design system level neutralization technologies. Conduct Critical Design Review. Fabricate system component/sub-component hardware. Continue signature duplication and surrogate threat emulator efforts (joint with Army). Reduce level of Marine Corps funding as Army increases funding levels.

- (U) ($2,733) JAMC: Complete fabrication of system hardware. Conduct DT 0. Prepare Milestone I documentation. Develop simulators to emulate operational performance. Coordinate efforts and prepare for transition to COUNTERMINE TLD and integrated efforts under this PE. Develop simulators to emulate operational performance.

- (U) ($1,975) COBRA: Complete fabrication/integration of enhanced sensor into Pioneer unmanned serial vehicle. Complete DT 0. Initiate Operational Testing 0 (OT 0).

- (U) ($2,000) TTES: Continue dynamic synthetic environmental development. Integrate behavioral and environmental products into the TTES system. Conduct initial 2-4 combatant tactical training assessment in a synthetic urban environment.

- (U) ($835) JCCEMG: Complete component testing. Assemble the skid mounted gun and conduct gun performance testing

(joint with Army).

- (U) ($1,707) ASAD: Solicit contract for ESM and acoustic passive sensor designs. Begin separate contracted development effort to develop and demonstrate passive acoustic and ESM sensor as an Avenger system upgrade.

- (U) ($5,040) C2-2000: Continue MAGTF C4I system software conversion, conduct capability demonstrations, and incorporate test results of transitioning these systems to the GCCS COE. Scope of software conversion and system transition to GCCS COE will decrease due to departmental budgetary constraints. Develop the associated software documentation to reflect movement from a "stove pipe" environment to an "open" environment.

- (U) ($1,284) FO/FAC: Complete fabrication. Conduct DT 0. Initiate OT 0 and transition of documentation in preparation for multi-service integration. Develop type-A specification for DEM/VAL phase.

- (U) ($380) SURVIVABILITY SYSTEMS FOR AMPHIBIOUS VEHICLES: Define performance goals for mine blast and related survivability measures. Complete low observable technology designs. Complete collective Nuclear/Biological/ Chemical protection trade-offs.

- (U) ($1,420) OUTRIDER: Continue modeling and simulation efforts to determine system utility on the battlefield using both man-in-the-loop and force-on-force systems. Prepare documentation to transition to DEM/VAL phase and Milestone I.

- (U) ($2,676) 21CLW: Continue the down-sizing and integration efforts of the Integrated Headset, Individual Soldier Radio/Computer, Thermal Weapons Sight, Protective Subsystem and Micro-Climate Cooling System to provide for the enhanced survivability and lethality of the dismounted infantryman on tomorrow's battlefield (joint with Army). Fully fund the Marine Corps commitment to the Joint Service Program. ADVANCED LIGHTWEIGHT GROUND WEAPONRY (ALWGW): Conduct concept development and alternative trade-offs of candidate technologies that lighten a Marine's combat load, improve lethality, and enhance maneuverability (joint with Army).

- (U) ($1,749) JOINT INTEGRATED ELECTRIC MOBILITY DEMONSTRATION: (formerly titled Advanced Engine/Propulsion Technology) Conduct testing of Advanced Power System. Begin integration of 2,250 horsepower (Hp) engine into medium weight class high water speed testbed to facilitate future integration of electric drive train and electric

water propulsion units (joint with Army).

- (U) ($1,171) JSZMCM: Continue fabrication of component hardware. Conduct DT/OT 0. Complete integration with JAMC, Navy SWMCM programs, and Joint Army/Marine Corps TLD via extensive modeling and simulation.

- (U) ($250) JOINT TACTICAL COMMUNICATIONS SYSTEM: (formerly titled Intentional Short Range Communications (ISRC)) This program transitioned from Exploratory Development, PE 0602131M. Initiate ATD to demonstrate - in cooperation with the Army ATD, Survivable Adaptive Systems - the operational utility of employing these technologies.

3. (U) FY 1996 PLAN:

- (U) ($2,348) ORSMC: Complete fabrication of system hardware. Finalize signature duplication and surrogate threat emulator efforts. Conduct DT/OT 0. Prepare Milestone I documentation. Transition to PE 0603612M, Project C2104.

- (U) ($2,500) JAMC: Integrate system prototype. Conduct OT 0. Prepare to participate in joint MCM ADVANCED CONCEPT TECHNOLOGY DEMONSTRATION (ACTD).

- (U) ($1,935) COBRA: Complete OT 0 and Milestone I documentation. Prepare DEM/VAL phase documentation and type-A specification. Transition program to PE 0603635M, Marine Corps Ground Combat/Support System, Project C2247.

- (U) ($1,000) TTES: Complete system integration. Conduct assessments with advanced human interface technology of fire team and rifle squad. Adapt TTES technology to support virtual prototyping and the assessment of tactical value of the 21CLW and other advanced infantry technologies. Conduct DT 0 and plan Early Operational Assessment.

- (U) ($1,000) ASAD: Transition ESM sensor technology to the Program Manager for integration onto the Avenger platform. Continue development of the passive acoustic sensor.

- (U) ($1,116) C2-2000: Complete MAGTF C4I system software conversion to the GCCS COE. Develop the capability to produce a "virtual" command post through the use of visualization software. Conduct capability demonstrations and transition results to applicable MAGTF CE C2 programs. This program transitions to PE 0206626M, Marine Corps Command, Control, Communications Systems, Project C2150, MAGTF C4I, Systems Engineering and Integration (SE&I).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

PROJECT NUMBER: C2223
PROJECT TITLE: Marine Corps Advanced Technology

- (U) ($461) JOINT TACTICAL COMMUNICATIONS SYSTEMS: Continue the development of the intentional short range communication system in order to demonstrate the ability to construct a "wireless" command post (joint with Army).
- (U) ($1,000) FO/FAC: Complete OT 0 testing and demonstration. Complete system type-A specification and initiate transition to DEM/VAL.
- (U) ($597) JOINT TDEW TECHNOLOGY: Continue joint development of frequency agile laser protection and participate in Joint Service TDEW efforts.
- (U) ($3,500) 21CLW: Complete initial downsizing and integration efforts. Conduct interim TLD with two to four systems, assessing achievement of technical goals and operational utility (joint with Army).
- (U) ($2,000) JOINT INTEGRATED ELECTRIC MOBILITY DEMONSTRATION: Complete fabrication and integration of medium weight class armored vehicle testbed platform featuring electric land propulsion drive, electric actuators, advanced digital control system, refined hydrodynamic appendages, lightweight bandtrack and lightweight plastic cooling components. Begin testing and evaluation. This constitutes Phase I of a joint, ongoing program with the Army's Tank and Automotive Research and Development Engineering Center (TARDEC), Warren, Michigan.
- (U) ($2,000) JOINT MODELING AND SIMULATION TECHNOLOGY: Preliminary technology transitioned from Exploratory Development, PE 0602131M. Identify and develop the environmental features that support advanced training devices and virtual prototyping in the littoral battlespace. Constructive and virtual representations of dynamic environmental and human features will be required at a level of resolution sufficient to depict individuals and squads. Develop technologies to support capabilities to train while deployed and to conduct mission planning and rehearsal.
- (U) ($4,000) JOINT MCM TLD/ACTD: Integrate Marine Corps/Army/Navy ATD MCM Technologies, ongoing battlefield simulation modeling, and C4I Concepts and Technologies. Begin Advanced Warfighting Demonstrations in support of Joint Army/Marine Corps TLD.
- (U) ($1,473) ALWGW: Participate in the Joint Objective Individual Combat Weapon (OICW) ATDs with the Army. Investigate feasibility of ruggedized day/night fiber optic sight for use by designated marksmen and

automatic/machine guns.

- (U) ($966) ADVANCED AMPHIBIOUS LOGISTICS DEMONSTRATION: Preliminary technology transitioned from Exploratory Development, PE 0602131M. Demonstrate Recording and Tracking Technologies utilizing a family of radio frequency tags to provide in-transit/total asset visibility of supplies and equipment for garrison and expeditionary operations.

4. (U) FY 1997 PLAN:

- (U) ($2,000) JOINT SOMD: Initiate joint program with the Army and Advanced Research Projects Agency (ARPA), Arlington, Virginia, to develop and demonstrate technologies for the next generation of high resolution sensors for minefield (including buried mine) and obstacle detection.

- (U) ($1,000) JAMC: Complete transition documentation and support ACTD jointly with the Army and Navy. Evaluate residual system capabilities and transition as appropriate to the Joint TLD.

- (U) ($1,000) TTES: Demonstrate fire team training and mission rehearsal utility. Complete adaptive effort. Complete DT 0/OT 0, prepare Milestone I documentation, and transition to DEM/VAL phase, PE 0603635M, Project C2250, TTES.

- (U) ($500) ASAD: Transition Avenger based acoustic sensor to the Program Manager for integration onto the Avenger. Shift focus to man-portable passive ESM and acoustic sensors for employment by Stinger fire units. This program transitions to PE 0206623M, Marine Corps Ground Combat/Supporting Arms Systems, Project C1120, Air Defense Missile System.

- (U) ($1,938) JOINT TACTICAL COMMUNICATIONS SYSTEM: Initiate fabrication and DT planning for a "wireless" command post.

- (U) ($1,000) FO/FAC: Continue FO/FAC transition documentation to complete DEM/VAL and incorporate advanced lightweight laser designator capability.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

PROJECT NUMBER: C2223
PROJECT TITLE: Marine Corps Advanced Technology

- (U) ($800) JOINT TDEW TECHNOLOGY: Continue to participate in the design, fabrication, testing and evaluation of frequency agile laser eye protection systems under the Joint Frequency Agile Protection Project. Continue development of high average power lasers, striving for greater waveform control, enhanced cooling techniques and increased applied power at greater distances. Execute those Broad Agency Announcement (BAA) responses selected from the FY 1996 solicitation.

- (U) ($3,500) 21CLW: Continue development of technologies to be integrated into the final system configuration. Downsizing and integration is the focus. Initiate planning efforts to conduct final TLD in FY 1998.

- (U) ($1,500) SURVIVABILITY SYSTEMS FOR AMPHIBIOUS VEHICLES: Fabricate subsystems based on BAA responses and begin integration into selected testbed platform. Continue testing and evaluation of testbed platform.

- (U) ($2,500) JOINT INTEGRATED ELECTRIC MOBILITY DEMONSTRATION: Complete design and begin fabrication of those subsystems identified as deficient during previous years' testing. Integrate subsystems transitioning from ongoing Exploratory Development efforts, including improved suspension, improved water propulsion, noise cancellation, and MCM/obstacle detection avoidance and recovery technologies. This constitutes Phase II of a joint, ongoing program with the Army's Tank-Automotive Command (TACOM), Warren, Michigan.

- (U) ($2,000) JOINT MODELING AND SIMULATION TECHNOLOGY: Continue development of dynamic environmental features. Initiate the adaptive process of preparing legacy communication systems to support at sea training of all elements of the MAGTF with complete linkage to the amphibious task force or the joint task force. Continue development of deployed training mission planning and rehearsal.

- (U) ($4,000) JOINT MCM TLD/ACTD: Integrate Marine Corps/Army/Navy MCM Technology assets linked with C4I and combined with simulation modeling techniques to provide a synchronized combat maneuver expanded over multiple military scenarios. Analyze Advanced Warfighting Demonstrations. Begin transition of high payoff technologies to joint acquisition category programs.

- (U) ($2,000) ALWGW: Fabricate prototypes and conduct field testing of OICW. Continue development of ruggedized fiber optic sight. Initiate development of the very lightweight mortar using advanced aerospace materials.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603640M PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology PROJECT NUMBER: C2223 PROJECT TITLE: Marine Corps Advanced Technology

- (U) ($2,000) ADVANCED AMPHIBIOUS LOGISTICS DEMONSTRATION: Demonstrate Expeditionary Engineering Technologies such as new family of air transportable, multiple-use cranes, and bridging system to enhance MAGTF Expeditionary Engineering.

- (U) ($1,000) JOINT IDENTIFICATION FRIEND OR FOE (IFF) TECHNOLOGY): Initiate a joint IFF task which will concentrate upon identifying requirements and appropriate technologies to enhance friendly force survivability in a joint operations environment. Initial emphasis will be placed on providing IFF capabilities to MAGTF GCE, both mounted and dismounted.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	24,909	25,961	XXX	XXX
(U) FY 1995 Appropriated:	XXX	25,961	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	+2,035	-1,628	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	26,944	24,333	25,896	26,738

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 funding changes due to end-of-year execution adjustments ($-199K) and a funding increase of $2,234K for additional achievements in: COBRA, VEHICLE AND HAND HELD MINE DETECTION, TTES, JCCEMG, FO/FAC and 21CLW efforts. FY 1995 funding changes due to congressional undistributed reductions for: Consulting Services ($-292K); Travel ($-36K); Federally Funded Research and Development Centers ($-127K); University Research ($-648K); and an assessment for Small Business Innovative Research ($-525K).

(U) Schedule: This FY 1995 decrease slowed the following program schedules: ORSMC, JCCEMG, C2-2000, SURVIVABILITY SYSTEMS FOR AMPHIBIOUS VEHICLES, and OUTRIDER. However, all these programs have updated program schedules and are

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

PROJECT NUMBER: C2223
PROJECT TITLE: Marine Corps Advanced Technology

fully funded and executable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0602618A (Ballistics Technology)
(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)
(U) PE 0604207A (STINGRAY)
(U) PE 0604710A (Night Vision Systems - Engineering Development)
(U) PE 0604806A (Chemical/Biological Defense Equipment - Engineering Development)
(U) PE 0604808A (Landmine Warfare and Barrier Engineering Development)
(U) PE 0602301E (Computing Systems and Communications Technology)
(U) PE 0602702E (Tactical Technology)
(U) PE 0603226E (Experimental Evaluation of Major Innovative Technologies)
(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 Corps Ground Combat/Support System)
(U) PE 0604719M (Marine Command Control/Communications Systems (Advanced))
(U) PE 0204163N (Fleet Communications)
(U) PE 0602315N (Mine Countermeasures, Mining and Special Warfare Technology)
(U) PE 0603555N (Undersea Superiority Technology Demonstrations)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603640M
PROGRAM ELEMENT TITLE: Marine Corps Advanced Technology

PROJECT NUMBER: C2223
PROJECT TITLE: Marine Corps Advanced Technology

(U) PE 0603782N (Mine and Expeditionary Warfare Advanced Technology)
(U) PE 0603794N (Command, Control, Communications, Advanced Technology)
(U) This program is in compliance with Tri-Service Reliance Agreements.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0095 Fleet Health Technology	11,950	19,546	13,307	13,582	14,739	14,955	15,355	15,777	CONT.	CONT.
M0096 Fleet Health Standards	5,610	4,312	4,445	4,584	4,666	4,744	4,886	5,032	CONT.	CONT.
M2022 Bone Marrow Registry	36,969	32,762	10,002	0	0	0	0	0	0	148,851
TOTAL	54,529	56,620	27,754	18,166	19,405	19,699	20,241	20,809	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Navy Medical Department's mission includes providing medical care and treatment to Navy and Marine Corps personnel in operational theaters. Goals include increasing return-to-duty rates of troops injured in combat, enhancing personnel performance in demanding Fleet jobs (and the selection of candidates for these jobs), reducing operationally related morbidity and mortality, and ensuring the physical readiness and safety of deployed personnel. This program element supports Joint Support Areas including Readiness, Support & Infrastructure, and Manpower, Personnel & Shore Training. Specific task areas include return to duty of battlefield casualties, blood and stem cell products and substitutes, treatments for wounds and multiple organ system failure, methods for managing injuries related to extreme thermal environments, and new capabilities in field diagnostics and medical/dental support. This program element also provides validated techniques for the selection of personnel based on medical criteria and standards and procedures which will protect Fleet personnel during exposure to Navy and Marine Corps operational environments. The impact of this program element includes improved medical logistics, safety, Service-wide standards and technologies. This program element also has supported the Navy's effort to register and match donors and complete bone marrow transplants.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0095 Fleet Health Technology	11,950	19,546	13,307	13,582	14,739	14,955	15,355	15,777	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Encompasses critical endeavors designed to enhance fleet health care, augment field treatment capabilities, and improve medical logistics necessary for support of Naval and Marine Corps forces and combat casualties. Ongoing projects focus on key biomedical and casualty-relevant areas including: (1) blood products, blood substitutes, and hematopoietic stem cells; (2) combat wounds and multiple organ system failure; (3) fleet health in extreme environments; and (4) field diagnostics and medical/dental support capabilities.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($2,537) TREATMENT OF CASUALTIES TO PREVENT SEPSIS AND SHOCK AND COMPLICATIONS ASSOCIATED WITH WOUND INFECTION: Continued animal model studies with monoclonal antibodies and conventional antibodies to prevent septic shock. Completed animal studies involving the interaction of growth factors and antibodies to evoke the production of large, rapid immune responses and prevent septic shock. Initiated four new thrusts in sepsis and septic shock research including: (1) identified host inflammatory response differences between sepsis resulting from Gram-positive and Gram-negative infections, (2) determined specific effects of antioxidant treatment of sepsis, (3) evaluated two classes of specific anti-inflammatory therapies; one based on inhibition of expression of cell adhesion molecules and the other based on specific inhibition of binding of cell adhesion molecules, and (4) investigated oxygen delivery to tissue during sepsis in animals to identify where oxygen transport is disturbed and how these disruptions in oxygen transport can be treated.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

- (U) ($2,607) BLOOD AND BLOOD PRODUCTS: Continued studies required to obtain Federal Drug Administration (FDA) licensure of (1) red blood cells frozen with 40% weight/volume (W/V) glycerol at -80°C for as long as 20 years, (2) human platelets frozen with 6% dimethylsulfoxide (DMSO) and stored at -80°C for 2 years, and (3) "functionally closed" system to deglycerolize red blood cells enabling post wash storage at 4°C for at least 2 weeks. Completed studies using different plastic bags and different containers for shipping frozen blood products. Presented data to FDA to initiate licensure of methodologies for frozen red blood cells and frozen platelets. Initiated studies to develop a portable, self contained, durable, deployable ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Continued Phase I clinical trials of enzymatic converted Type B human red cells to universal Type O. Completed data collection from efficacy testing of fresh and lyophilized liposome encapsulated hemoglobin using recombinant human hemoglobin.

- (U) ($2,125) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Continued and completed several stages of development of polymerase chain reaction techniques for detecting messenger ribonucleic acid for different cell surface receptors on mouse and human lymphocytes. Initiated studies of T-lymphocyte costimulatory receptors and their role in regulating T-lymphocyte activation in vivo in order to determine how to regulate (i.e., turn on and off) the immune system. Specifically: (1) using deoxyribonucleic acid (DNA) techniques, made the DNA constructs necessary to create required transgenic mouse models and introduce these DNA constructs into the mice; (2) characterized the immune system effects of the transgene in the mice; and (3) determined the effect of a cell surface receptor's (i.e., CD28) biologics on immune responses in vivo.

- (U) ($854) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENT CONDITIONS: Continued experimental studies on the effects of vasopressin on physiological and behavioral performance under conditions of thermal stress. These studies will support ground troops in desert warfare scenarios having large fluid requirements and a tremendous logistics burden to supply potable water. Completed cold pathophysiology research. Specific studies included evaluation of the effects of tyrosine on the performance of mission related skills by Sea-Air-Land team members during winter training exercises.

- (U) ($2,008) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continued to integrate Computer Assisted Medical Diagnosis System and Shipboard Automated Medical System (SAMS), and expand diagnostic and treatment plan support. Completed clinical trials to evaluate the noninvasive transcutaneous analytic measurement method involving the reflection of infrared light from the skin to measure 9 blood analytes. The use

of noninvasive blood analysis devices reduces the cost, logistic support, and provides immediate real time information to support casualty care at Echelon 2 care level. Initiated clinical trials to evaluate and test noninvasive transcutaneous hematocrit/oxygen saturation monitor.

- (U) ($714) DENTAL EMERGENCY READINESS: Continued testing new methods and materials to prevent and treat dental emergencies and maximize operational readiness in Navy and Marine Corps personnel. This included: (1) evaluating the performance of dental materials in the laboratory and clinic, especially in the area of longevity of autoclaved instruments, (2) evaluating the potential of new materials to reduce costs while improving overall infection control, and (3) field testing promising dental equipment, especially for emergency contingencies.

- (U) ($1,105) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Continued development of the database on the role of epidemiological, orthopedic, structural and biomechanical factors related to the risk of musculoskeletal, i.e., overuse, injury among select Navy and Marine Corps populations. Completed effort to derive predictive models of stress fracture susceptibility in military personnel by use of noninvasive measurements of bone structure. Developed a general classification function from an extensive database of biomechanical information in order to identify injury-prone individuals.

2. (U) FY 1995 PLAN:

- (U) ($2,000) MAMMOGRAM TECHNOLOGY: A standard model will be devleoped to assist in validation and intercomparision of Computer Aided Diagnosis (CAD) techniques. Plans are to (1) develop a high resolution digital mammography image database which has been pathologically verified, (2) perform independent Reciever Operator Characteristic studies at two clinical sites to validate the clinical utility of CAD algorithms and Direct X-ray Detectors for mammography, and (3) use the database to develop training and evaluation material for radiologists.

- (U) ($700) NAVAL BIODYNAMICS LAB: The effects of motion on cognitive and physical performance will be determined. Funds are to be used to investigate two adverse affects of motion: direct biomechanical interference with physical and cognitive tasks, and the general debilitating effects of motion sickness.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

- (U) ($5,000) BREAST CANCER CENTER: The National Naval Medical Center (NMMC) will develop a center of excellence for the management of breast diseases, emphasizing training of medical personnel in specialized methods of early detection and treatment of breast cancer and focusing on women under 40 years of age for whom routine mammographic screening may not be appropriate.

- (U) ($2,822) TREATMENT OF CASUALTIES TO PREVENT SEPSIS AND SHOCK AND COMPLICATIONS ASSOCIATED WITH WOUND INFECTION: Continue development of four new thrusts: (1) identify host inflammatory response differences which occur during comparison of Gram-positive sepsis with Gram-negative sepsis, (2) determine specific effects of antioxidant treatment of sepsis, (3) evaluate two classes of specific anti-inflammatory therapies; one based on inhibition of expression of cell adhesion molecules and the other based on specific inhibition of binding of cell adhesion molecules, and (4) investigate oxygen delivery to tissue during sepsis in animals to identify where oxygen transport is disturbed and how these disruptions in oxygen transport can be treated.

- (U) ($3,201) BLOOD AND BLOOD PRODUCTS: Continue to obtain data for FDA licensure of (1) human red blood cells frozen with 40% W/V glycerol at -80°C for 20 years, (2) human platelets frozen with 6% DMSO at -80°C for 2 years, and (3) "functionally closed" system to deglycerolize red blood cells enabling post wash storage at 4°C for at least 2 weeks. Continue Phase I clinical trials of enzymatic converted Type B human red cells to universal Type O. Continue studies on a portable, self contained, durable, deployable, ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Initiate studies on extended liquid storage of human red cells to 12-16 weeks.

- (U) ($2,040) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Continue studies with T-lymphocyte costimulatory receptors and their role in regulating T-lymphocyte activation in vivo to determine how to regulate (i.e., turn on and off) the immune system. Specifically: (1) characterize the immune system effects of the transgenes in vivo, and study the effects of a cell surface receptor's (i.e., CD28) biologics in the various in vivo models; and (2) create pure transgenic mouse strains for specific models.

- (U) ($2,309) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Continue evaluation of the effects of vasopressin on physiological and behavioral performance under conditions of thermal stress.

- (U) ($2,643) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continue to interface the

Epidemiological Information System (EPISYS), SAMS and selected medical databases. Continue to develop models for projecting casualty rates for various battle intensities. Continue to validate the casualty projection system for shipboard casualties.

- (U) ($672) DENTAL EMERGENCY READINESS: Continue to develop new methods and materials to prevent and treat dental emergencies and maximize operational readiness in Navy and Marine Corps personnel. This includes: (1) evaluating performance of dental materials in the laboratory and clinic, especially in the area of longevity of autoclaved instruments, (2) evaluating potential of new materials to reduce costs while improving overall infection control, and (3) field testing promising dental equipment, especially for emergency contingencies.

- (U) ($1,049) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Complete effort to determine role of epidemiological, orthopedic, and biomechanical factors related to the risk of musculoskeletal injury, i.e., overuse, injury among select Navy and Marine Corps populations. Verify a general classification function generated from an extensive database of biomechanical information designed to identify injury-prone individuals, by employing a prospective cohort study. Design and implement intervention strategies to reduce the incidence of injury and to improve the treatment of injury.

3. (U) FY 1996 PLAN:

- (U) ($2,796) TREATMENT OF CASUALTIES TO PREVENT SEPSIS AND SHOCK AND COMPLICATIONS ASSOCIATED WITH WOUND INFECTION: Continue the development of new thrusts: (1) validate the inflammatory response differences which occur during infections with Gram-positive versus Gram-negative organisms, (2) validate specific effects of antioxidant treatment of sepsis, (3) continue to evaluate anti-inflammatory therapies to determine whether inhibition of expression of cell adhesion molecules or inhibition of binding of cell adhesion molecules is better, and (4) continue to investigate the focus of oxygen transport disruption and postulate therapies. Initiate studies on development of therapeutic approaches to treatment of hemorrhagic shock.

- (U) ($3,383) BLOOD AND BLOOD PRODUCTS: Submit data to FDA for license of (1) human red blood cells frozen with 40% W/V glycerol at -80°C for 20 years, (2) human platelets frozen with 6% DMSO at -80°C for 2 years, and (3) "functionally closed" system to deglycerolize red blood cells enabling post wash storage at 4°C for at least 2 weeks. Complete Phase I clinical trials of enzymatic converted Type B cells to Type O cells. Continue studies

on a portable, self contained, durable, deployable ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Continue studies on extended liquid storage of human red cells to 12-16 weeks.

- (U) ($2,054) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Validate the results of the in vivo studies with T-lymphocyte costimulatory receptors. Initiate use of the transgenic mouse strains for studies which will elucidate costimulatory treatment mechanisms for specific model diseases.

- (U) ($871) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Complete the evaluation of the effects of vasopressin on physiological and behavioral performance under conditions of thermal stress and validate the findings.

- (U) ($2,662) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continue to interface the EPISYS, SAMS and selected medical databases. Continue to develop models for projecting casualty rates for various battle intensities. Complete the validation of the casualty projection system for shipboard use.

- ($804) NAVY DENTAL RESEARCH: Continue efforts encompassing 1) the systematic, scientific investigation of problems related to the oral health, wellness, disease, and injury of Navy and Marine Corps personnel; 2) the development of methods, materials, and products that increase operational readiness and improve dental care in the military setting; and 3) the collection and analysis of data to change or influence policy or doctrine. Examples of specific, high payoff projects include development of a multimedia diagnostic system for corpsmen; risk assessment strategies and program; dental disease progression methods and diagnostics; and a managed dental care system; and study of Navy dental examination periodicity and mercury contamination of wastewater from Navy dental treatment facilities.

- (U) ($1,057) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Validate the relative risks assigned to epidemiological, orthopedic and biomechanical factors related to musculoskeletal trauma. Complete the validation of the general classification function previously generated to identify injury-prone individuals and initiate prospective cohort study. Assess intervention strategies to reduce the incidence, and improve the treatment, of injury.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

4. (U) FY 1997 PLAN:

- (U) ($2,888) TREATMENT OF CASUALTIES TO PREVENT SEPSIS AND SHOCK AND COMPLICATIONS ASSOCIATED WITH WOUND INFECTION: Continue the development of the thrusts: (1) Complete the validation of the theories of inflammatory responses and postulate intervention mechanisms for Gram-negative and Gram-positive sepsis, (2) complete the validation of specific effects of antioxidant treatment of sepsis, (3) complete the studies of anti-inflammatory therapy as inhibitory to cell adhesion molecules and begin preparation of data package to FDA, and (4) complete the investigation of the focus of oxygen transportation disruption and initiate studies on intervention. Continue studies on therapeutic approaches to treatment of hemorrhagic shock.

- (U) ($3,423) BLOOD AND BLOOD PRODUCTS: Continue studies on a portable, self contained, durable, deployable ex vivo expansion system for bone marrow stem cells to be used for autologous stem cell transfusion. Complete additional studies required by FDA for the licensure of enzymatic conversion of Type B red cells to Type O. Transition studies with enzymatic converted Type A to Type O into preclinical trials. Complete studies on extended liquid storage of human red cells to 12-16 weeks.

- (U) ($2,087) MODULATION OF IMMUNE SYSTEM OF CASUALTIES: Continue using transgenic mouse strains for studies which will elucidate costimulatory treatment mechanisms.

- (U) ($884) PHYSIOLOGICAL ENHANCEMENT OF PERFORMANCE IN EXTREME ENVIRONMENTAL CONDITIONS: Complete the validation of vasopressin effects on physiological and behavioral performance under conditions of thermal stress; begin preparation of FDA licensure package.

- (U) ($2,703) MEDICAL MANAGEMENT TOOLS AND EQUIPMENT USED IN FIELD OPERATIONS: Continue to interface the EPISYS, SAMS and selected medical databases; validate the relationships and ensure the effectiveness. Continue to develop models for projecting casualty rates for various battle scenarios and intensities.

- (U) ($804) NAVY DENTAL RESEARCH: Continue efforts encompassing 1) the systematic, scientific investigation of problems related to the oral health, wellness, disease, and injury of Navy and Marine Corps personnel; 2) the development of methods, materials, and products that increase operational readiness and improve dental care in the military setting; and 3) the collection and analysis of data to change or influence policy or doctrine.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0095 PROJECT TITLE: Fleet Health Technology

Examples of specific high payoff projects include development of a multimedia diagnostic system for corpsmen; risk assessment strategies and program; dental disease progression methods and diagnostics; and a managed dental care system; and study of Naval dental examination periodicity and mercury contamination of wastewater from Navy dental treatment facilities.

- (U) ($1,073) PREVENTION AND TREATMENT OF MUSCULOSKELETAL INJURIES: Propose intervention techniques to reduce the risks of musculoskeletal trauma associated with epidemiological, orthopedic and biomechanical factors. Study the value of intervention techniques which preclude high-risk individuals from becoming victims of musculoskeletal trauma.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	12,495	13,291	XXX	XXX
(U) FY 1995 Appropriated:	XXX	20,991	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-545	6,255	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	11,950	19,546	13,307	13,582

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year Execution Update (-545). FY 1995 changes due to: Congressional plus-ups for Breast Cancer Center (+5,000), Naval Biodynamics Lab (+700), and Mammogram Technology (+2,000); Congressional undistributed reductions for University Research (-1,107), travel (-18) and an assessment for Small Business Innovative Research (-320).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

PROJECT NUMBER: M0095
PROJECT TITLE: Fleet Health Technology

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602233N (Readiness, Training and Environmental Quality)
- (U) PE 0604771N (Medical Development (ENG))

This program is coordinated through the Armed Services Biomedical Research Evaluation and Management Committee.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M0096 Fleet Health Standards	5,610	4,312	4,445	4,584	4,666	4,774	4,886	5,032	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Develops valid medical standards for selection, training, and retention, reduces attrition and injury, and enhances personnel performance in Navy operational environments.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($1,144) Medical standards for training/enhance performance: Provided eye fatigue/distortion data related to Night Vision Goggles use to improve training and enhance performance in poor weather and night operations.
- (U) ($3,650) Medical standards for training/enhance performance: Provided updated specifications for flight simulators to reduce simulator sickness and improve training and operational readiness.
- (U) ($150) Reduce attrition and injury: Compared several toxicity assessment methodologies for organic nitrate compounds to improve safety screening for materials acquisition and for better exposure standards.
- (U) ($150) Reduce attrition and injury: Completed studies using new physiological and analytical techniques to better assess the toxicity of Navy-specific hazardous materials such as a severe neurotoxicant found in turbine lubricants.
- (U) ($301) Reduce attrition and injury: Tested prototype device using light-emitting diodes (LEDs) to characterize the dosimetry of Radio Frequency (RF) exposures for use in shipboard safety programs. Characterized Navy-relevant RF exposures.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0096 PROJECT TITLE: Fleet Health Standards

- (U) ($215) Reduce attrition and injury: Database established and mathematical model developed to assess the quality of shore occupational safety and health programs, which can be used to measure and evaluate interventions for injury and illness. Initiated assessment of Command Total Quality Leadership influence on health promotion.

2. (U) FY 1995 PLAN:

- (U) ($367) Reduce attrition and injury. Deliver to CNO (N-45) a validated model for measuring the quality of shore-based safety and health programs. Identify neurotoxicant in turbine lubricants. Developed molecular techniques for screening neurotoxic hazardous materials.

- (U) ($172) Reduce attrition and injury. Develop toxicity assessment methodologies for organic nitrate compounds to improve health risk assessment of shipboard hazardous materials.

- (U) ($363) Reduce attrition and injury: Complete testing of prototype LED dosimeter for shipboard RF exposures. Initiate development of expert system for shipboard industrial hygiene hazard recognition and surveys.

- (U) ($858) Medical standards. Provide biomedical specifications to improve safety and reduce injury in an electromagnetic radiation (EMR)/agile laser battlefield.

- (U) ($793) Reduce attrition and injury. Deliver recommendations to reduce incidence of injury due to aviator neck stress.

- (U) ($1,558) Enhance performance. Continue development of biomedical countermeasures to decrements of physical and cognitive performance during preparation for and performance of sustained combat operations.

- (U) ($201) Reduce attrition and injury: Develop improved countermeasures to heat strain for shipboard engine room and firefighting personnel via torso cooling vests.

3. (U) FY 1996 PLAN:

- (U) ($737) Medical standards for selection. Continue development of gender-neutral occupational strength and fitness standards for aviation and shipboard personnel.

- (U) ($1,173) Reduce attrition and injury. Develop Physiological Heat Exposure Limit curves for shipboard engine room and firefighting personnel. Develop Physiological Cold Exposure Limit curves for Marine Corps Mountain Warfare Training Center.
- (U) ($375) Reduce attrition and injury. Continue development of shipboard industrial hygiene expert system; deliver prototype.
- (U) ($330) Reduce attrition and injury: Complete testing protocol for screening hazardous materials toxicity assessment methodologies for organic nitrate compounds.
- (U) ($357) Reduce attrition and injury. Deliver pocket-size LED dosimeter for RF radiation. Continue dosimetry research on ship topside RF exposures.
- (U) ($1,173) Reduce attrition and injury. Deliver Physiological Heat Exposure Limit (PHEL) curves for shipboard engine room and firefighting personnel. Deliver work-rest cycle guidelines for naval firefighters.
- (U) ($1,473) Enhance performance. Develop alertness monitoring/management system. Develop sleep and alertness enhancers.

4. (U) FY 1997 PLAN:

- (U) ($1,009) Medical standards for selection. Deliver gender-neutral occupational strength and fitness standards for shipboard and aviation duty.
- (U) ($1,490) Deliver guidelines. Provide recommendations for use of biomedical countermeasures to counteract performance decrements associated with sustained operations.
- (U) ($935) Enhance performance. Deliver improved countermeasures to heat strain for shipboard engine room and firefighting personnel via a torso vest.
- (U) ($150) Reduce attrition and injury: Deliver validated expert system for shipboard industrial hygiene hazard recognition and survey reporting.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M0096 PROJECT TITLE: Fleet Health Standards

- (U) ($552) Reduce attrition and injury: Initiate testing, evaluation, and refinement of physiologically-based pharmacokinetic model of shipboard exposures to cleaning solvents. Initiate toxicological evaluation of chemicals associated with Navy workplace exposures to predict health outcomes and develop exposure standards.
- (U) ($473) Reduce attrition and injury: Conduct field measurement and computational dosimetry study of RF radiation exposures in Navy and Marine Corps operational environments.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	5,307	4,529	XXX	XXX
(U) FY 1995 Appropriated:	XXX	4,529	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	303	-217	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	5,610	4,312	4,445	4,584

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to End-of-Year execution update (+303). FY 1995 changes due to Congressional undistributed reductions in University research (-111), travel (-6) and an assessment for Small Business Innovative Research (-100).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)
PROJECT NUMBER: M0096
PROJECT TITLE: Fleet Health Standards

(U) RELATED RDT&E:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0604771N (Medical Development (ENG))

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603706N
PROGRAM ELEMENT TITLE: Medical Development (Advanced)

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
M2022 Bone Marrow Donor Registry										
	36,969	32,762	10,002	0	0	0	0	0	0	148,851

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The C.W. Bill Young Marrow Donor Recruitment and Research Program is a medical research program with the goal of developing the basis for identifying donors and provide correctly matched marrow for military casualties and patients with diseases best treated with marrow transplantation including marrow supression caused by radiation or chemical injury.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($14,000) Implemented DNA Based HLA Typing with Navy Lead and Navy Technology Support for Civilian Laboratory Development (100,000 typings in FY94).
- (U) ($6,000) Continued coordinated national system to identify volunteers willing to provide marrow and platelets, HLA type them, and rapidly select the correctly matched donor and provide the marrow for the transplant -- The National Marrow Donor Program (NMDP). 251,000 donors, of which 74,000 minorities added to NMDP files through Navy support in FY94.
- (U) ($8,000) Ongoing civilian contracts to DNA type all HLA genetic loci for more than 2,000 NMDP donor - recipient pair samples held in NMDP repository.
- (U) ($8,969) Executive Agent for DoD Marrow Donor Program through DoD Policy. 25,000 volunteers recruited by DoD program in 1994.
- (U) ($2,000) Clinical Implementation of DNA typing procedures for all HLA antigens (HLA-class II typing

implemented and HLA-class I in development stage).

2. (U) FY 1995 PLAN:

- (U) ($14,000) Implement DNA Based HLA Typing with Navy Lead and Navy Technology Support for Civilian Laboratory Development (100,000 typings in FY95).
- (U) ($8,000) Continue ongoing civilian contracts to DNA type all HLA genetic loci for more than 2,000 NMDP donor-recipient pair samples held in NMDP repository.
- (U) ($6,000) Continue coordination of national system to identify volunteers willing to provide marrow and platelets, HLA type them, and rapidly select the correctly matched donor and provide the marrow for the transplant -- NMDP. 250,000 donors added to NMDP files through Navy support in FY95.
- (U) ($4,762) Executive Agent for DoD Marrow Donor Program through DoD Policy. 25,000 volunteers recruited by DoD program in 1995.

3. (U) FY 1996 PLAN:

- (U) ($8,000) Complete civilian conracts to DNA type all HLA genetic loci for more than 2,000 NMDP donor - recipient pair samples held in NMDP repository.
- (U) ($2,002) Clinical implementation of DNA typing procedures for all HLA antigens. Expect demonstration of class I DNA based typing in early FY 1996.

4. (U) FY 1997 PLAN: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603706N PROGRAM ELEMENT TITLE: Medical Development (Advanced) PROJECT NUMBER: M2022 PROJECT TITLE: Bone Marrow Registry

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	36,969	0	XXX	XXX
(U) FY 1995 Appropriated:	XXX	34,000	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	0	-1,238	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	36,969	32,762	10,002	0

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1995 changes due to Congressional adjustment (+34,000), Congressional undistributed reduction in University Research (-588) and an assessment to Small Business Innovative Research (-650).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Mission Support Technology)
(U) PE 0604771N (Medical Development, Engineering)

This program is coordinated through the Armed Services Biomedical Research and Management Committee.

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L0542 Air Human Factors Engineering	683	969	1,074	1,138	1,159	1,182	1,218	1,254	CONT.	CONT.
L1770 Manpower and Personnel Development	3,119	3,495	3,866	4,217	4,317	4,419	4,551	4,688	CONT.	CONT.
L1771 Ship Human Factors Engineering	1,433	2,054	2,076	2,206	2,238	2,276	2,342	2,410	CONT.	CONT.
L1772 Education and Training Development	3,710	5,797	5,010	5,154	5,297	6,435	6,628	6,826	CONT.	CONT.
L1773 Simulation and Training Devices	4,294	6,178	5,771	7,333	9,483	9,639	9,867	10,104	CONT.	CONT.
L2235 Interactive Multisensor Analysis Training Technology	3,758	0	0	0	0	0	0	0	0	3,758
TOTAL	16,997	18,493	17,797	20,048	22,494	23,951	24,606	25,282	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element supports the Joint Support Areas for Manpower & Personnel, Shore Training, and Readiness, Support & Infrastructure; it also supports the Joint Mission Area assessments for most warfare areas, and the Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff. It develops technologies that enable the Navy to select, assign and manage its people; to train effectively in classroom settings, in simulated environments and while deployed; and to operate and maintain complex weapon systems. It consists of the following technologies:

1. (U) Air and Ship Human Factors Engineering: These projects develop information management techniques, advanced interface technologies, and decision support systems, all of which help ensure that complex systems will be operated and maintained more effectively, with fewer human-induced errors, and with greater safety.

2. (U) Manpower and Personnel: This project provides Navy personnel system managers with the ability to choose and retain the right people and to place them in jobs that best use their skills, training, and experience. Fleet readiness can

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

be enhanced and personnel costs reduced via such technologies as modeling, mathematical optimization, advanced testing, statistical forecasting, and human performance measurement.

3. (U) Education and Training Development: This project focuses on the acquisition and maintenance of complex skills through individual and team training technologies. It improves training efficiency and effectiveness by applying operations research and instructional, cognitive, and computer sciences to the logistics, development, delivery, evaluation, and execution of training.

4. (U) Simulation and Training Devices: This project improves mission effectiveness and safety by applying both simulation and instructional technology to the design of training systems. The project develops and evaluates systems to improve advanced training, skill maintenance and mission rehearsal capability.

5. (U) Interactive Multisensor Analysis Training Technology: This project will develop and demonstrate training technology to enhance sensor system employment and tactical skills in undersea warfare, with emphasis on conceptually-oriented approaches that will be applicable to other areas of Navy training.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L0542 Air Human Factors Engineering	683	969	1,074	1,138	1,159	1,182	1,218	1,254	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and demonstrates advanced human factors engineering (HFE) technology to improve the integration of the human in Navy airborne weapons systems. General goals of the project are to enhance human performance effectiveness, reduce design-induced critical human performance errors, and accelerate insertion of advanced HFE technology into existing and new weapons systems. Prior work in this project has focused on developing and refining a decision aiding architecture, the Knowledgeable Observation, Analysis-Linked Advisory System (KOALAS), which is unique in that it allows for both data-driven as well as operator inputs into the decision making process.

(U) The current task focuses on the problem of integrating information from multiple aircraft to enhance performance in the multi-dimensional battle space. Since there are unique data flow requirements for each aircraft, there are risks associated with realizing the full potential of the Navy's proposed SONATA global grid initiative. The purpose of the current task is to mitigate these risks by providing iterative demonstrations of our ability to effectively combine and present information to the operator, and to develop the guidelines and specifications for each platform necessary for the effective implementation of this technology.

(U) This project supports Joint Chiefs of Staff Future Joint Warfighting Capabilities and is responsive to numerous warfighting requirements identified in Joint Mission Area (JMA) assessments. Specific JMAs and associated requirements include the following:

- (U) Joint Strike: requirement for near-real time targeting is addressed by developing and refining a data fusion architecture which optimizes decision making; requirement for precision weapons delivery is addressed by developing optimized pilot displays.

- (U) Joint Space & Electronic Warfare/Intelligence: requirements for additional throughput capability to process

large volumes of data, and for tactical communication links with high data rates and more diverse platforms, are being supported by developing the capability to effectively present information from multiple sources to operators of diverse platforms.

- (U) Joint Littoral/Strategic Sealift, and Strategic Deterrence: requirements for dealing with complex tactical situations, including rapid switching among target sets, are addressed by developing specifications for enhanced displays which minimize complexity.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($317) New Starts:
  - (U) Initiated development of ES-3 simulation.
  - (U) Initiated F/A-18 and F-14D simulation interface.

- (U) ($366) Completions:
  - (U) Completed F/A-18 wing and lead simulation and demonstrated improved performance resulting from more optimum use of Electronic Warfare assets.
  - (U) Demonstrated a 50% increase in radar range for F-14D with use of KOALAS architecture.
  - (U) Conducted Aircrew Systems Advisory Panel meetings to brief F-14D, F/A-18 and S-3 simulation work and gather operational input from aircrew.
  - (U) Continued investigation of crew-system integration issues related to Intelligent MultiPlatform, MultiSensor Integration (IMMSI).
  - (U) Demonstrated objective HFE performance criteria for testing intelligent control systems.

2. (U) FY 1995 PLAN:

- (U) ($969) Completions:
  - (U) Demonstrate enhanced situational awareness and tactical response in objective warfare scenarios for

inter-platform simulation of F-14D, F/A-18, S-3 and ES-3.
- (U) Document results of evaluation and complete Human Factors specification and systems integration requirements for the IMMSI architecture.

3. (U) FY 1996 PLAN:

- (U) ($774) New Starts:
  - (U) Develop capability for the tactical decision maker to collect and process communications data delivered in various formats and in quantities exceeding human limits.
  - (U) Develop measures of effectiveness criteria for testing intelligent control systems.

- (U) ($300) Completion:
  - (U) Develop operational scenarios to demonstrate advantages of adaptive automation.

4. (U) FY 1997 PLAN:

- (U) ($688) New Start:
  - (U) Initiate investigation of crew system integration issues related to incorporation of adaptive automation.

- (U) ($450) Continuations:
  - (U) Develop methods to extract critical tactical information based on cognitive/perception capabilities using modelling to improve situational awareness.
  - (U) Develop advanced tactical data presentation methods to enhance tactical visualization.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: L0542 PROJECT TITLE: Air Human Factors Engineering

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	717	987	XXX	XXX
(U) FY 1995 Appropriated:	XXX	987	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-34	-18	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	683	969	1,074	1,138

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 reduced due to end-of-year execution update (-34). FY 1995 reduced for Congressional undistributed reductions for university research (-17) and travel (-1).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L1770 Manpower and Personnel Development	3,119	3,495	3,866	4,217	4,317	4,419	4,551	4,688	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the Manpower & Personnel Joint Support Area by responding to requirements for technologies that will maintain or improve fleet readiness while reducing personnel end strength; enable the Navy to manage the force effectively and efficiently; and optimize the selection and assignment of personnel to highly demanding jobs. The major goals are to ensure that the Navy has a force that is flexible, integrated, and responsive; that skilled personnel are available to handle complex weapons systems when needed; and that smaller forces will have greater capabilities by placing the right person in the right job at the right time. The program supports the delivery of new technologies in modeling, mathematical optimization, advanced testing, statistical forecasting, and human performance measurement.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($2,306) Continuations:
  - (U) Developed a Delayed Entry Program decision support system to control the timing and mix of new accessions.
  - (U) Designed and developed prototype enlisted strength policy analysis model to produce compatible short and long-term recruiting, strength, and retention plans and policies; and developed detailed projection models to forecast monthly retirements, losses and gains to support strength plan monitoring.
  - (U) Developed and demonstrated an assignment policy monitoring model and the associated computer-based technology improvements to support the assignment decision process.

- (U) ($813) Completions:
  - (U) Developed scoring systems and screening techniques to ensure quality of personnel adequate to operate

under expected conditions, and to find flexible and adaptable personnel who are also creative and innovative.
- (U) Completed development of peacetime and mobilization medical manpower models at the detailed skill level.
- (U) Demonstrated Quality of Life (QOL) Predictive Model that explains Navy member and family satisfaction and organizational outcomes, in order to determine the impact QOL activities such as Family Service Centers have on retention and readiness.

2. (U) FY 1995 PLAN:

- (U) ($458) New Starts:
  - (U) Design alternative measures of readiness for operational units and summary level measures; conduct feasibility assessment of developing a resources-to-readiness impact model to relate changes in resources to changes in readiness.

- (U) ($1,562) Continuations:
  - (U) Evaluate the ability of the assignment policy trade-off-system to prove that policy goals are realistic and quantify the tradeoffs among policies such as moving costs, billet gapping and skill match.
  - (U) Design a decision support system that improves the accuracy of enlisted accession, training, retention, promotion and strength projections by integrating the management of recruiting, delayed entry program, and initial skill training pipelines; design an enlistment incentive management system to improve use of available recruit training seats and recruit financial incentives.

- (U) ($1,475) Completions:
  - (U) Develop computer-based testing methodology for identifying test-takers who are deliberately trying to fail; assess validity of dynamic spatial tests.
  - (U) Test, evaluate and demonstrate the accuracy and skill allocation ability of the Medical Manpower Trade-off Analysis Model.
  - (U) Develop and validate the QOL socioeconomic model to predict increases in retention and readiness in response to varying levels of QOL support.
  - (U) Test and evaluate the impact of computer-based technology enhancements on detailing efficiency and effectiveness.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1770
PROJECT TITLE: Manpower and Personnel Development

3. (U) FY 1996 PLAN:

- (U) ($1,716) New Starts:
  - (U) Determine feasibility of simulating effects of changes in job classification criteria on skill manning levels and on representation of key demographic groups across job categories.
  - (U) Evaluate alternative technologies for application to reserve strength planning; design models to project effect of changes in USN policies on USNR populations.

- (U) ($800) Continuations:
  - (U) Test and evaluate alternative measures of readiness. Design resources-to-readiness impact model to relate changes in resources (dollars, people, training) to changes in fleet readiness.
  - (U) Design and test alternative econometric models for allocating distribution-impacting pays, such as sea pay, sub-pay and hazardous duty pay, to skill groups; develop econometric models for allocating retention impacting pays and bonuses, given new Navy skill categories and career paths.

- (U) ($1,350) Completions:
  - (U) Test and evaluate the assignment execution monitoring system to measure policy compliance and to provide feedback for corrective action.
  - (U) Conduct technology impact demonstration on assignment policy tradeoff system.
  - (U) Develop a decision support system that integrates the management of recruiting, delayed entry program, enlistment incentives, initial skill training and enlisted strength planning to improve ability of these systems to respond to each other.
  - (U) Develop recruit attrition and advancement forecasting models; incorporate into enlisted strength policy analysis model; test and evaluate resulting system in operational setting.

4. (U) FY 1997 PLAN:

- (U) ($1,217) New Starts:
  - (U) Evaluate new technologies in market research for application to recruiting strategies.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1770
PROJECT TITLE: Manpower and Personnel Development

- (U) Design techniques to incorporate personnel performance and productivity measures into unit and fleet readiness measures.

- (U) ($1,200) Continuations:
  - (U) Develop models to simulate effects of changes in job classification criteria on skill manning levels and on representation of key demographic groups across categories.
  - (U) Design USNR strength planning models consistent with USN strength planning models and which recognize USN policy impacts on reserve populations.

- (U) ($1,800) Completions:
  - (U) Develop, test and evaluate the resources-to-readiness model to relate changes in resources to changes in readiness.
  - (U) Develop and implement econometric models for allocating distribution-impacting pays and retention-impacting pays to new Navy skill groups, given changes in career paths; integrate with strength policy analysis model to allow economic variables to be systematically factored into policy analyses.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	2,998	3,633	XXX	XXX
(U) FY 1995 Appropriated:	XXX	3,633	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	121	-138	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	3,119	3,495	3,866	4,217

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1770
PROJECT TITLE: Manpower and Personnel Development

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to end-of-year execution update (+121). FY 1995 reduced to reflect Congressional undistributed reductions for university research (-70); consulting support services (-36); travel (-5); and an assessment for Small Business Innovative Research (-27).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This project adheres to Tri-Service Reliance Agreements on Manpower and Personnel Technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training, and Environmental Quality)
(U) PE 0603007A (Human Factors, Personnel and Training Advanced Technology)
(U) PE 0603227F (Personnel, Training, and Simulation Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L1771 Ship Human Factors Engineering	1,433	2,054	2,076	2,206	2,238	2,276	2,342	2,410	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The goal of this project is to improve ship, task force and battle group operations by developing human factors technology for incorporation into operational systems and training programs. This technology is designed to reduce training and personnel requirements and to enhance mission performance in such areas as global surveillance, joint operations, mission planning, data fusion and Command and Control Warfare. The project supports Joint Chiefs of Staff Future Joint Warfighting Capabilities as well as requirements in several Joint Management Areas, including: Joint Space and Electronic Warfare/Intelligence (e.g., displays for integrating information from multiple sources); Joint Littoral/Strategic Sealift (e.g., aiding decision makers in complex tactical situations under stressful conditions); and Joint Surveillance (e.g., displaying information in formats optimized for the needs of different users).

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($1,433) Completions:
  - (U) Developed method for minimizing storage requirements and speed of accessing NATO STANAG 4420 and color-coded NTDS tactical symbols on TAC-3 computer systems.
  - (U) Completed information display requirements analysis for integrating console intercom unit (CIU) switches and controls with operator's tactical display and console input devices.
  - (U) Developed network protocols allowing Macintosh-based simulation driver software to interface directly with TAC-3 computer systems.
  - (U) Completed test plan for comparing the effectiveness of variable coded symbology (VCS) to existing ACDS Block 1 track filtering methods.
  - (U) Coordinated ongoing development of man-machine interface for the Disaster Relief Operations (DRO) anchor

desk with both regional and national headquarters of Federal Emergency Management Agency as well as, US, Commander in Chief, Pacific (USCINCPAC). Components of the DRO anchor desk have been successfully demonstrated in two hurricane exercises, one for USCINCPAC, one for the State of Hawaii.

- (U) Added significantly new analytic capabilities to the Analysis of Multiple Courses of Action decision support system.
- (U) Completed requirements analysis and evaluation criteria for use of groupware tools within the Operational Planning Team. Hardware procurement should be complete by end of FY 1994.

2. (U) FY 1995 PLAN:

- (U) ($600) New Starts:
  - (U) Complete information requirements analysis for the newly created position of Command and Control Warfare Commander (C2WC). Determine prototype display formats, information management system and collaborative decisionmaking needs. Coordinate development effort with Command and Control Warfare Center, San Diego.

- (U) ($722) Continuations:
  - (U) Conduct usability studies to identify strategies Combat Information Center (CIC) operators use when selecting and changing VCS display filters.
  - (U) Conduct studies to determine optimal combinations of VCS symbol sets and coding dimensions (e.g., blinking, strobing, color saturation) and propose VCS design guidelines based on research findings.
  - (U) Compare effectiveness of software- and input device-controlled interface for operating CIUs to existing shipboard CIU design.
  - (U) Develop, test and evaluate advanced user interface technologies (e.g., 3-D audio) to improve CIC operator alerting and warning systems; prepare design guidelines for improved audio alerts and alerting mechanisms based on research findings.

- (U) ($732) Completions:
  - (U) Complete overall integration of DRO anchor desk within the USCINCPAC Command Center Improvement Program. Demonstrate completed anchor desk capabilities in simulated and real world disaster situations at both USCINCPAC as well as within wide area network demonstrations conducted among the various Unified Commands.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: L1771 PROJECT TITLE: Ship Human Factors Engineering

3. (U) FY 1996 PLAN:

- (U) ($679) New Start:
  - (U) Conduct information and display requirements analysis for introduction of personal digital assistants (PDAs) to remote joint task force staffs to enhance on-situation assessment and monitoring of overall plan execution.

- (U) ($697) Continuation:
  - (U) Complete development of all prototype display formats, collaborative linkages and information management systems for the C2WC.

- (U) ($700) Completions:
  - (U) Link TAC-3 computer equipped with advanced human-system integration tools and techniques to a real-time Navy tactical database.
  - (U) Conduct man-in-the-loop testing and evaluations of the above tools and techniques to validate their utility in the context of a real-time scenario involving multiple CIC watchstanders.
  - (U) Transition Advanced Information Management Evaluation and Demonstration software products to real-world Navy TAC systems; ensure all transitioned software complies with TAC approved X-Window and Motif design standards.

4. (U) FY 1997 PLAN:

- (U) ($755) New Start:
  - (U) Determine the requirements and capabilities needed for optimized information navigation within a shipboard command and control environment. Evaluate the commercial-off-the-shelf software available and select the best candidate.

- (U) ($751) Continuation:
  - (U) Complete design of the man-machine interfaces required for introducing PDAs into mission planning and execution.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT NUMBER: L1771 PROJECT TITLE: Ship Human Factors Engineering

- (U) ($700) Completion:
  - (U) Do prototype testing in both shore and afloat environments of the C2WC workstation. Transition software and hardware to Joint Maritime Communication Information System program.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	1,476	2,114	XXX	XXX
(U) FY 1995 Appropriated:	XXX	2,114	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-43	-60	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	1,433	2,054	2,076	2,206

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to end-of-year execution update (-43). FY 1995 reduced to reflect Congressional undistributed reductions for university research (-37), Federally Funded Research Development Center reduction (-4), travel (-3), and an assessment for Small Business Innovative Research (-16).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROJECT NUMBER: L1771
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT TITLE: Ship Human Factors Engineering

(U) RELATED RDT&E:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training, and Environmental Quality)
(U) PE 0602270E (Technology Development)
(U) PE 0603226E (Advanced Distributed Simulation)
(U) PE 0604703N (Manpower, Personnel, Training, Simulation and Human Factors)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L1772 Education and Training Development	3,710	5,797	5,010	5,154	5,297	6,435	6,628	6,826	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project addresses requirements in the Shore Training Joint Support Areas by focusing advanced technology on the acquisition and maintenance of complex skills through both individual and team training. It applies operations research and instructional, cognitive, and computer sciences in order to address requirements for improving (a) training throughput, efficiency and affordability necessary for "right-sizing" both the operational forces and the training infrastructure; (b) the effectiveness of training for increasingly complex weapons systems employed in littoral warfare, under fast-paced and stressful conditions, and with limited opportunities for "real-world" practice; and (c) training assessment and training system feedback capabilities for maximizing training responsiveness to operational requirements.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($2,800) Continuations:
  - (U) Developed an on-line training reservation system that will significantly reduce training system costs and improve fleet training-related readiness.
  - (U) Developed prototypes for enhanced video-teletraining capabilities and for a multi-media authoring and delivery system that will provide single-instructor training to multiple sites, and allow subject matter experts to develop and modify curriculum materials that involve video, computer-generated lessonware and interactive electronic technical data.

- (U) ($910) Completions:
  - (U) Demonstrated advanced Interactive Courseware for Total Ship Survivability that will embed within the

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1772
PROJECT TITLE: Education and Training Development

Integrated Shipboard Management System that is under development, in order to improve decision-making under stress, and to integrate damage control, engineering and combat systems personnel into a more effective team.
- (U) Evaluated the Navy Corrections Retraining Assessment Model's ability to raise the performance and retention potential of Navy personnel in corrective custody.

2. (U) FY 1995 PLAN:

- (U) ($584) New Starts:
  - (U) Design methodology to measure quantitatively combat readiness using standardized, valid and reliable measures of effectiveness (MOEs) for battle groups, platforms and weapon subsystems with links to both team and individual training.

- (U) ($4,575) Continuations:
  - (U) Evaluate initial multi-media curriculum authoring and training delivery system prototype that enables rapid development and revision of curricula and that capitalizes on the increasing availability of electronic data (e.g., Interactive Electronic Technical Manuals, Navy Paperless Ship).
  - (U) Continue development of Interactive Multisensor Analysis Training technology for Undersea Warfare to aid tactical visualization and control and expand emphasis on technologies which address the problems of skill degradation.
  - (U) Continue development and begin evaluations of training seat reservation, school seat allocation, and course scheduling system for more efficient training throughput and increased fleet readiness.

- (U) ($638) Completion:
  - (U) Demonstrate and evaluate enhanced interactive video-teletraining for providing "hands-on" and behavior-oriented training from primary delivery site to multiple remote sites.

3. (U) FY 1996 PLAN:

- (U) ($191) New Start:
  - (U) Begin design of ashore/afloat interactive training prototype incorporating hypermedia and intelligent

tutoring to enable individualized training, increased student achievement, and reduced instruction time and training costs.

- (U) ($3,495) Continuations:
  - (U) Design MOEs system providing both descriptive and diagnostic information at multiple levels (e.g., individual, team, weapons systems, battle group) that links training resources and effectiveness to operational readiness.
  - (U) Continue development and demonstration of Interactive Multisensor Analysis Training system for Undersea Warfare, including capability for classroom and for individual and team employment training.

- (U) ($1,324) Completions:
  - (U) Complete development and demonstration of Navy training reservation system and course scheduling system, including yield management models and mission critical/readiness models to optimize the use of training pipeline resources and maximize responsiveness to fleet Navy Enlisted Classification requirements.
  - (U) Extend initial classroom automation prototype to include networked classroom capability and interfaces to interactive electronic technical manuals; assess total system; and develop specifications for implementation.

4. (U) FY 1997 PLAN:

- (U) ($487) New Start:
  - (U) Initiate design of an adaptive operator training system that will determine when trainees have developed knowledge structures and abilities essential for complex Electronic Warfare and Anti-Submarine Warfare tasks and improve the prediction of which instructional methods produce optimal transfer of training to operational conditions.

- (U) ($4,667) Continuations:
  - (U) Assess existing training, logistics and fleet performance variables, and design resource data system, predictive model and methodology for generating training-linked MOEs for operational readiness.
  - (U) Expand development, demonstration and evaluation of Interactive Multisensor Analysis Training system for Undersea Warfare to additional warfare areas to assess generalizability and efficacy.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROJECT NUMBER: L1772
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT TITLE: Education and Training Development

- (U) Continue design of ashore/afloat interactive training prototype incorporating hypermedia and intelligent tutoring that capitalizes on a domain information/knowledge base and enables trainee application of knowledge to practice and real-time performance evaluation.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	3,870	6,013	XXX	XXX
(U) FY 1995 Appropriated:	XXX	6,013	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-160	-216	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	3,710	5,797	5,010	5,154

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to end-of-year execution update (-160). FY 1995 reduced to reflect Congressional undistributed reductions for university research (-113), travel (-8), and an assessment for Small Business Innovative Research (-95).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1772 PROJECT TITLE: Education and Training Development

(U) RELATED RDT&E: This project adheres to Tri-Service Reliance Agreements on Training Systems technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0604703N (Personnel, Training, Simulation, and Human Factors)
(U) PE 0603007A (Human Factors, Personnel, and Training Advanced Technology)
(U) PE 0603227F (Personnel, Training, and Simulation Technology)
(U) PE 0605798D (Joint Services Manpower and Personnel Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
L1773 Simulation and Training Devices	4,294	6,178	5,771	7,333	9,483	9,639	9,867	10,104	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the Shore Training Joint Support Area, as well as most Joint Mission Areas (JMAs) and Joint Chiefs of Staff Future Joint Warfighting Capabilities, all of which depend on high quality training to ensure mission success. The project responds to requirements for effective and affordable training and mission rehearsal capability by applying advanced simulation technology and innovative instructional concepts to the design of training systems. Examples of JMA requirements supported by tasks in this project include: training skilled personnel to handle complex weapons that may not be fired for extended periods (Strategic Deterrence); training for near-real-time targeting (Joint Strike); training operators and decision makers to respond to data received and processed at increasing speeds (Joint Space and Electronic Warfare (EW)/Intelligence); and training personnel to deal with target sets that are variable and difficult to identify as friendly or hostile (Joint Surveillance).

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($363) New Start:
  - (U) Initiated development of technology for automated, on-line assessment of individual and team performance as the first stage of an effort to develop shipboard instructor support that can greatly improve training for complex decision making in the high-stress, ambiguous environments of limited objective, littoral warfare.

- (U) ($500) Continuation:
  - (U) Demonstrated ability to interface a generic flight simulation to a large scale network of dissimilar simulation systems representative of joint operations; expanded the capabilities of Naval Aviation Simulation Network Training (NASNET) Interface Units in support of developing products that will meet the requirements

of joint service distributed training.

- (U) ($3,431) Completions:
  - (U) Completed development and evaluation of Forward-Deployable Aviation Simulator Technology, including evaluation of helmet mounted displays; integration of moderate cost photo image generation system; and man-in-the-loop experiments to determine required cockpit/visual system fidelity requirements.
  - (U) Designed, tested and evaluated shipboard EW sensors (AN/SLQ-32) for Battle Force Tactical Trainer (BFTT) milestone DT-IIA and provided BFTT connectivity and appropriate simulation technology for the Surface Warfare Officers School as part of the Organic Combat Systems Training Technology (OCSTT) task.

2. (U) FY 1995 PLAN:

- (U) ($1,348) New Start:
  - (U) Demonstrate real-time beam forming and signal processing simulation technology combined with innovative instructional techniques in order to strengthen submarine sonar employment training and increase utilization of the BQQ-5 Sonar System from about 30% to nearly 100% of its designed capabilities.

- (U) ($3,330) Continuations:
  - (U) Demonstrate NASNET Distributed Interactive Simulation (DIS) technology on fielded F-14B and F-14D trainers as part of an effort to provide high fidelity training systems networks for affordable training that will exercise all aviation components in a realistic environment including joint operations.
  - (U) Continue deployable instructor support program by beginning development of a guidance system to assist in diagnosing performance, selecting scenarios and implementing training strategies. This program is essential if the fleet is to realize the vast potential of embedded and onboard tactical team training systems, which currently lack support or training for instructors.

- (U) ($1,500) Completion:
  - (U) Implement C4I-related DIS protocols and demonstrate the ability of OCSTT's Combat Direction Center to respond to a wide variety of automated and semi-automated forces; test DIS network connectivity in joint training and mission rehearsal scenarios in order to improve the Navy's ability to operate in a wide variety

of force configurations, including some that may not be defined until units are on the scene.

3. (U) FY 1996 PLAN:

- (U) ($1,245) New Start:
  - (U) Initiate the integration and development of Virtual Environment Training Technology (VETT) for seated tasks such as those performed by Naval Aviators in order to improve the fidelity and significantly reduce the costs and physical size of aviation training devices.

- (U) ($3,017) Continuations:
  - (U) Demonstrate vastly improved shipboard instructor support based on new technology onboard a ship in support of afloat training and BFTT in order to improve tactical team training.
  - (U) Continue to improve innovative instructional and simulation techniques for sonar employment training using Commercial-Off-the-Shelf (COTS) hardware in order to greatly improve training and to reduce training systems costs by a factor of ten.

- (U) ($1,509) Completion:
  - (U) Implement NASNET DIS technology in additional fielded training systems such as the E-2C trainers. Demonstrate the networking of Naval aviation trainers to Navy ships via BFTT and other services' training devices to improve joint training and mission rehearsal.

4. (U) FY 1997 PLAN:

- (U) ($1,461) New Start:
  - (U) Initiate development of technology for computer generated forces that are fully automated, self learning, and DIS compliant in order to reduce the cost and improve the effectiveness of tactical training in all warfare areas.

- (U) ($4,550) Continuations:
  - (U) Continue to improve the development of VETT for seated Naval aviation tasks.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603707N
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development

PROJECT NUMBER: L1773
PROJECT TITLE: Simulation and Training Devices

- (U) Continue demonstration of improved shipboard training in support of afloat training and BFTT.

• (U) ($1,322) Completion:
- (U) Demonstrate improved instructional and simulation techniques for sonar employment training using COTS hardware in order to greatly improve training and to reduce training systems costs.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	4,431	6,373	XXX	XXX
(U) FY 1995 Appropriated:	XXX	6,373	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-137	-195	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	4,294	6,178	5,771	7,333

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 changes due to end-of-year execution update (-137). FY 1995 reflects Congressional undistributed reductions for university research (-119), travel (-9), and an assessment for Small Business Innovative Research (-67).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603707N PROJECT NUMBER: L1773
PROGRAM ELEMENT TITLE: Manpower, Personnel, and Training Advanced Technology Development PROJECT TITLE: Simulation and Training Devices

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: This project adheres to tri-service Reliance agreements on Training Systems technology. Work is related to and fully coordinated with efforts in:

(U) PE 0601152N (In-House Laboratory Independent Research)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training and Environmental Quality)
(U) PE 0603216A (Synthetic Flight Simulator Devices Development)
(U) PE 0603227F (Personnel, Training and Simulation Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2206 Environmental Requirements Advanced Technology (ERAT)	0	5,738	6,234	6,161	6,203	6,237	6,416	6,603	CONT.	CONT.
T1816 Logistics Technology Development (LOGDEV)	9,099	0	0	0	0	0	0	0	CONT.	CONT.*
T1910 Logistics Engineering Advanced Demonstrations (LEAD)	6,087	16,272	15,270	16,313	16,738	17,166	18,659	19,171	CONT.	CONT.
TOTAL	15,186	22,010	21,504	22,474	22,941	23,403	25,075	25,774	CONT.	CONT.

* Project T1816 has been combined with Project T1910 beginning in FY 1995.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element funds the Navy's advanced technology development core efforts in logistics. The focus is on Navy-unique aspects of logistics technology. The projects apply advanced technology to logistics needs and problems to: design weapons systems support to eliminate requirements for large logistics tails; reduce the high cost of maintaining weapon systems and improve readiness; assist program managers with technology to support weapon systems within shortened development cycles; and, reduce weapons system repair downtime. Beginning in FY 1995, tasks formerly associated with LOGDEV will be combined into the Logistics Engineering Advanced Demonstrations (LEAD) project. Also in FY 1995, an environmental quality project will begin that is aimed at demonstrating ways to reduce shipboard pollution, remediation of harbors and shore facilities, and improve industrial treatment processes. Ongoing environmental quality efforts currently funded under LEAD will transition to this new project.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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) COST (Dollars in Thousands)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY1997 ESTIMATE	FY1998 ESTIMATE	FY1999 ESTIMATE	FY2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2206 Environmental Requirements Advanced Technology (ERAT)	0	5,738	6,234	6,161	6,203	6,237	6,416	6,603	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project in supports near-term advances in support of the four Project Reliance environmental quality pillars: Pollution Prevention, Clean-up, Conservation, and Compliance. Primary focus will be on minimizing shipboard pollution, remediation of harbors and shore facilities, and improved methods of industrial waste treatment. The Environmental Quality task on Non-Polluting/Biodegradable Antifouling Hull Coatings moves to this project from project T1910 in FY 1995. The following is a new start in FY 1996/FY 1997: Environmentally Benign Logistics Operations.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS: Not applicable.

2. (U) FY 1995 PLAN:

(U) Environmentally Sound Ships:

(U) Non-Polluting/Biodegradable Antifouling Hull Coatings (AFHC):
- (U) ($1,617) Award Phase 3 Broad Agency Announcement (BAA) contracts for easy release coatings and phase 2 contracts for natural antifoulants.
- (U) ($622) Conduct physical property and small scale testing of easy release and natural antifouling coatings.
- (U) ($268) Initiate ship tests of natural antifouling coatings.

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($410) Initiate effort to perform biological pre-treatment and ultraviolet post-treatment of non-oily wastewater to obtain an acceptable effluent.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology
PROJECT NUMBER: R2206
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) Automated Underwater Hull Maintenance/Monitoring System:
- (U) ($1,524) Begin hull sensor selection for integration on underwater robotic hull maintenance vehicle to detect cracks and repair areas on hull.

(U) Environmentally Safe Shipyards:

(U) Destruction of Hazardous Waste by Supercritical Water Oxidation (SCWO):
- (U) ($1,297) Initiate prototype testing of SCWO technology to treat organic, toxic waste at industrial treatment facilities. Design and initiate construction of a SCWO plant.

3. (U) FY 1996 PLANS:

(U) Environmentally Sound Ships:

(U) Non-Polluting/Biodegradable AFHC:
- (U) ($1,834) Complete small scale test of coatings. Evaluate ship patch/stripe tests and transition to the Naval Sea Systems Command 6.4 Demonstration and Validation Program.

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($850) Conduct pierside demonstration of prototype wastewater treatment system.

(U) Automated Underwater Hull Maintenance/Monitoring System:
- (U) ($1,600) Complete initial vehicle design and select vehicle command and control system.

(U) Environmentally Safe Shipyards:

(U) Destruction of Hazardous Wastes by SCWO:
- (U) ($1,950) Complete site preparation, construction of SCWO plant and perform acceptance testing.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R2206 PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

4. (U) FY 1997 PLAN:

(U) Environmentally Sound Ships:

(U) Shipboard Non-Oily Wastewater Treatment:
- (U) ($1,100) Test, debug and demonstrate prototype wastewater treatment assembly aboard ship.

(U) Automated Uunderwater Hull Maintenance/Montioring System:
- (U) ($2,690) Develop prototype cleaning tool under commercial contract and conduct field tests on image analysis process for underwater operations.

(U) Environmentally Safe Shipyards/Field Activities:

(U) Destruction of Hazardous Wastes by SCWO:
- (U) ($1,570) Demonstrate supercritical water oxidation plant operation. Prepare for transition to operational use.

(U) Environmentally Benign Logistics Operations:
- (U) ($801) Initiate effort to design and demonstrate alternative environmentally benign and improved storage, transportation and handling processes.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	6,000	XXX	XXX
(U) FY 1995 Appropriated:	XXX	6,000	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	0	-262	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	0	5,738	6,234	6,161

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

PROJECT NUMBER: R2206
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustments in FY 1995 are for Congressional Undistributed Cuts for University Research (-104), Travel (-8); and, an assessment for Small Business Innovative Research (-150).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training & Environmental Quality Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
T1910 Logistics Engineering Advanced Demonstrations (LEAD)	6,087	16,272	15,270	16,313	16,738	17,166	18,659	19,171	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The LEAD project improves weapon system readiness and supportability through development of advanced logistics technology. Tasks in this project will provide advanced diagnostic and test capabilities, and advanced industrial technology for ship maintenance and environmental compliance. Project facilitates transition of concepts from Exploratory Development to other research and development categories or directly to the fleet. Work in the Logistics Technology Development project (T1816) moves to this project in FY 1995. The Non-Polluting/Biodegradable Antifouling Hull Coatings task moves from this project to new project R2206 in FY 1995. The following are new starts in FY 1996/FY 1997: Automatic Test and Calibration of Equipment, Advanced Diagnostics, Automated Asset Visibility, Advanced Material Availability, and Equipment Configuration.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS (includes Project T1816):
(U) Shipboard Flexible Computer Integrated Manufacturing (FCIM)
- (U) ($475) Completed material procurement for the Shore Intermediate Maintenance Activity (SIMA) at the Trident Refit Facility.
- (U) ($1,070) Completed software development, integration and installation for SIMA testing.
- (U) ($637) Conducted system testing at the SIMA, Trident Refit Facility.

(U) High Pressure Water Automated Closed-Loop Paint Stripping System:
- (U) ($755) Assembled subsystems and completed testing program on recoatability of paint under contract awarded in FY 1993. Tested and demonstrated at shipyard and transitioned technology.

(U) Non-Polluting/Biodegradable Antifouling Hull Coatings:
- (U) ($1,145) Awarded Broad Agency Announcement (BAA) contracts for Phase 2 (easy release coatings

formulations).
- (U) ($163) Awarded natural antifoulants BAAs.
- (U) ($625) Conducted small scale testing of BAA easy release products.
- (U) ($218) Conducted ship testing of easy release BAA products.

(U) Interactive Electronic Technical Manual (IETM)
- (U) ($257) Initiated task and performed system requirements review.
- (U) ($742) Began system development and initiated acquisition of automated conversion tools, using commercially available hardware and software in an open system architecture.

(U) Standard Hardware Acquisition and Reliability Program (SHARP): (Funded in Project T1816 in FY 1994)
- (U) Continued development of Standard Electronic Modules (SEM), Standard Power Supplies, Standard Battery Systems, and Standard Enclosures Systems reducing development costs and logistics support costs associated with non-standard components, and improving system reliability.
- (U) Transitioned SHARP developed enclosures, modules, power supplies, and fiber optic interconnect hardware and technology into Navy/National Aeronautics and Space Administration (NASA) Fiber Optic Control System Integration.
- (U) Developed low cost military SEM format E power supplies and transition applicable commercial technology.
- (U) Developed commercial off-the-shelf (COTS) battery charger/analyzer system and family of mine warfare system batteries and related technologies.

2. (U) FY 1995 PLAN:

(U) Imaging Technology:
- (U) ($2,000) Conduct imaging technology development.

(U) SHARP:
- (U) ($3,000) Continue standard product development in support of electronic circuit assemblies, advanced enclosure systems, power systems and energy systems for insertion of new technologies. This reduces development time and costs and logistics support costs associated with non-standard components, and improves

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology PROJECT NUMBER: T1910 PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

system reliability.
- (U) ($1,105) Develop advanced electronics packaging/cooling techniques.
- (U) ($1,145) Develop guidance for use by weapon system designers to mitigate the logistics risk of utilizing commercial-off-the-shelf (COTS) products. Includes product guidance, electromagnetic interference studies and COTS battery charger task.
- (U) ($1,115) Demonstrate improved repairability and logistics support of electronic circuit assemblies.

(U) Shipboard FCIM:
- (U) ($300) Conduct system planning and design for tender application.
- (U) ($903) Complete system integration, installation and training on tender.
- (U) ($772) Conduct system testing on tender and prepare for operational transition.

(U) IETM:
- (U) ($1,708) Complete system development and integration to prototype limited production capability.
- (U) ($200) Perform test of conversion capability on sample technical manuals selected by Systems Commands.

(U) Real-Time Infrared System Test SeT (RTIR):
- (U) ($1,006) Begin design and fabrication of infrared demonstration test set for use in diagnostics and maintenance.

(U) Laser Weld Repair of Naval Materials:
- (U) ($726) Begin integration of new laser, neural net and fiber optic technology into capability to repair shipboard mechanical components faster and more economically. Complete development and demonstration of a laser valve repair cell.

(U) Next Generation Test Generator:
- (U) ($800) Begin effort to generate end-to-end performance test patterns of new test generator system with application to avionic and non-avionic system diagnostics.

(U) Diamond Film as an Electronic Module Substrate:
- (U) ($746) Initiate demonstration effort to mount 500 watt capability on substrate and to downsize required cooling system.

(U) Automated Shipboard Fueling System:
- (U) ($746) Initiate adaptation of the existing DDG-963/CG-47 Fuel Fill and Control System simulation model for the preliminary design of the Automated DDG-51 Fuel Fill and Control System.

3. (U) FY 1996 PLAN:

(U) SHARP:
- (U) ($3,370) Continue standard product development in support of electronic circuit assemblies, advanced enclosure systems and thermal management, power and energy storage, and advanced interconnect technology for insertion of new technologies developed in industry and 6.2 research. Specific efforts include a modular avionics demonstration, development of a unified shipboard rack enclosure, and testing participation in the multi-service Reliability Technology program.
- (U) ($820) Demonstrate advanced electronic packaging cooling and interconnect techniques for support of high performance electronics. Efforts include high temperature packaging, transmit and receive module and optical backplane interconnect developments.
- (U) ($2,160) Demonstrate improved repairability and logistics support in cost efficient and timely transportable techniques and processes for replacing nonprocurable and unreliable electronic circuit assemblies. Specific efforts include demonstrating analog modeling and simulation and first pass prototyping and assisting weapon system designers in using COTS products.

(U) Shipboard FCIM:
- (U) ($985) Transition afloat-based FCIM to fleet implementation.

(U) IETM:
- (U) ($780) Complete prototype package defining automated technical data conversion process for government-

owned and proprietary software.
- (U) ($520) Transfer technical manual conversion technology and prototype processes to government programs and the public domain.

(U) RTIR:
- (U) ($1,375) Design and fabricate a greater definition infrared array (256x256 pixels) for use in built-in test equipment to expand its usability across systems.

(U) Laser Weld Repair of Naval Materials:
- (U) ($975) Develop and demonstrate ship propeller shaft repair using a laser working cell.

(U) Next Generation Test Generator:
- (U) ($755) Begin incorporating a neural network capability to classify test patterns within 95% accuracy. This capability will be added to generate avionic test programs automatically.

(U) Diamond Film as Electronic Module Substrate:
- (U) ($695) Fabricate SEM format E size diamond film on substrates/heatsinks and electronic circuitry on 6" x 6" SEM-E substrates.

(U) Automated Shipboard Fueling System:
- (U) ($1,875) Complete engineering design for DDG51 automated fueling system and perform pierside testing and initiate at-sea tests.

(U) Automatic Test and Calibration of Equipment:
- (U) ($960) Initiate effort to design and demonstrate a capability to conduct remote test and calibration of equipment to eliminate requirements for labor-intensive equipment removal.

4. (U) FY 1997 PLAN:
(U) SHARP:

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology
PROJECT NUMBER: T1910
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

- (U) ($3,155) Continue standard product development in support of electronic circuit assemblies, advanced enclosure systems and thermal management, power systems and energy storage and advanced interconnect for insertion of new technologies developed in industry and 6.2 research. Specific efforts include joint common radio frequency (RF) module development and ultra lightweight enclosures; demonstration of nickel metal hydride, lightweight composite graphics NiCad, and silver advanced energy technologies.
- (U) ($870) Demonstrate advanced electronic packaging cooling and interconnect techniques for support of high performance electronics. Tasks include high temperature packaging, advanced thermal interconnects, advanced convection cooling, dual use advanced photonics technology and high throughput interconnects.
- (U) ($2,303) Demonstrate improved repairability and logistics support in cost efficient and timely, transportable techniques and processes for replacing nonprocurable/unreliable electronic circuit assemblies. Specific tasks include mixed mode modeling and simulation and assisting weapon system designers in using COTS products.

(U) RTIR:
- (U) ($1,375) Demonstrate full scale real time infrared test set in a realistic field environment and begin transition to weapon systems programs.

(U) Laser Weld Repair of Naval Materials:
- (U) ($610) Develop and demonstrate a laser repair cell utilizing a 3-dimensional telerobotic manipulator. Begin transition of dual-use technology to government and commercial activities.

(U) Next Generation Test Generator:
- (U) ($800) Complete the neural network architecture and demonstrate the test generator.

(U) Diamond Film as Electronic Module Substrate:
- (U) ($550) Perform thermal, electrical and environmental module and enclosure tests and demonstrations.

(U) Automated Shipboard Fueling System:
- (U) ($850) Complete at-sea tests of shipboard fueling system and system documentation.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603712N PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology PROJECT NUMBER: T1910 PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) Advanced Diagnostics:
- (U) ($1,250) Initiate effort to demonstrate next generation automatic non-intrusive electronic devices utilizing advanced diagnostics concepts.

(U) Automatic Test and Calibration of Equipment:
- (U) ($800) Continue effort to define required interactive interfaces between multiple pieces of equipment for producing self-calibration and test.

(U) Automated Asset Visibility:
- (U) ($1,100) Develop and demonstrate improved concepts and technology for automated total asset tracking.

(U) Advanced Material Availability:
- (U) ($1,700) Initiate effort to test and demonstrate advanced fabrication materials and automated manufacturing processes for use in a broad range of afloat and ashore logistics operations.

(U) Equipment Configuration:
- (U) ($950) Develop and demonstrate a realtime design/logistics interface capability that assures a high degree of accuracy between actual product configuration and associated databases.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	6,374	15,024	XXX	XXX
(U) FY 1995 Appropriated:	XXX	17,024	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-287	- 752	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	6,087	16,272	15,270	16,313

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603712N
PROGRAM ELEMENT TITLE: Environmental Quality & Logistics Advanced Technology
PROJECT NUMBER: T1910
PROJECT TITLE: Environmental Requirements Advanced Technology (ERAT)

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustment in FY 1994 is for End-of Year execution (-287) to reflect below threshold reprogramming. Fund adjustments in FY 1995 are for: Congressional Undistributed Cuts for University Research (-406); Travel (-21); and, an assessment for Small Business Innovative Research (-325).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602233N (Readiness, Training & Environmental Quality Technology)
(U) PE 0602234N (Materials, Electronics, and Computer Technology)
(U) PE 0603792N (Advanced Technology Transition)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X1933 Undersea Warfare (USW) Advanced Technology Demonstration	11,257	10,937	13,187	13,523	13,902	14,372	14,790	15,221	CONT.	CONT.
X1959 Critical Sea Tests (CST) Phase II	24,214	19,739	3,973	0	0	0	0	0	0	97,131
H2089 Advanced Collection Technology	9,865	10,193	6,435	9,679	11,914	14,155	14,571	14,998	CONT.	CONT.
V2159 Anti-Submarine Warfare Target	1,921	945	0	0	0	0	0	0	0	4,866
R2142 Shallow Water Surveillance Advanced Technology	9,505	17,030	28,221	34,323	35,865	38,761	40,171	38,842	CONT.	CONT.
X2186 Low Low Frequency Technology	14,600	2,457	0	0	0	0	0	0	0	17,057
TOTAL	71,362	61,301	51,816	57,525	61,681	67,288	69,532	69,061	CONT.	CONT.

* FY 1994 and FY 1995 reflect FY 1996 S&T restructure with projects and associated funding moving from PE 0603555N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) focuses on the advanced development of USW technologies in support of three of the "Top 5" Future Joint Warfighting Capabilities endorsed by Joint Chiefs of Staff as they apply to the undersea threat, namely: (a) maintaining near perfect real-time surveillance of an enemy's undersea forces and communicating that knowledge to joint forces in near-real-time; (b) developing a range of tactical USW capabilities that could be employed at the lower end of the full range of military operations with minimum risk of casualties or collateral damage to friendly forces; (c) developing a robust, world-wide capability for detecting,

localizing, and neutralizing undersea threats, including diesel-electric submarines in littoral waters, in decisive conflict with minimal risk of casualties or collateral damage to friendly forces. Emphasis is on development of fieldable prototypes, components and systems necessary to demonstrate and validate concepts and techniques previouslv developed in 6.1 and 6.2 or developed and suggested by industry/academia. Advanced techniques developed for gathering and realistic at-sea environmental data needed to benchmark developmental USW systems. Work under this PE supports the following Joint Mission Areas: Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence, Maritime Support of Land Forces, Forward Presence, Manpower and Personnel, and Shore Training. Specifically:

(U) Joint Littoral Warfare has requirements for technology developments that will enable our forces to dominate the undersea and surface battlespaces in littoral environments. Work under this PE provides technologies to obtain information necessary to develop improved USW systems to detect, track and localize threat submarines. At-sea measurement data is also gathered and analyzed to determine the effectiveness of current and developmental systems in a wide variety of environments. The emphasis is on the issues associated with operations in shallow water environments. Such information is essential for the development of undersea surveillance and weapon systems/components with robust littoral water capabilities. This program also provides prototype and advanced development level components to validate USW surveillance concepts, research products and technologies for full spectrum processing, low-frequency active transducers, fiber optic sensors, and transmission nodes and arrays for deployable undersea surveillance systems. These components address the Joint Littoral Warfare need to provide improved USW systems capable of detecting, classifying and tracking undersea threats in shallow waters. Development and testing of acoustic warfare concepts addresses the Littoral Warfare Area need for force coordination and tactical control.

(U) Joint Surveillance addresses issues of real-time detection, localization, classification and tracking of the undersea threat. The joint is developing and demonstrating a system which will utilize lower cost/size/power sensors and fiber optic components, as well as deployment methods for such systems. Measurements made under the CST and Low-Low-Frequency Active projects provide data necessary to evaluate the performance of current and developmental USW sensors, including low-frequency active sonar systems. Data in a wide variety of ocean environments is being analyzed with emphasis on the particular issues associated with sensor operation in shallow water environments. The Advanced Collection Technology (ACT) project develops advanced technologies that will provide information necessary for the development of effective undersea surveillance systems.

(U) Strategic Deterrence addresses issues relating to the protection of U.S. ballistic and cruise missile-launching

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

submarines. Full Spectrum work helps meet Strategic Deterrence needs for SSBN passive systems that will be effective against quiet threats. The CST and ACT projects provide essential measurements of USW system performance in realistic at-sea environments and information on the to help optimize USW system performance. Continued superiority in passive systems is essential to the continued safety of the SSBN force as it enables them to detect and avoid potential threats.

(U) Maritime Support of Land Forces requires our naval forces to sustain sea-borne power projection through local domination of the surface and undersea battlespaces in the vicinity of logistic and replenishment forces in open ocean and littoral areas. This program provides improved USW components, and analysis of at-sea performance measurements in a wide variety of ocean environments to help ensure our forces will maintain this dominance in the future.

(U) Mobile Acoustic Target transducer technology developed under this PE supports the Manpower and Personnel and Shore Training Joint Mission Areas requirements to maintain fleet readiness through improved training of personnel at-sea and by providing the capability for more realistic evaluations of undersea combat and weapon systems.

(U) These efforts also support the Navy's joint warfare strategy by providing improved capabilities to dominate the surface and undersea battlespaces.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X1933 Undersea Warfare (USW) Advanced Technology Demonstration	11,257	10,937	13,187	13,523	13,902	14,372	14,790	15,221	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and tests prototype USW system components building on the concepts, algorithms and technologies developed under the 6.1 and 6.2 programs. It also supports the advanced development of sensors, nodes and arrays and provides for transition of the [redacted] (further details are available at a higher classification level). It sponsors developmental work on acoustic warfare concepts and system analysis of advanced USW surveillance concepts to determine their suitability for further development. The five major components in this project are: the [redacted] Advanced Acoustic Source Technology, Advanced Full Spectrum Processing, and USW Planning and Warfighting Payoff Assessment. Joint Mission Areas supported by this project include: Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence, Forward Presence, and Maritime Support of Land Forces. Specifically:

(U) Joint Littoral Warfare requires systems that will enable our forces to dominate the surface and undersea battlespaces in littoral, shallow-water environments. This project provides prototype and advanced development level components to validate USW surveillance concepts, research products, and technologies for Full Spectrum Processing and Low-Frequency Active Sonar Transducers. Both areas meet a Joint Littoral Warfare need to provide improved USW systems to detect, track, and localize threat submarines in shallow waters. The Full Spectrum Processing work focuses on the development of software and devices to detect [redacted] which emanate from both diesel-electric and nuclear threat submarines. The Advanced Active Source Technology Initiative focuses on developing lighter-weight, lower-cost broadband transducers for use in both wide-area and tactical undersea surveillance applications against diesel-electric submarines operating in shallow waters. This work also addresses Joint Surveillance issues of real-time detection, localization, classification and tracking of undersea threats and Maritime Support of Land Forces requirements. The intent is to enable our forces to dominate the local undersea battlespace in the vicinity of logistic and replenishment forces. The Full Spectrum work also helps meet Strategic Deterrence needs for SSBN passive systems that will be effective against quiet threats.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: X1933 PROJECT TITLE: Undersea Warfare Advanced Technology Demonstration

(U) The USW Planning and Warfighting Payoff Assessment work supports Joint Littoral Warfare requirements for force coordination and tactical control. A robust acoustic warfare doctrine is an essential element if tactical forces are to be successfully employed. Proliferation of high-power active sources and the emergence of bistatic and multistatic active sonar operating doctrines requires effective planning and coordination to avoid mutual interference and to optimize sensor utilization.

(U) The project is developing and demonstrating advanced sensors and transmission methods, suitable for use in the undersea environment, as well as deployment methods for such systems. This work helps address Joint Littoral Warfare and Joint Surveillance needs for USW systems capable of detecting, tracking and localizing submarines in shallow water environments.

(U) These efforts also support the Navy's joint warfare strategy by providing an improved capability to dominate the surface and undersea battlespace. This project is service unique.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($3,724)
  (U) Conducted regional exercises, analyzed, and reported previous year's results.
  (U) Completed:
  --(U) deployment tests, and began system integration.
  --(U) sensor and advanced signal processing design efforts.

- (U) ($1,657) Advanced Active Source Technology Development:
  (U) Tested three candidate source technologies: sparker cluster, inverse flextensional, and slotted cylinder (split ring).
  (U) The inverse flextensional source activity was terminated due to severe reduction of transition (ship) platform quantities.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology
PROJECT NUMBER: X1933
PROJECT TITLE: Undersea Warfare Advanced Technology Demonstration

- (U) ($3,785) Advanced Full Spectrum Processing:
  (U) Completed design of

  (U) Continued:
  -- (U) and applied results to processor development and testing.

- (U) ($1,237) USW Planning:
  (U) Provided Acoustic Warfare recommendations reflecting acoustic interoperability and Command, Control, Communications and Intelligence/threat integration developments. Addressed joint deployable and mobile Integrated Undersea Surveillance Systems, surface, Maritime Patrol Aircraft, etc., interoperability and connectivity issues in support of the counter cruise missile initiative.

- (U) ($854) Warfighting Payoff Assessment:
  (U) Continued modeling and analysis to quantify and assess the expected warfighting payoffs of full spectrum and active acoustic bistatic initiatives within this program element.

2. (U) FY 1995 PLAN:

- (U) ($4,078)
  (U) Continue integration of system during tests.
  (U) Complete field test and finalize sensor designs and advanced signal processing techniques.
  (U) Continue development of unique capabilities by conducting ICESHELF FY 1995; complete analysis of previous year's work and report results.

- (U) ($700) Advanced Active Source Technology Development:
  (U) Conduct evaluation of sparker cluster and slotted cylinder source technologies.
  (U) Fabricate, test, and evaluate three full scale slotted cylinders at the
  (U) Test the sparker cluster elements in a salt water environment.

(U) Conduct element level evaluation of candidate source technologies as identified in FY 1995 Transduction Workshop.

- (U) ($5,994) Advanced Full Spectrum Processing:
  (U) Transition integrated into a fieldable prototype; document value added.
  (U) Expand:
  -- (U) processor capabilities to include
  -- (U) efforts to construct embedded training for full spectrum processing and develop special purpose processors/processing for

- (U) ($59) USW Planning:
  (U) Address critical Acoustic Warfare issues via white papers on selected topics, drawing upon lessons learned from Critical Sea Test (CST)/Magellan exercises.

- (U) ($106) Warfighting Payoff Assessment:
  (U) Complete analysis of Full Spectrum Processing contribution of Low-Frequency Active bistatic value-added, and performance of Low-Frequency Active as a function of frequency.

3. (U) FY 1996 PLAN:

- (U) ($4,503)
  (U) Conduct initial system development and performance assessments of system.
  (U) Assess unique matched mode, matched field advanced signal processing techniques in acoustically quiet shallow regional environment.
  (U) Field test for applicability to
  (U) Complete monthly and annual performance assessment reports.

- (U) ($1,974) Advanced Acoustic Source Technology:
  (U) Conduct at-sea testing of slotted cylinder and sparker arrays.

(U) Continue development of sources selected in Transduction Workshop.

- (U) ($5,526) Advanced Full Spectrum Processing:
  (U) Upgrade the Full Spectrum program fully automated fieldable prototype to include a multi-feature combined acoustic display.
  (U) Develop a robust automated capability for
  (U) Fuse active and passive acoustic capability.

- (U) ($526) USW Planning:
  (U) Analyze results of CST data analysis to determine impact on Low-Low-Frequency Active acoustics.

- (U) ($658) Warfighting Payoff Assessment:
  (U) Assess the payoff of selected current and proposed USW ATDs developments providing decision makers the basis for technology investment decisions.

4. (U) FY 1997 PLAN:

- (U) ($3,652)
  (U) Complete system development of, and performance assessments for,
  (U) Transition signal processing techniques to regional shallow water applications.
  (U) Complete assessment and transition to application.
  (U) Conduct ICESHELF 97, complete analysis and report results.

- (U) ($1,488) Advanced Acoustic Source Technology:
  (U) Conduct evaluation of selected 6.3 acoustic source technologies as proposed by the 1995 combined Advance Research Projects Agency/Office of Naval Research/Systems Command Transduction Workshop.

- (U) ($7,301) Advanced Full Spectrum Processing:
  (U) Develop a situational trainer for the fused active and passive multi-feature combined acoustic system.
  (U) Upgrade the Full Spectrum Processing Program Prototype to include a capability against

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: X1933 PROJECT TITLE: Undersea Warfare Advanced Technology Demonstration

- (U) ($541) USW Planning:
  (U) Coordinate and consolidate sea-test requirements across systems and platforms.
- (U) ($541) Warfighting Payoff Assessment:
  (U) Assess the payoff of selected current and proposed USW ATDs.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	11,746	12,670	XXX	XXX
(U) FY 1995 Appropriated:	XXX	12,670	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	-489	-1,733	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	11,257	10,937	13,187	13,523

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 funding decreased by $489K due to end-of-year execution adjustments. FY 1995 funding reflects congressional undistributed reductions for travel ($-17K); Consulting Services ($-855K); FFRDCs ($-355K); and university research ($-506K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology
PROJECT NUMBER: X1933
PROJECT TITLE: Undersea Warfare Advanced Technology Demonstration

(U) RELATED RDT&E:

(U) PE 0601153N	(Defense Research Sciences)
(U) PE 0602314N	(Undersea Warfare Surveillance Technology)
(U) PE 0602315N	(MCM, Mining, and Special Warfare Technology)
(U) PE 0602435N	(Ocean and Atmospheric Technology)
(U) PE 0603254N	(Air ASW Systems Development)
(U) PE 0603553N	(Surface ASW)
(U) PE 0603792N	(Advanced Technology Transition)
(U) PE 0604261N	(Acoustic Search Sensors (ENG))
(U) PE 0604311N	(Integrated Surveillance System)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X1959 Critical Sea Tests (CST) Phase II	24,214	19,739	3,973	0	0	0	0	0	0	97,131

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project conducts integrated at-sea tests using the full range of undersea warfare (USW) platforms to support development of mid- and low-frequency active (LFA) sonar systems, passive sonars, and the scientific examination of environmental effects on sonar signals. It also facilitates testing of sonar system interoperability, USW Surveillance data fusion and Command/Control/Communications/Computer/Intelligence issues for both battle group and theater level acoustic warfare. Centralizing at-sea acoustic testing provides synergism and lowers the overall cost of obtaining test data in actual sea environments. The need to obtain data on sonar system performance in shallow-water, littoral areas was specifically cited as an urgent need by the National Academy of Sciences Littoral Warfare Study Panel as a result of their spring 1993 review. The panel also cited a need to characterize the effects of the shallow-water environment. The data provided by this project addresses this need. The project supports the Joint Mission Areas of Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence, and Maritime Support of Land Forces.

(U) Joint Littoral Warfare has requirements for advanced systems that will enable our forces to dominate the undersea and surface battlespaces in littoral environments. This project provides at-sea measurement data necessary to assess the performance of current USW systems. This data set is also used to develop new techniques and systems having improved performance against diesel-electric submarines in shallow water environments. This helps meet Joint Littoral Warfare needs to provide improved USW systems to detect, track and localize threat submarines in shallow, as well as deep, waters. These systems also improve the defense of both surface ships and submarines through the timely detection and classification of hostile undersea threats. Work in this project also addresses Joint Littoral Requirements for force coordination and tactical control as the sea tests are also used to develop and assess new acoustic warfare doctrines designed to minimize interference between undersea sensor systems and to test USW data fusion concepts.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: X1959 PROJECT TITLE: Critical Sea Tests Phase II

(U) Joint Surveillance needs include issues of real-time detection, localization, classification and tracking of the undersea threat. This project addresses needs in undersea sensing and the development of LFA bistatics. Sea tests conducted under this program provide data to evaluate performance of current and developmental sonar sensors, including low-frequency fixed, mobile, and sonobuoy systems, in a wide variety of ocean environments with emphasis on shallow water operations. Such data is critical to provide a better understanding of the effects of the ocean environment on undersea sensors and to develop sensors that will have a robust capability in shallow water environments.

(U) Strategic Deterrence requirements include issues related to the protection of U.S. ballistic and cruise missile-launching submarines. The sea test data provided by this project provides an improved understanding of the effects of the environment on submarine sonar systems to help optimize the development and employment of SSBN sonar detection and torpedo countermeasure systems which will help our forces evade both surface and undersea threats.

(U) Maritime Support of Land Forces requires that our forces have the capability to dominate the local sea areas in the vicinity of logistic and replenishment forces to allow them to sustain power projection forces in open ocean and littoral areas. This project provides sea test data on current and developmental sonar systems and on the characteristics of the ocean environment with emphasis on shallow water regions. Such data is used to evaluate current undersea sensor performance relative to new sensors. Techniques are also assessed in order to develop systems that will enable future Navy forces to dominate the local surface and undersea battlespaces and to provide a robust shield against undersea threats in the vicinity of logistic forces.

(U) This effort also supports the Navy's joint warfare strategy by providing an improved capability to dominate the surface and undersea battlespaces. This project is service unique, and provides opportunities for testing developmental and prototype sensors/systems with operational Navy systems in actual sea test environments through "Magellan" testing.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($7,032) Conducted combined tactical and Acoustic Warfare sea test with Pacific Fleet and UK/Canadian USW assets in littoral waters off California (CST 10/LFA 12/MAGII).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: X1959 PROJECT TITLE: Critical Sea Tests Phase II

- (U) ($8,340) Provided upgraded passive/active test platform capability and platforms/assets for conducting sea tests in support of system development, shallow water Science and Technology (S&T) Acoustics, and Acoustic Warfare issues.
- (U) ($1,500) Participated in Joint Exercises to integrate and coordinate surveillance data into Command/ Control/Communication infrastructure for North American Aerospace Defense Command/Navy Counter-Cruise Missile Initiative.
- (U) ($5,817) Analyzed FY 1992 and FY 1993 sea test data and provided Active Acoustic (50-1000Hz) and Acoustic Warfare reports on both scientific and operational results to USW platform users.
- (U) ($1,525) Designed a portable shallow-water source array suitable for at-sea tests.

2. (U) FY 1995 PLAN:

- (U) ($4,595) Provide source and receiver platforms to host Research and Development acoustic source arrays and fusion processing capability for coordinated multi-static USW sea test operations.
- (U) ($714) Conduct joint S&T, system development and surveillance sea test with SACLANTCEN in littoral/shallow water environments of the Mediterranean Sea. Conduct investigation and testing of tactical active wavetrains.
- (U) ($3,530) Analyze FY 1994 and prior sea test data and provide reports on system implications to USW platform users.
- (U) ($10,900) Conduct advanced development of low-frequency and low-low-frequency technology.

3. (U) FY 1996 PLAN:

- (U) ($3,973) This project terminates in FY 1996. Analyze FY 1995 and prior sea test data. Provide reports, including a special CST issue of the Journal of Underwater Acoustics, on scientific and development results to USW platform users. Transfer or demobilize sea test assets.

4. (U) FY 1997 PLAN: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: X1959 PROJECT TITLE: Critical Sea Tests Phase II

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	23,993	23,209	XXX	XXX
(U) FY 1995 Appropriated:	XXX	23,209	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUD:	+221	-3,470	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	24,214	19,739	3,973	0

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: FY 1994 funding was adjusted for end-of-year execution adjustments ($233K) and to adjust for a LLFA reprogramming ($-12K). FY 1995 funding reflects congressional undistributed reductions for university research ($-2,311K); Consulting Services ($-522K); FFRDCs ($-55K); and travel ($-32K). There is also an assessment for Small Business Innovative Research ($-550K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0602435N (Ocean and Atmospheric Technology)
(U) PE 0603254N (Air ASW Systems Development)
(U) PE 0603553N (Surface ASW)
(U) PE 0603785N (Combat Systems Oceanographic Performance Assessment (CSOPA))

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3
PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology
PROJECT NUMBER: X1959
PROJECT TITLE: Critical Sea Tests Phase II

(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0604221N (P-3 Modernization Program)
(U) PE 0604311N (Integrated Surveillance System)
(U) PE 0604503N (Submarine System Equipment Development)
(U) PE 0604784N (Distributed Surveillance Systems)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
H2089 Advanced Collection Technology	9,865	10,193	6,435	9,679	11,914	14,155	14,571	14,998	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project builds advanced development and prototype devices that are used for the operational collection of

Collection of such data is required to ensure the viability of current and future Undersea Warfare (USW) combat systems and to aid in the development of fleet tactics for the employment of these systems. In particular, development of low-frequency active sonar systems requires data in the Hz region. An ongoing effort in this program is to develop a family of calibrated active sonobuoys that will enable the collection of] data over the entire range of U.S. Navy weapon and sonar frequencies. Other efforts integrate radar, optical, and electromagnetic detection capabilities with advanced signal processors and displays suitable for the collection of] information. This project supports the Joint Mission Areas of Joint Littoral Warfare, Joint Surveillance, Strategic Deterrence and Maritime Support of Land Forces.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (u) ($7,200) Completed:
  -- (u) developmental testing of the sonobuoys.
  -- (U) development and initiated testing of the sonobuoys.
- (U) ($1,238) Continued development of capability in shallow water for the

- (U) ($1,427) Initiated:
  -- (U) prototyping and integration of an advanced | system to provide an

extended frequency range capability to collect in shallow water environments.

-- (U) hardware definition of a modified to provide a capability and improve algorithms for integration into the Advanced Processor Experimental (APEX) signal processor. This provides a better long-range surveillance and detection capability against submarines operating in shallow water areas.

-- (U) operational testing of sonobuoys.

2. (U) FY 1995 PLAN:

- (U) ($6,256) Complete testing of sonobuoys with the APEX signal processor. Take delivery of pre-production sonobuoys.
- (U) ($2,392) Continue:
  -- (U) development of an advanced system providing a wide-band sensor data collection capability of data over the complete frequency band.
  -- (U) development of a real-time capability in the APEX signal processor and associated post-mission algorithms.
- (U) ($1,545) Initiate:
  -- (U) display improvements required by new signal processing being developed for APEX.
  -- (U) development of an sonobuoy.

3. (U) FY 1996 PLAN:

- (U) ($1,427) Complete:
  -- (U) developmental testing of the system for shallow water.
  -- (U) development of a real-time capability in the APEX signal processor and associated post-mission algorithms for shallow water.
  -- (U) development of a real-time sonobuoy capability in the APEX signal processor and associated post-mission algorithm for shallow water.
- (U) ($1,200) Continue development of an advanced system providing a wide-band sensor data collection capability of data over the complete frequency band.

- (U) ($2,915) Continue development of new signal processing software for the APEX signal processor to achieve maximum performance from systems.
- (U) ($893) Integrate a protype AN/APS-137 Inverse SAR Radar with the periscope detection advanced technology demonstration and raw data record capabilities into the APEX signal processor.

3. (U) FY 1997 PLAN:

- (U) ($2,714) Develop and test modification to hardware and software for performance in
- (U) ($1,200) Complete development of an advanced [ ] system providing a wide-band sensor data collection capability of data over the complete frequency band.
- (U) ($3,674) Continue development of new signal processing software for the APEX signal processor to achieve maximum performance from systems.
- (U) ($1,200) Continue the integration of a SAR/Inverse SAR capability for the
- (U) ($891) Initiate the development of system technology for the

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	9,972	10,488	XXX	XXX
(U) FY 1995 Appropriated:	XXX	10,488	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUD:	-107	-295	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	9,865	10,193	6,435	9,679

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: H2089 PROJECT TITLE: Advanced Collection Technology

C. (U) OTHER PROGRAM FUNDING SUMMARY:

- (U) Funding: FY 1994 funding reflects an end-of-year execution adjustment to reflect below-threshold reprogrammings ($-107K). FY 1995 funding reflects congressional undistributed reductions for university research ($-181K); travel ($-14K); and an assessment for Small Business Innovative Research ($-100K).
- (U) Schedule: Not applicable.
- (U) Technical: Not applicable.

(U) RELATED RDT&E:

(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602314N (Undersea Warfare Surveillance Technology)
(U) PE 0603254N (Air ASW Systems Development)
(U) PE 0603553N (Surface ASW)
(U) PE 0603792N (Advanced Technology Transition)
(U) PE 0604212N (ASW and Other Helo Developments)
(U) PE 0604221N (P-3 Modernization Program)
(U) PE 0604261N (Acoustic Search Sensors (ENG))

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2142 Undersea Warfare Concepts	9,505	17,030	28,224	34,323	35,865	38,761	40,171	38,842	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program focuses significant science and technology resources on Advanced Technology Demonstrations in support of the Joint Chiefs of Staff's Top Five Joint Warfighting Capabilities. Specifically, this project demonstrates technologies designed to maintain near-perfect real-time knowledge of the enemy and communicate that knowledge to battlegroup units. There are three major components in this project: Airborne/Shipborne Periscope Detection, Lightweight Broadband Variable Depth Sonar, and Littoral Warfare Advanced Development. Each component supports the Joint Mission Areas of Joint Littoral Warfare, Joint Surveillance, and Maritime Support of Land Forces.

(U) The Littoral Warfare Advanced Development subproject plans, executes and analyzes data from sea trials designed to provide increased understanding of the littoral environment and proof of concept for undersea warfare technologies. The effort is focused at the detection, classification, and localization of diesel-electric submarines and mines in the littoral environment. These sea trials will be conducted in areas chosen to produce the bottom interaction, high clutter, and water column variability that prevents current systems from performing well against the diesel-electric submarine and mine threat. The program structure will allow the fleet, system command, and science and technology communities to provide feedback and guidance into the prioritization of the technical issues that require resolution in order to meet the threat. Major sea trials, conducted approximately every eighteen months, will address the high priority issues identified by the Undersea Warfare (USW) community such as sensor interoperability, bistatic/multistatic scenarios, and improvements to current and emerging systems. The major sea trials will be augmented with smaller scale, responsive sea trials designed to provide economy by resolving technical issues that require more investigation to be effectively addressed during a major sea trial. This subproject addresses the Joint Littoral Warfare requirements to detect, classify and localize submarines and mines in support of the warfighting capability of power projection from the sea. This work also addresses the Joint Surveillance issues of real-time detection, classification, localization, and tracking of undersea threats.

(U) The Lightweight Broadband Variable Depth Sonar subproject develops and demonstrates a new capability in active sonar by investigating a high-risk/high-payoff compound technology solution to the Navy's littoral (shallow) water USW problem. This project will demonstrate that the new high energy-dense ceramic Lead Magnesium Niobate can be used to make small, lightweight sonars, and that broad bandwidth acoustic signals can reveal even small submarines in shallow water. It will integrate these two technologies on an operational surface combatant and will demonstrate the capability of this technology against submarine targets in littoral waters of interest to the Navy. This testbed will be inter-operable with and complementary to the Navy's existing SQQ-89 USW system. This subproject meets the Joint Littoral Warfare requirement to provide improved USW systems to detect, track, and localize diesel-electric threat submarines in wide-area and tactical shallow water undersea surveillance applications. This work also addresses Joint Surveillance issues of real-time detection, localization, classification and tracking of undersea threats. Maritime Support of Land Forces requirements to enable our forces to dominate the local undersea battlespace in the vicinity of logistic and replenishment forces are also addressed.

(U) The Airborne/Shipborne Radar Periscope Detection subproject is automating the detection and discrimination of a USW radar for use on ships and aircraft. This effort will increase the probability of detecting submarine periscopes and decrease significantly the probability of false alarms. This increase in capability becomes tactically important at higher sea states and in littoral waters where false targets are common. The platforms for the airborne application will be a P-3 and an S-3, and the platforms for the shipborne applications will be destroyers and aircraft carriers. Combining the airborne and shipborne periscope detection radar programs, which were once separated, provides economy since approximately 45% of the effort is common to both applications. Shipborne periscope detection is expected to present some very low grazing angles, and additional measures such as doppler discrimination, polarization discrimination, and constant false alarm algorithms will be employed if necessary. This work addresses Joint Littoral Warfare requirements to detect and classify undersea targets in support of the warfighting capability of power projection from the sea. It also supports Joint Surveillance requirements by demonstrating a new approach to detecting small submarines. Non-acoustic sensors are used to significantly enhance shallow water USW capabilities associated with potential littoral regional conflicts.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($9,505) Airborne/Shipborne Periscope Detection:
  - Collected data from P-3 aircraft in littoral areas and completed data analysis.

- Completed prototype system design and component selection.
- Initiated brassboard system development.

2. (U) FY 1995 PLAN:

- (U) ($17,303) Airborne/Shipborne Periscope Detection:
  - (U) Complete brassboard system and begin laboratory testing.
  - (U) Incorporate promising technologies from shipborne periscope detection advanced technology demonstration.

3. (U) FY 1996 PLAN:

- (U) ($5,800) Lightweight Broadband Variable Depth Sonar (NEW START):
  - (U) Initiate development of a Lightweight Broadband Variable Depth Sonar for surface ships that will detect and classify small, quiet, slow moving submarines and mines in shallow water environments.

- (U) ($15,775) Airborne/Shipborne Periscope Detection:
  - (U) Conduct:
    -- (U) Brassboard flight test demonstration.
    -- (U) Brassboard ship test demonstration.
    -- (U) Brassboard shore test demonstration.
    -- (U) Ship fleet demonstration unit configuration decision.
  - (U) Continue development of airborne and shipborne fleet demonstration units.

- (U) ($6,646) Littoral Warfare Advanced Development (NEW START):
  - (U) Obtain guidance and feedback from representatives of the USW community (including fleet, system command, and science and technology participants) on priority system and technical issues that require resolution in order to meet the diesel-electric submarine and mine threat.
  - (U) Plan and execute initial littoral sea trial to address the high priority issues determined by the USW community.
    (U) Publish quick-look report from initial sea trial.

- (U) Identify and conduct small-scale, responsive sea trials as needed to further investigate or resolve technical issues not addressed during the initial major sea trial.
- (U) Consolidate and refurbish high priority/cost equipment from previous USW sea test programs (enabling significant cost-savings by reducing the need for new equipment procurement).

3. (U) FY 1997 PLAN:

- (U) ($11,899) Lightweight Broadband Variable Depth Sonar:
  - (U) Model and analyze broadband projector subsystem, broadband receive array, and signal processing subsystems.
  - (U) Initiate:
    -- (U) fabrication and testing of projector subsystem.
    -- (U) fabrication of receive array.

- (U) ($16,000) Airborne/Shipborne Periscope Detection:
  - (U) Complete:
    -- (U) Delivery of three periscope detection radar fleet demonstration units, one for a P-3 aircraft, one for a ship, and one which serves as a necessary spare for both airborne and shipboard applications.
    -- (U) shore test of periscope detection radar fleet demonstration units. The altitude of the shore installation will allow this test to represent both airborne and shipborne applications.

- (U) ($6,424) Littoral Warfare Advanced Development:
  - (U) Continue small-scale, responsive sea trials to further investigate and resolve technical issues identified in the FY 1996 major sea trial.
  - (U) Complete final report of FY 1996 major sea trial results.
  - (U) Plan and prepare for a major sea trial in FY 1998, incorporating results from FY 1996 major sea trial and small-scale sea tests, and continued guidance and feedback from the USW community (including fleet, system command, and science and technology participants).

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603747N PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology PROJECT NUMBER: R2142 PROJECT TITLE: Shallow Water Surveillance Advanced Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	0	XXX	XXX
(U) FY 1995 Appropriated:	XXX	0	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	9,505	17,030	XXX	XXX
(U) FY 1996/97 OSD/OMB Budget Submit:	9,505	17,030	28,221	34,323

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: In FY 1994 funds transferred from PE 0603555N due to PE restructuring ($11,875K). There is also an end-of-year execution adjustment ($630K) and a TRP reprogramming ($-3,000K). In FY 1995, funds transferred from PE 0603555N due to PE restructuring ($26,075K). There are also congressional undistributed reductions for congressional actions ($-7,601K); university research ($-496K); FFRDCs ($-37K); travel ($-15K); and an assessment for Small Business Innovative Research ($-896K). FY 1995 funding also reflects a congressionally directed delay in the lightweight, broadband, variable depth sonar project new start.

(U) Schedule: LBVDS new start moved from FY 1995 to FY 1996.

(U) Technical: None.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602435N (Ocean and Atmospheric Technology)
- (U) PE 0603254N (Air ASW Systems Development)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603747N
PROGRAM ELEMENT TITLE: Undersea Warfare Advanced Technology

PROJECT NUMBER: R2142
PROJECT TITLE: Shallow Water Surveillance Advanced Technology

- (U) PE 0603553N (Surface ASW)
- (U) PE 0603785N (Combat Systems Oceanographic Performance Assessment (CSOPA))
- (U) PE 0603792N (Advanced Technology Transition)
- (U) PE 0604221N (P-3 Modernization Program)
- (U) PE 0604261N (Acoustic Search Sensors (ENG))
- (U) PE 0204311N (Integrated Surveillance System)
- (U) PE 0604503N (Submarine System Equipment Development)
- (U) PE 0604784N (Distributed Surveillance Systems)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603771N
PROGRAM ELEMENT TITLE: Industrial Preparedness Manufacturing Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R1050 Manufacturing Technology	140,629	86,118	41,251	37,609	38,156	28,521	29,286	30,437	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Manufacturing Technology (MANTECH) Program is intended to improve the productivity and responsiveness of the U.S. defense industrial base by funding the development of manufacturing technologies. The MANTECH program, by providing seed funding for the development of moderate to high risk process and equipment technology, permits contractors to upgrade their manufacturing capabilities. Ultimately, the program aims to produce high-quality weapon systems with shorter lead times and reduced acquisition costs. Major areas of endeavor both underway and planned include: advanced manufacturing technology for electronics assembly, laser metalworking, flexible computer manufacturing, composites, metalworking and welding technology. The MANTECH program is being integrated into the Joint Mission Area/Support Area and Joint Warfare Operational Capability process and will utilize the results of these initiatives as appropriate in the program planning process.

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

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

(U) Composites Processing and Manufacturing

- (U) ($6,975) National Center of Excellence for Composites Manufacturing Technology: Completed survey of existing repair procedures and existing Non-Destructive Item procedures for the Field Repair and Non-Destructive Evaluation of Low Observable Structures; completed Low Observable Core Manufacturing Process with implementation

and testing; completed the design and analysis of a composite Mine Countermeasures ship rudder for the Composite Marine Control Surface Program and completed all material testing; continued efforts on the Infrared Spectroscopy project; performed a cooperative "Senior Project", to construct a solar-powered boat with students from Marquette University under the Composites Technology Center initiative; completed and presented the program concept plan/roadmap to the Naval Air Systems Command for review and comment on the Fit-Up and Assembly project.

(U) Metals Processing and Manufacturing

- (U) ($40,000) National Center for Metalworking Technology: Continued development of advanced metalworking technology in squeeze casting; weld optimization for accelerate cooling/direct quench (AC/DQ) steels; advanced consumables for AC/DQ steels; joining of high strength, high toughness alloys for submarine hull applications; improved performance of sliding gold plated electrical conductors; and ion implantation process for surfacing.
- (U) ($1,500) Electroslag Surfacing: Conducted trial runs at Long Beach Naval Shipyard; conducted shipyard/manufacturer demonstrations; continued evaluations of repairability of Electroslag cladding by Gas Metal Arc Welding; continued optimization of the Electroslag process for 70Cu-30Ni cladding; and continued the development of written and video training materials.
- (U) ($13,500) Laser Surface Engineering: The material categories that were addressed by the Center included electronic and opto-electronic materials, polymers, metals, ceramics and diamond films. Films, coatings and surface treatments were developed to achieve wear, corrosion and thermal resistance for mechanical systems such as machine elements, tools, engine components, thermal systems and control surfaces. Research and technology development in manufacturing of diamond and related coatings, nano devices, ion implantation systems, surface modification of composite constituents, physical vapor deposition, chemical vapor deposition, plasma deposition and spray metal forming were addressed.
- (U) ($8,000) National Center for Advanced Gear Manufacturing Technology: Continued cooperative effort with National Institute of Standards and Technology and the Department of Energy, Oak Ridge Facilities, to facilitate a collaborative total quality measurement capability which optimizes domestic, quality assured, precision gear metrology and manufacturing services to industrial, academic and government participants. Developed a calibration service for gear artifacts and master gears; advance gear measurement techniques and mechanisms for achieving traceability of measurements; training and education of the gear industry in proper integration of metrology in gear manufacture, as well as in specific measurement techniques; development and advancement of gear standards for gear metrology; and the development of a formal laboratory accreditation program for gear-related measurement.

- (U) ($1,000) Laser Metalworking: Implemented the mature developed laser processes to Navy facilities including Mare Island Naval Shipyard and Puget Sound Naval Shipyard. Additionally, process development and qualification efforts were continued in the area of laser based repair and refurbishment of nickel aluminum bronze structures, lightweight structures, and cladding. Began development of procedures for laser based coating/paint removal and the development of cladding alloys/procedures for environmentally compliant coatings.
- (U) ($2,500) Spray Metal Forming: Produced prototype components for test and evaluation; solicited additional applications from other services; evaluated production costs; and began test and evaluation of components.
- (U) ($12,000) Cast Ductile Projectiles: Began transition Phase I (Definition) for the MK 64 type cast projectiles and update technical data package; completed feasibility Demonstration Phase IV (environmental testing) for HiFrag type projectiles; completed feasibility Demonstration Phase II (design pattern and core and six consecutive castings) for the MK 64 High Explosive projectile and began Phase III to finalize pattern and core and produce 100 castings; completed Phase I Feasibility Demonstration (stress and thermal analysis and modeling) of the MK 201 76mm projectile; completed Phase I Feasibility Demonstration (stress and thermal analysis) of the MK 200 76mm projectile; continued efforts in the MK 82 Bomb Program to certify cast ductile iron as an acceptable material for use in bomb fabrication and further develop cast ductile iron technology.
- (U) ($500) Taconite Process Technology: The combined efforts of academia, industry and government developed a process to economically extract commercially usable iron ore from taconite.

(U) Advanced Industrial Practices

- (U) ($4,000) Center of Excellence in Ship Hull Designs and Electrical Systems: Supported the design and manufacturing of power transmission systems to include gears, transmissions and cargo winches; shiphulls to include coastal shipping hulls; and electrical systems to include generators, power distribution networks and fiber optic transmission. This included direct support to ship owners/operators, shipyards, component manufacturers, design agents and academic institutions.
- (U) ($5,000) Manufacturing Producibility Center: Established the Manufacturing Producibility Center to evaluate and refine industrial manufacturing processes, designs and patents developed by the Navy Research Laboratories and Centers of Excellence; transferred proven technologies to private industry; assessed the feasibility of enhancing or improving developed patents, processes and designs; and developed improvements to selected technologies to make them commercially viable.
- (U) ($1,000) National Center for Best Manufacturing Practices: Commenced the set-up of the Center of Excellence to promote technology transfer and solve common problems faced by U.S. firms, both commercial and defense.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603771N PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology PROJECT NUMBER: R1050 PROJECT TITLE: Manufacturing Technology

Continued upgrade and maintenance of the Program Manager's Workstation, training and deployment, seminars and workshops, research and customer service and users groups management and development.

(U) Electronics Processing and Manufacturing

- (U) ($7,000) Multi-Function Self-Aligned Gate: Began pre-production run of 100 modules and production validation run of 1200 modules to be implemented in the Cooperative Engagement Capability Program for Airborne and Shipboard testing of active aperture communication arrays. Completed the transition and insertion of selected Air Force contractors technology into ITT production facility. Continued with semi-annual government/industry briefings to effect real-time technology distribution.
- (U) ($11,000) Electronics Manufacturing Productivity Facility: Cleanliness testing at 12 mil pitch surface mount devices; fluxless soldering demonstration and deployment; process hardening of conformal with low volatile organic compounds materials; conformal coating dye tag standard development; process development for rework and repair at 12 mil pitch; and reflow/curing at 12 mil pitch.
- (U) ($750) Electro-Optics Manufacturing: Developed a technology thrust in electro-optics manufacturing, with emphasis on dual-use technology deployment. Developed a strategic plan to execute this thrust.
- (U) ($6,000) EA-6B: The Navy is currently seeking low cost alternatives to the ADVCAP upgrade program in accordance with the FY 1995 Authorization Conference Report.
- (U) ($2,200) Advanced Telecommunications Institute: Continued education programs in telecommunications, multimedia systems, and computing technology.
- (U) ($3,000) Fiber-Optic Acoustic Sensors: Fiber-Optic Acoustic Sensor Technology included a Hydrophone Winding Station, a Hydrophone Optical Assembly Station and a Towed Array Station. The development of this technology has application beyond the defense establishment and includes oceanography and marine biology. It is planned to produce advanced fiber-optic acoustic stations.

(U) Manufacturing Systems

- (U) ($6,000) Automated Manufacturing Research Facility: The Research Facility concentrated efforts in three major areas: 1.) Manufacturing Systems - continued activities in factory engineering, particularly with respect to establishing integrated engineering systems for process, factory, and enterprise design and in the development of tools for evaluating the producibility of mechanical parts utilizing feature-based design inputs; 2.) Precision Machining - continued the on-going Enhanced Machine Controller project which will develop open architecture machine controllers; and 3.) Pilot Demonstrations - aimed at transitioning advanced technology from

the research facility program to commercial manufacturers including precision machining, reverse engineering cells, and an integrated workstation for computer-aided manufacturing systems engineering.

- (U) ($3,300) Joint Logistics Support Center Rapid Acquisition of Manufactured Parts: The funds provided for the Rapid Acquisition of Manufactured Parts were to permit continued research to improve manufacturing processes in depots and industrial facilities.

(U) Other

- (U) ($3,500) Lifecycle Improvement by Networking Critical Technologies: Further development and implementation of the technology resource network for the shipyards and depots. Environmental state of practice reports were issued and follow-on recommended prioritized environmental compliance programs were initiated. Commercialization as a dual-use electrical interconnect screening system with potential application throughout DOD and private industry will be commercialized.
- (U) ($1,500) National Center for Energetics Materials: The Center concentrated efforts in two major areas: 1.) Process Technology and 2.) Environment Technology. Process Technology included: Process Controls for improving methods for process analysis and data collection with the goal of decreased product variability and increased production yields; manufacturing techniques for developing new methods of manufacturing energetic materials with an emphasis on continuous processing techniques in manufacture of energetic materials; and Process Analysis for reducing cycle times, improving quality and minimizing variability. Environmental Technology focused on Pollution Prevention, Environmental Compliance and Reclamation/Recycle efforts.
- (U) ($404) Support: Continued project management at the field activities, laboratories and Naval Industrial Resources Support Activity to participate on Technical Advisory Boards, Executive Advisory Boards and proposal evaluations of all Manufacturing Technology projects. Developed presentations on Manufacturing Technology, Technology Investment Project, Joint Directors Laboratory Reliance Panel on Manufacturing, Science and Technology; and continued the Navy strategic planning process to identify manufacturing gaps in weapons systems.

2. (U) FY 1995 PLAN:

(U) Composites Process and Manufacturing

- (U) ($25,500) National Center of Excellence for Composites Manufacturing Technology: Current projects include: Resin Transfer Molding, Composite Prepreg Scrap Recycling, Non-Destructive Inspection of Heat Damage and Repair Bond Integrity, Composites Electronic Housing, High Thermal Conductivity Fibers, and Manufacturing Technology for

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603771N PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology PROJECT NUMBER: R1050 PROJECT TITLE: Manufacturing Technology

Composite Marine Control Surfaces.

(U) Metals Processing and Manufacturing:

- (U) ($20,164) National Center of Excellence for Metalworking Technology: Continue metalworking initiatives in Powder Injection Molding, Surface Treatment Technology, Semi-Solid Metalworking, Advanced Refurbishment of Engine Parts, Automated Deburring and Chamfering System, Electroslag Surfacing, Material Standards for Powder Metallurgy Alloys and Advanced Consumables for Welding 80-100 ksi Yield Strength Steels.
- (U) ($4,000) Navy Joining Center: This Center has been working on their Rapid Response initiative to provide assistance to Government and industry on materials joining issues. Examples of these issues are containers used to ship electronic missile guidance systems, aircraft engine components, and hazardous materials. High quality welds are vital to the structural integrity and hermetic sealing of these containers. New initiatives in welding procedures and direct shop floor technology transfer will be started. Rapid solutions to Navy materials joining will improve the quality and reduce the cost of manufacturing for new components as well as improve productivity and yield of repair and rework operations. New initiatives include: Underwater Wet Welding, Control of Weld Residual Stresses and Distortion in Thin Section Panel Fabrication and Automated Weld Contour Inspection.
- (U) ($6,000) Cast Ductile Iron: Continue efforts in the development and demonstration of technical feasibility of using cast ductile iron in the fabrication of major caliber ammunition. The application of these new techniques to the casting ductile iron is projected to result in lower cost large caliber ammunition with improved quality and fragmentation effectiveness over forged components.

(U) Advanced Industrial Practices:

- (U) ($334) Manufacturing Producibility Center: FY 1994 funds are currently being used to compete this effort to establish a Producibility Center. FY 1995 funds will be used to maintain contract compliance and issue direction for new projects to the Center.
- (U) ($1,000) National Shipbuilding Research Program: Funds will be used to continue shipbuilding initiatives with the University of Michigan, Peterson Builders and other initiatives identified by the executive steering committee which is comprised of both Government and Commercial shipbuilding activities.
- (U) ($4,000) Best Manufacturing Practices Center of Excellence: This newly established center will continue to identify "best practices" in manufacturing and management across the US industrial base and document those practices in a database to stimulate industry in sharing technologies. The Center will also continue working with the University of Maryland (and others) in research initiatives to be included in college curriculum.

Continue work with the Department of Commerce Manufacturing Extension Partnership program to get new technologies and lessons learned to small and medium size companies across the U.S. Continue to enhance the Program Manager's Workstation to be a more effective tool in helping move from military standards to commercial practices in acquisition reform.

- (U) (5,400) Gulfcoast Regional Maritime Technology Center: The goal of this Center is to become a valued asset to the U.S. shipbuilding industry as it regains its position as a global competitor in maritime markets. They will be responsive to the needs of shipyards and suppliers throughout the U.S. Current initiatives are the Maritime Standards Resource Center and Simulation Based Design for Marine Applications.

(U) Electronics Processing and Manufacturing

- (U) ($11,000) Electronics Manufacturing Productivity Facility (EMPF) : The EMPF areas of endeavor are electronics design, assembly, test, inspection and rework. Efforts to be continued are: Surface Mount Assembly Workcell for Fine Pitch Devices, Wiring Automation System, Solder Alternatives Research, Chloro-Flouro-Carbon Alternatives Testing, Adaptive Manufacturing, Teaching Factories, Fluxless Soldering, Solder Paste Characterization, and Microwave Assembly Cost Reduction. Initiate integrated effort within Office of Naval Research Departments on Power Electronic Building Blocks (PPEB).
- (U) ($1,600) Fiber Optic Acoustic Sensors: Funds will be used to continue this effort started in FY 1994. Be the end of FY95, this program will be complete.

(U) Other

- (U) ($7,120) Technical Engineering: Projects to be funded include: Manufacturing & Engineering Systems (at the National Institute of Standards and Technology); Laser Metalworking; Surface Engineering; Gears and Metrology efforts; the Energetic Materials Technology Center; and the Multi-Function Self Aligned Gate (Transmit/Receive Modules program) for the Cooperative Engagement Concept. Funds will also be issued to Navy laboratories and field activities in order to maintain a controlled contract monitoring process to ensure programs stay on schedule.

3. (U) FY 1996 PLAN:

(U) Composites Processing and Manufacturing

- (U) ($11,000) National Center of Excellence for Composites Manufacturing Technology: Current projects include:

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603771N PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology PROJECT NUMBER: R1050 PROJECT TITLE: Manufacturing Technology

Resin Transfer Molding, Composite Prepreg Scrap Recycling, Non-Destructive Inspection of Heat Damage and Repair Bond Integrity, Composites Electronic Housing, High Thermal Conductivity Fibers, and Manufacturing Technology for Composite Marine Control Surfaces.

(U) Metals Processing and Manufacturing

- (U) ($12,750) National Center of Excellence for Metalworking Technology: Continue metalworking efforts in Power Injection Molding, Surface Treatment Technology, Semi-Solid Forming, Material Standards for Powder Metallurgy Alloys and Advanced Consumables for Welding 80-100 ksi Yield Strength Steels. Complete efforts in Advanced Refurbishment of Engine Parts, Automated Deburring and Chamfering System and Electroslag Surfacing.
- (U) ($3,000) Navy Joining Center: Continue the following initiatives: Underwater Wet Welding, Control of Weld Residual Stresses and Distortion in Thin Section Panel Fabrication and Automated Weld Contour Inspection.
- (U) ($2,750) Manufacturing Science and Advanced Materials Processing Center: Ramp up efforts started in FY94 that were not funded in FY95 due to fiscal constraints on discretionary funds. These efforts include three major projects: Surface Engineering and Materials, Laser Metalworking, and Advanced Gear Manufacturing.
- (U) ($500) Cast Ductile Iron: Continue work on the cast ductile projectile 76mm bombs. Initiate Phase II of the Cast Ductile Bombs program. This work will center around 500 and 1000 pound bombs including prove-out tests.

(U) Advanced Industrial Practices

- (U) ($2,000) Best Manufacturing Practices Center of Excellence Continue efforts with the University of Maryland Engineering Center on student research projects. Conduct 12-15 best practice surveys of defense, commercial and small businesses. Incorporate these practices into a nationwide database. Develop one technical guideline document. Continue operation of the Center itself.
- (U) ($1,000) National Shipbuilding Research Program: Continue efforts as decided by the Executive Advisory Board for the Shipbuilding Council. The continued efforts are with University of Michigan and Peterson Shipbuilders. Initiate work with two other commercial shipyards and one university.

(U) Electronics Processing and Manufacturing

- (U) ($6,251) Electronics Manufacturing Productivity Facility: Continue efforts in the Power Electronics Building Blocks, Surface Mount Assembly Workcell for Fine Pitch Devices, Wiring Automation System, Solder Alternatives Research, Chloro-Flouro-Carbon Alternatives Testing, Adaptive Manufacturing, Teaching Factories, Fluxless Soldering, and Solder Paste Characterization.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603771N PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology PROJECT NUMBER: R1050 PROJECT TITLE: Manufacturing Technology

- (U) ($500) Multi-Function Self-Aligned Gate: Complete this project with associated final reports and end-of-project demonstration details.

(U) Manufacturing Systems
- (U) ($500) Manufacturing and Engineering Systems: Continue efforts in automated manufacturing and standards.

(U) Other
- (U) ($1,000) Energetics Material Center: Continue efforts in Continuous Processing of Composite Propellants, Supercritical Fluid Processing of Energetics, Ammonium Dintiramide MANTECH, and Co-Extrusion.

4. (U) FY 1997 PLAN:

(U) Composites Processing and Manufacturing
- (U) ($9,500) National Center of Excellence for Composites Manufacturing Technology: Initiate efforts in Zdirection Reinforcement, Manufacturing of Ceramic Matrix Composites, Implementation of Processing Science and Manufacturing Processes of Ancillary Equipment. Continue efforts in Resin Transfer Molding, Composite Prepreg Scrap Recycling, Non-Destructive Inspection of Heat Damage and Repair Bond Integrity, Composites Electronic Housing, High Thermal Conductivity Fibers, and Manufacturing Technology for Composite Marine Control Surfaces.

(U) Metals Processing and Manufacturing
- ($11,250) National Center of Excellence for Metalworking Technology: Continue metalworking efforts in Power Injection Molding, Surface Treatment Technology, Semi-Solid Forming, Material Standards for Powder Metallurgy Alloys and Advanced Consumables for Welding 80-100 ksi Yield Strength Steels.
- ($2,750) Navy Joining Center: Continue efforts in Underwater Wet Welding, Control of Weld Residual Stresses and Distortion in Thin Section Panel Fabrication and Automated Weld Contour Inspection.
- ($2,350) Manufacturing Science and Advanced Materials Processing Center: Continue efforts in Laser Metalworking, Surface Engineering and Materials and Advanced Gears.
- ($500) Cast Ductile Iron: Complete Phase II of Cast Bomb program and initiate Phase III and continue up to Low Rante Initial Production.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603771N PROJECT NUMBER: R1050
PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology PROJECT TITLE: Manufacturing Technology

(U) Advanced Industrial Practices
- (U) ($2,000) Best Manufacturing Practices Center of Excellence: Conduct 12 best practice surveys, develop two technical guideline documents, continue dissemination of technology transfer documentation, initiate two new research initiatives with academia.
- (U) ($900) National Shipbuilding Research Program: Continue efforts with commercial shipyards, University of Michigan and collaboration with the Gulfcoast Regional Maritime Technology Center.
- (U) ($400) Gulfcoast Regional Maritime Technology Center: Work closely with the National Shipbuilding Research Program to identify and solve critical manufacturing issues in the shipbuilding technology arena. Continue efforts in Simulation-Based Design, RAM Database for Ships, Optical Fiber and Shipboard Sensors and Motor Drives.

(U) Electronics Processing and Manufacturing
- (U) ($6,059) Electronics Manufacturing Productivity Facility: Complete the Power Electronic Building Block Program. Continue efforts in Surface Mount Assembly Workcell for Fine Pitch Devices, Wiring Automation System, Solder Alternatives Research, Chloro-Flouro-Carbon Alternatives Testing, Adaptive Manufacturing, Teaching Factories, Fluxless Soldering, and Solder Paste Characterization.

(U) Manufacturing Systems
- (U) ($500) Manufacturing and Engineering Systems: Continue efforts in automated manufacturing and computer aided design.

(U) Other
- (U) ($900) Energetics Material Center: Continue efforts in Continuous Processing of Composite Propellants, Supercritical Fluid Processing of Energetics, Ammonium Dintiramide MANTECH, and Co-Extrusion.
- (U) ($500) Lifecyle In-Service Repair Program: Projects include: Repair Technology Network, Information Technology for Repair, Environmental Technology for Repair Processes, Composite Materials Repair Technology and Foreign Manufacturing Repair Technology.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603771N
PROGRAM ELEMENT TITLE: Industrial Preparedness and Manufacturing Technology

PROJECT NUMBER: R1050
PROJECT TITLE: Manufacturing Technology

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	140,629	20,164	XXX	XXX
(U) FY 1995 Appropriated:	XXX	87,818	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	0	-1,700	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	140,629	86,118	41,251	37,609

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: OSD funding for the Navy Manufacturing Science and Technology portion of P.E. 0603705D was transferred into this P.E. in FY 1995 and out. FY 1995 funding was decreased due to an assessment for Small Business Innovative Research ($-1,700K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E: Not applicable.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2226 Mine Countermeasures (MCM) Advanced Technology	43,739	40,989	50,958	50,958	49,541	52,185	52,776	49,814	CONT.	CONT.
TOTAL	43,739	40,989	50,958	50,958	49,541	52,185	52,776	49,814	CONT.	CONT.

* FY 1994 and FY 1995 reflects FY 1996 S&T restructure. Funding moved from former project R2127 and Program Element (PE) 0603555N, project R2142.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program supports demonstrations of technologies for Naval Expeditionary Forces performing the missions of Mine and Expeditionary Warfare. The technologies support a range of capabilities enabling Naval Expeditionary Forces to influence operations ashore.

(U) The previous focus of this PE was to demonstrate and evaluate the capability to adapt the Magic Lantern Advanced Development Model system to meet the shallow water (SW) and surf zone (SZ) minefield detection goals. In FY 1996, this PE has been combined with the appropriate advanced technology demonstrations (ATDs) previously in PE 0603555N and refocused to more effectively transition technologies responding to high-priority Naval Expeditionary Warfare mission requirements. The emphasis is on simulating and testing prototypes of technologies with the potential for providing Naval capabilities in five major areas:

- Mine Warfare (Mine Countermeasures and Mining)
- Amphibious Warfare
- Special Warfare
- Explosive Ordnance Disposal

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

-C4I

Projects will produce prototypes suitable for testing in operational environments and will rely on modeling and simulation to investigate military capability.

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

RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

PROJECT NUMBER: R2226
PROJECT TITLE: Mine Countermeasures Advanced Technology

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($10,984) SW MCM DEMOS: Developed software algorithms to enable target recognition capability for Magic Lantern Adaptation. Completed hardware fabrication and began at-sea testing of the imaging system.
- (U) ($14,055) EXPLOSIVE NEUTRALIZATION: Deployed inert explosive arrays and fuzing. Delivered finalized rocket designs. Bench tested fire control hardware. Initiated launch control algorithm development.
- (U) ($9,200) ADVANCED LIGHTWEIGHT INFLUENCE SWEEP GEAR: Fabricated and tested acoustic and magnetic components. Started acoustic and magnetic subsystem procurement packages.
- (U) ($4,500) ADVANCED DEGAUSSING: Continued work on reducing ship magnetic signatures.
- (U) ($5,000) UNMANNED UNDERSEA VEHICLE FOR MINE WARFARE: Initiated ATD to demonstrate unmanned undersea vehicle capability for clandestine mine detection in very SW. This effort transfers to PE 0603502N in FY 1995.

2. (U) FY 1995 PLAN:

- (U) ($4,525) SW MCM DEMOS: Complete testing of Magic Lantern Adaptation in realistic operational conditions. Identify critical environmental parameters and technology. Develop automatic target recognition capability in the imaging system. Develop plans for reducing the size and weight of existing hardware.
- (U) ($16,018) EXPLOSIVE NEUTRALIZATION: Conduct small scale in-water explosive performance tests against threat mines. Integrate fire control subsystem with platform.
- (U) ($12,946) ADVANCED LIGHTWEIGHT INFLUENCE SWEEP GEAR: Finalize acoustic and magnetic component designs. Award acoustic and magnetic subsystem procurement packages to initiate subsystem fabrication based on design specification.

RDT&E,N BUDGET ITEM JUSTIFICATION DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603782N PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology PROJECT NUMBER: R2226 PROJECT TITLE: Mine Countermeasures Advanced Technology

- (U) ($7,500) ADVANCED DEGAUSSING: Continue scale engine room mockup with magnetic engines and corrosion, stray, and eddy current source reduction analyses for MCM ships. Develop Closed Loop Degaussing concepts and evaluate advanced deperming techniques on a full scale steel hull surface ship.

3. (U) FY 1996 PLAN:

- (U) ($2,492) ADVANCED SURVEILLANCE/RECONNAISSANCE: Utilize advanced satellite, aircraft and surface craft based sensors to assess their ability for surveillance and reconnaissance of littoral battle spaces and to determine the effectiveness for mine and expeditionary warfare applications. Develop automatic target recognition/acquisition algorithms and multi-sensor data fusion techniques to meet the requirement of rapid, wide-area surveillance/reconnaissance and fire control.

- (U) ($18,600) ADVANCED MINE and OBSTACLE CLEARANCE: Demonstrate at-sea deployment of line charge array from air cushion platform. Demonstrate lethality of beach-zone array against land mines. Demonstrate lethality of SZ array against SZ mines.

- (U) ($10,600) ADVANCED MINE SWEEPING: Continue fabrication and factory testing of full-scale acoustic and magnetic subsystems capable of meeting the requirements of in-stride capability to sweep mines in SW. Continue integration of subsystems on air cushion platforms for demonstration testing.

- (U) ($7,073) ADVANCED DEGAUSSING: Complete deperming test on full-scale surface combatant. Conduct closed loop degaussing tests with on-board sensor suite on a surface combatant to develop prediction algorithms.

- (U) ($1,000) MODELING AND SIMULATION: Develop modeling and simulation capability to investigate and document the effectiveness of the concepts developed in this PE. Provide background for selection of prototyping projects and for supporting the higher level modeling and simulation of the Joint Countermine Advanced Concept Technology Demonstration (ACTD).

- (U) ($1,400) ADVANCED AIRBORNE TARGET DESIGNATOR: Initiate development of a prototype airborne target designator based on United States Marine Corps Forward Observer/Forward Air Controller technology. The prototype will be used to demonstrate a capability for shipboard control of guided weapons launched from ground

launchers, ships, and aircraft.

- (U) ($1,468) C4I TECHNOLOGY: Initiate development of a prototype ship-to-shore command and control system for relaying surveillance and target information at high data rates for Naval fire support.

- (U) ($6,800) JOINT COUNTERMINE ACTD: Plan and integrate appropriate technology programs, prepare test sites, and provide logistics support for demonstrating the operational effectiveness of the combined systems participating in the ACTD. Develop the required communication links and system simulations necessary to enhance the integration and to evaluate the military utility of the Mine and Expeditionary Warfare systems of the ACTD. Produce multiple system hardware copies to leave behind with the fleet as residuals.

- (U) ($1,525) SURFACE SURVEILLANCE, TARGET ACQUISITION, AND FIRE CONTROL: Initiate development of a prototype airborne radar providing an all-weather Moving Target Indicator, target acquisition and fire control capability.

4. (U) FY 1997 PLAN:

- (U) ($3,627) ADVANCED SURVEILLANCE/RECONNAISSANCE: Continue utilizing advanced sensors to measure critical battle space parameters and quantify their effectiveness. Demonstrate capabilities in automatic target recognition and multi-sensor data fusion.

- (U) ($16,500) ADVANCED MINE and OBSTACLE CLEARANCE: Demonstrate at-sea deployment of inert SZ array from air cushion platform. Transition the explosive array technology to PE 0603502N for integration with tactical delivery systems.

- (U) ($8,000) ADVANCED DEGAUSSING: Complete full scale demonstration of MCM ferromagnetic and secondary source reduction systems at different geomagnetic locations. Demonstrate prototype closed loop degaussing system in a steel hull surface ship.

- (U) ($9,265) ADVANCED MINE SWEEPING: Perform component check out and demonstration on test platform.

RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

PROJECT NUMBER: R2226
PROJECT TITLE: Mine Countermeasures Advanced Technology

- (U) ($1,500) MODELING AND SIMULATION: Continue modeling and simulation to investigate the military utility of potential Mine and Expeditionary Warfare systems. Provide background for selection of prototyping projects.

- (U) ($1,600) ADVANCED AIRBORNE TARGET DESIGNATOR: Conduct lab and field testing of prototype hardware and software. Initiate packaging and configuration design studies.

- (U) ($1,691) C4I TECHNOLOGY: Perform limited communication system interoperability tests in a laboratory and range environment. Develop a simulation characterizing network performance in an operational environment.

- (U) ($7,000) JOINT COUNTERMINE ACTD: Continue integrating the technology programs, preparing the test sites, and providing logistics support for the ACTD. Continue developing the communication links and system simulations for the ACTD. Continue producing residual hardware to leave behind with the fleet.

- (U) ($1,775) SURFACE SURVEILLANCE, TARGET ACQUISITION, AND FIRE CONTROL: Initiate packaging studies and cost analyses. Initiate integration of radar, signal processor and data link. Conduct laboratory and limited field tests of hardware and software modules.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	4,525	XXX	XXX
(U) FY 1995 Appropriated:	XXX	4,525	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	43,739	36,464	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	43,739	40,989	50,958	50,958

(U) CHANGE SUMMARY EXPLANATION:

RDT&E,N BUDGET ITEM JUSTIFICATION

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603782N
PROGRAM ELEMENT TITLE: Mine and Expeditionary Warfare Advanced Technology

PROJECT NUMBER: R2226
PROJECT TITLE: Mine Countermeasures Advanced Technology

(U) Funding: Funding increases in FY 1994 due to comparability adjustments for PE realignments ($41,936K) and end-of-year execution adjustments ($1,803K). Funding in FY 1995 reflects comparability adjustments for PE realignments ($38,946K); congressional undistributed reductions for: university research ($-815K), consulting support services ($-77K), Federally Funded Research and Development Centers ($-54K), and travel ($-61K); and an assessment for Small Business Innovative Research ($-1,475K).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- PE 0601153N (Defense Research Sciences)
- PE 0602131M (Marine Corps Landing Force Technology)
- PE 0602314N (Undersea Surveillance and Weapons Technology)
- PE 0602315N (MCM, Mining and Special Warfare Technology)
- PE 0602435N (Oceanographic and Atmospheric Technology)
- PE 0603502N (Surface and Shallow Water MCM)
- PE 0603528N (Non-Acoustic ASW)
- PE 0603612M (Marine Corps Mine Countermeasures)
- PE 0603640M (Marine Corps Advanced Technology)
- PE 0604373N (Airborne Mine Countermeasures)
- PE 0604784N (Distributed Surveillance System)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Advanced Technology Demonstration										
R1889	85,894	71,668	96,825	108,423	114,685	120,264	123,567	128,629	CONT.	CONT.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program demonstrates high-risk/high-payoff technologies that could significantly improve Joint Chiefs of Staff's Future Joint Warfighting Capabilities. Advanced Technology Demonstration (ATD) programs cover integrating and assessing technology in a realistic operational environment. These programs offer an opportunity to identify and move efficiently emerging technologies from laboratory experiments to fleet systems. ATD programs are selected for a match between technological potential and Navy requirements which are derived from operational issues of concern to the fleet, Joint Mission Area/Support Area assessments, and the Science and Technology Roundtables. Risk-reducing ATDs 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) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 1995

BUDGET ACTIVITY: 3 PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition
PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Demonstration

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($465) QUIET PROPELLER -- Conducted sea trials for quiet surface ship propeller and analyzed data. Demonstrated significant reduction in propeller cavitation at high speed, with corresponding reduction in radiated noise.
- (U) ($3,700) MULTIBEAM DETECTION/CLASSIFICATION -- Conducted multi-channel sonar system at-sea demonstration, showing significant improvement in threat detection and classification through improved signal processing. Prepared system data package to facilitate transition.
- (U) ($1,500) SYNTHETIC APERTURE RADAR (SAR) COUNTERMEASURES -- Continued airborne testing of methods for spoofing threat radars.
- (U) ($5,100) MULTI-BAND ANTI-SHIP MISSILE DEFENSE TACTICAL ELECTRONIC SYSTEM (MATES) -- Integrated and tested hardware/software. Performed field test showing improved soft-kill of threat cruise missiles.
- (U) ($3,660) SUBMARINE VOLUMETRIC TOWED ARRAY -- Completed multiple-line hydro-mechanical trials of improved towed array sonar with transition potential to New Attack Submarine.
- (U) ($6,420) MULTI-MISSION PROPULSION -- Finished vehicle assembly and conducted ground and flight tests of improved propulsion system for air-to-air missiles.
- (U) ($2,000) HIGH PERFORMANCE AMMUNITION MAGAZINE -- Completed full-scale demonstration construction and conducted high explosive test.
- (U) ($2,670) AIRCRAFT SITUATIONAL AWARENESS -- Completed ATD. Additional details available at a higher level of classification.
- (U) ($4,200) LOW PROBABILITY OF INTERCEPT COMMUNICATIONS -- Began subsystem electronic design and hardware fabrication. Wrote system control and network software.
- (U) ($4,200) ADVANCED ANTI-SUBMARINE WARFARE (ASW) RECEIVER -- Demonstrated key hardware components and software algorithms to greatly improve data rate and reliability of communications between sonobouys and maritime patrol aircraft.
- (U) ($4,200) ADVANCED SELF-DEFENSE COMBAT SYSTEM (ASDCS) -- Completed development of system architecture to improve response time of surface ship air defenses against threat cruise missiles. Developed, interconnected, and tested principal elements in local area network.
- (U) ($3,800) TORPEDO TERMINAL PLACEMENT -- Completed and evaluated system modeling, performed test vehicle integration,

and initiated in-water testing of heavyweight configuration.

- (U) ($2,337) FREEZE-DRIED RED BLOOD CELLS -- Increased circulation survival rate. Conducted animal testing. Developed scale-up techniques.
- (U) ($2,476) VOICE/DATA INTEGRATION -- Extended software capabilities to allow integration of low-data-rate voice and tactical data over a network consisting of multiple 2400 bits per second links. Provided integration techniques that are scalable to higher-bandwidth communication media.
- (U) ($400) RADIANT OUTLAW -- Continued development of innovative technique for classifying radar contacts by doppler vibration signature.
- (U) ($200) HELMET-MOUNTED MISSION REHEARSAL SIMULATION SYSTEM (HMMRSS) -- Continued development of prototype system for improving pilot mission performance through on-ship virtual-reality training.
- (U) ($480) CORONA AND PULSED POWER AGENT DESTRUCTION -- Completed demonstration of prototype system for filtering and destroying threat chemical and biological agents in intake to surface ship ventilation systems.
- (U) ($2,350) AIR VEHICLE DIAGNOSTIC SYSTEM (AVDS) -- Initiated ATD to reduce maintenance cost and improve safety of critical mechanical components through computer monitoring of equipment noise and vibration. Acquired host computer system and collected SH-60 helicopter gear train seeded fault data to train neural network.
- (U) ($2,500) ADVANCED HYBRID PROPULSOR - Initiated ATD to develop an affordable, lighter propulsor for future submarines. Hydroacoustically designed and fabricated scale models of innovative submarine propulsor.
- (U) ($1,250) LM-2500R ENGINE -- Conducted Congressionally-directed study.
- (U) ($29,907) CRUISE MISSILE DEFENSE (MOUNTAIN TOP) -- Conducted Standard Missile (SM-2) flight out profile simulations and design mods for AEGIS and SM-2. Tested Advanced Research Projects Agency surveillance radar against air targets and conducted atmospheric testing. Procured two Cooperative Engagement Concept units and planned installation for the mountain top and designated AEGIS ship. Moved SPG-51 to mountain top. Initiated the engineering to modify an AEGIS ship to fire on remote track.
- (U) ($1,000) MAGNETOHYDRODYNAMICS (MHD) -- Completed Congressionally-directed ATD. Continued design of underwater test vehicle for open ocean environment to demonstrate and determine the feasibility of the MHD concept.
- (U) ($1,079) Selected and performed planning for FY 1996-start ATDs. Conducted independent review of ongoing ATD programs.

2. (U) FY 1995 PLAN:

- (U) ($1,420) SAR COUNTERMEASURES -- Complete final demonstration of synthetic aperture radar countermeasure system and

transition to full-scale engineering development.

- (U) ($3,300) ADVANCED ASW RECEIVER -- Complete ATD with realistic testing of improved sonobouy communication prototype system.
- (U) ($3,790) HMMRSS -- Complete integration of helmet-mounted display with enhanced photo imagery display capability, including rapid updates of target/threat imagery.
- (U) ($5,466) FREEZE-DRIED RED BLOOD CELLS -- Complete pre-clinical trials and seek Federal Drug Administration investigational approval for a new drug.
- (U) ($5,690) LOW PROBABILITY OF INTERCEPT COMMUNICATIONS -- Perform system integration and complete flight demonstration of both communication link performance and performance against various intercept receiver types.
- (U) ($5,210) ASDCS -- Install in land- based work station and conduct multiple target encounter simulated test to demonstrate operational capability of ASDCS.
- (U) ($4,360) RADIANT OUTLAW -- Install sensor pod on P-3C testbed aircraft. Conduct flight tests to demonstrate performance in classification of radar contacts.
- (U) ($4,360) TORPEDO TERMINAL PLACEMENT -- Complete final in-water demonstration of heavyweight and lightweight configuration. Prepare system and software specifications.
- (U) ($3,310) VOICE/DATA INTEGRATION -- Demonstrate integrated voice and data services over low-bandwidth, mixed-media network such as High Frequency (HF), Ultra HF Satellite Communication, and HF Line of Sight. Demonstrate interoperability between warrior and high speed terrestrial networks via interconnections to the Global Grid demonstration testbed.
- (U) ($190) MATES -- Deliver final report documenting technology developed for surface ship self defense against incoming cruise missiles.
- (U) ($5,870) AVDS -- Train neural network diagnostic software to identify and warn of helicopter gearbox impending failure using seeded faults. Test ability of system to correctly identify faulty and non-faulty gearboxes, and to diagnose specific faults.
- (U) ($4,260) ADVANCED HYBRID PROPULSOR -- Conduct water tunnel and tow tank tests at 1/16 scale. Demonstrate cavitation in maneuvers at 1/15 scale. Conduct structural and shock analyses.
- (U) ($3,310) EAGER (AUTONOMOUS DECOY) -- Initiate ATD demonstrating autonomous decoy for ship self defense against threat cruise missiles. Design airframe and propulsion system; modify existing flight control system; procure electronic payload and initiate modifications.
- (U) ($2,840) HF SURFACE WAVE SHIPBOARD RADAR (HFSWR) -- Initiate ATD to demonstrate a cost effective transmitter and antenna that meets the power gain and performance parameters to satisfy baseline target detection requirements for

warning of low-flying low-signature threat cruise missiles and tactical ballistic missiles.

- (U) ($4,260) SHALLOW WATER (SW) TORPEDO GUIDANCE & CONTROL (G&C) -- Initiate development of detection/classification/homing algorithms against a diesel-electric submarine in SW environments.
- (U) ($4,450) VIBROTACTILE SPATIAL ORIENTATION -- Initiate ATD to improve flight safety by demonstrating a nonvisual, tactile feedback system for maintaining pilot orientation to the horizon. Conduct initial demonstration in fixed wing aircraft.
- (U) ($6,820) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Initiate ATD to demonstrate an integrated composite antenna mast for surface ship applications. Goals include reduced signature, reduced topside weight, and improved antenna/sensor performance. Complete design, verify performance predictions, and commence fabrication of structural mast full-scale land-based test article.
- (U) ($1,667) SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM -- Conduct Congressionally-directed demonstration.
- (U) ($1,095) Select and perform planning for FY 1997-start ATDs. Conduct independent reviews of on-going ATD programs.

3. (U) FY 1996 PLAN:

- (U) ($6,000) RADIANT OUTLAW -- Complete flight tests and demonstration of performance in classifying radar contacts based on unique doppler signature.
- (U) ($5,000) HMMRSS -- Complete final demonstration of next-generation mission rehearsal system.
- (U) ($3,850) AVDS -- Complete flight and ground demonstrations of fully-integrated system and evaluate performance. Prepare data package for transition of technology to operational systems.
- (U) ($6,000) ADVANCED HYBRID PROPULSOR -- Conduct 1/4 scale propulsor performance demonstration on the Large Scale Vehicle at Lake Pend Oreille, ID. Evaluate acoustic performance and transition technology to New Attack Submarine.
- (U) ($7,000) HFSWR -- Exercise simulator to examine effects of various threat scenarios. Prepare system specifications and issue contract for shipboard demonstration system.
- (U) ($6,750) EAGER (AUTONOMOUS DECOY) -- Complete system design, fabricate test hardware, integrate subsystems, bench test.
- (U) ($4,300) VIBROTACTILE SPATIAL ORIENTATION -- Conduct demonstration of nonvisual, tactile feedback system in a rotary-wing aircraft and a second fixed-wing aircraft.
- (U) ($5,000) SW TORPEDO G & C -- Demonstrate SW classification and environmental adaptation to achieve enhanced performance against diesel-electric submarines in SW environments.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Demonstration

- (U) ($7,900) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Conduct land-based testing of full-scale structural masts to confirm predictions/design.
- (U) ($4,800) HIGHLY RESPONSIVE MISSILE CONTROL SYSTEM -- Initiate ATD to improve ship self defense against anti-ship cruise missiles, via highly maneuverable intercept missile technology. Define performance requirements and develop required control system algorithms.
- (U) ($3,600) SMART SKINS ARRAY -- Initiate ATD to embed large aperture antenna arrays in aircraft skin for improved sensor performance. Complete design verification and subcomponent testing.
- (U) ($5,500) TACTICAL AIRCRAFT DIRECTED INFRARED COUNTERMEASURES (DIRCM) -- Initiate ATD to track and jam infrared (IR) guided missile threats to aircraft. Complete performance testing of mid-IR laser and develop system software for pointer/tracker.
- (U) ($5,000) DUAL MISSION ADVANCED MISSILE AIRFRAME -- Initiate ATD to demonstrate a hybrid missile airframe to restore U.S. tactical advantage against advanced air threats. Perform design of airframe and jet reaction control device.
- (U) ($6,000) COMPETENT MUNITIONS FOR THE 5" GUN -- Initiate ATD to demonstrate a low cost, highly accurate guidance and control package for improved naval surface fire support from surface ship 5" guns. Conduct inertial guidance gyro demonstration.
- (U) ($3,000) ADVANCED EMBEDDED TRAINING CONCEPTS FOR SHIPBOARD SYSTEMS -- Initiate ATD to improve shipboard training. Complete integration of enabling technologies including: eye tracking, advanced computer technology, helmet-mounted displays, and advanced visualization techniques.
- (U) ($4,500) ADVANCED ELECTRONIC COUNTERMEASURES (ECM) TRANSMITTER FOR SHIP DEFENSE -- Initiate ATD to provide more effective soft-kill capability against anti-ship cruise missiles. Complete system design and performance trade-off.
- (U) ($5,000) MULTI-BEAM, MULTI-FREQUENCY, SUBMARINE SUPER HF (SHF) PHASED ARRAY ANTENNA -- Initiate ATD to improve submarine connectivity with the littoral battleforce. Perform module design and layout for demonstration phased array.
- (U) ($4,000) LITTORAL WARFARE REAL-TIME ELECTROMAGNETIC INTERFERENCE (EMI) MANAGEMENT SYSTEM -- Initiate ATD to improve bandwidth availability and reduce interference through instantaneous control of combat system frequency assignments. Define data requirements and develop EMI prediction and assessment models.
- (U) ($2,000) VOICE/DATA INTEGRATION -- Complete demonstration. Deliver data package for transition to operational systems.
- (U) ($1,625) Select and perform planning for FY 1998-start ATDs. Conduct independent reviews of on-going ATD programs.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Demonstration

4. (U) FY 1997 PLAN:

- (U) ($4,000) HFSWR -- Complete at-sea demonstration of HFSWR against low-flying aircraft targets and sea-skimming target drones.
- (U) ($4,500) EAGER (AUTONOMOUS DECOY) -- Complete preliminary testing, assemble demonstration vehicle, integrate vehicle and payload, and conduct demonstration.
- (U) ($4,300) VIBROTACTILE SPATIAL ORIENTATION -- Complete final fixed-wing demonstration which includes the added capabilities of target awareness.
- (U) ($4,000) SW TORPEDO G & C -- Demonstrate the complete SW detection/ classification/homing processing system using the MK50 and ADCAP sensors.
- (U) ($7,900) ADVANCED ENCLOSED MAST/SENSOR SYSTEM -- Fabricate at-sea mast, install and conduct initial performance demonstration of at-sea mast. Transition to advanced development for extended at-sea trials.
- (U) ($6,500) HIGHLY RESPONSIVE MISSILE CONTROL SYSTEMS -- Complete performance assessment and hardware/software integration.
- (U) ($4,200) SMART SKINS ARRAY -- Fabricate Advanced Development Model (ADM) and conduct ADM ground test/analysis.
- (U) ($5,400) TACTICAL AIRCRAFT DIRCM -- Demonstrate countermeasures for fixed targets, rail-based target, and airborne captive seekers.
- (U) ($5,600) DUAL MISSION ADVANCED MISSILE AIRFRAME -- Complete fabrication of airframe, rocket motor, jet reaction control, autopilot and telemetry.
- (U) ($6,000) COMPETENT MUNITIONS FOR THE 5" GUN -- Conduct inertial guidance fuse package demonstration.
- (U) ($4,000) ADVANCED EMBEDDED TRAINING CONCEPTS FOR SHIPBOARD SYSTEMS -- Conduct demonstration of an advanced training prototype system.
- (U) ($5,500) ADVANCED ECM TRANSMITTER FOR SHIP DEFENSE -- Complete fabrication, assembly and conduct component/subsystem testing.
- (U) ($6,000) MULTI-BEAM, MULTI-FREQUENCY, SUBMARINE SHF PHASED ARRAY ANTENNA -- Conduct component performance evaluation and perform design qualification tests.
- (U) ($6,000) LITTORAL WARFARE REAL-TIME EMI MANAGEMENT SYSTEM -- Complete development of intra- and inter-platform networks and electromagnetic environment monitor.
- (U) ($34,523) Select and perform planning for FY 1998-start ATDs. Conduct independent reviews of on-going ATD programs.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Demonstration

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	85,627	79,863	XXX	XXX
(U) FY 1995 Appropriated:	XXX	75,210	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	267	-3,542	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	85,894	71,668	96,825	108,423

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Funding increases in FY 1994 due to end-of year-execution adjustments ($267K). In FY 1995, funding changes due to congressional undistributed reductions for: university research ($-3,415K); Federally Funded Research and Development Centers ($-13K); and travel ($-114K).

(U) Schedule: Not Applicable.

(U) Technical: Not Applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: (Dollars in thousands) Not Applicable.

(U) RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602111N (Air and Surface Weapons Technology)
- (U) PE 0602121N (Surface Ship and Submarine HM&E Technology)
- (U) PE 0602122N (Aircraft Technology)

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603792N
PROGRAM ELEMENT TITLE: Advanced Technology Transition

PROJECT NUMBER: R1889
PROJECT TITLE: Advanced Technology Demonstration

- (U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
- (U) PE 0602233N (Readiness, Training and Environmental Quality Tech)
- (U) PE 0602234N (Materials, Electronics & Computer Technology)
- (U) PE 0602270N (Electronic Warfare Technology)
- (U) PE 0602314N (Undersea Warfare Surveillance Technology)
- (U) PE 0602435N (Oceanographic & Atmospheric Technology)
- (U) PE 0602633N (Undersea Warfare Weapon Technology)

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X2091 Space and Electronic Warfare (SEW) Advanced Technology	2,710	9,744	15,792	17,387	20,765	17,758	18,224	18,706	CONT.	CONT.
R2239 Advanced Targeting	0	10,098	11,002	13,320	8,753	995	995	995	CONT.	CONT.
TOTAL	2,710	19,842	26,794	30,707	29,518	18,753	19,219	19,701	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) funds two projects: (1) R2239, Advanced Targeting and, (2) Project X2091, Space and Electronic Warfare (SEW) Advance Technology which develops communications technologies, real-time precision targeting information and decision aids which support the effective utilization of naval forces in conducting Joint operations with the other Services or our allies. Efforts include development of high capacity, low-probability-of-intercept communication; distributed networks; distributed command and control real-time multi-level secure systems; integrated voice/data/video communications techniques; software specification tools; algorithms for specific target identification and precision targeting; interactive collaborative decision aids; and supporting technologies for a multi-mission broadband antenna and Command, Control, and Communications (C3) embedded training. The PE is planned jointly in accordance with Tri-Service Reliance agreements for C3 technology and is reviewed and approved by the principals of the Joint Directors of Laboratories for Reliance.

(U) This PE primarily supports the following Joint Mission Areas and Support Areas: Strike Warfare, Littoral Warfare, Space and Electronic Warfare (SEW)/Intelligence, Strategic Deterrence, Maritime Support of Land Forces, and Readiness. The focus is on development and demonstrations of next-generation C3 systems, demonstrating a capability to perform precision targeting aided by real-time interactive force level planning and rehearsal in a joint arena supporting a multi-platform environment, aircraft, and submarines. There are two projects supported by the PE:

1. (U) SEW Advanced Technology -- This project is pursuing work in telecommunications, networking, security, and real-time decision aids for Joint military operations. Efforts will develop and demonstrate a multinet, multimedia communications

controller that provides a smart software-intelligent interface between user Transmit/Receive communications systems capable of adjusting bandwidth/frequency to balance system loading, as well as state-of-the-art telecommunications technologies such as high data rate local-area-networks (LAN) that can meet unique military data transfer requirements using commercially developed Asynchronous Transfer Mode (ATM)/Synchronous Optical Network technologies. These high speed LANs will provide the ability to perform collaborative strike planning in the Real-Time Support for Joint Power Projection project by developing and integrating multi-node expert computer workstations and intelligent data bases, through ATM networking which will eventually operate in the gigabits per second regime. Information can then be communicated electronically from a shipboard multi-beamed steerable antenna interoperating with reconnaissance and surveillance sensors and aircraft to enhance joint strike planning among Navy platforms and between other Services. In addition, integrating real-time information from sources such as the Precision Signals Intelligence (SIGINT) Targeting System (PSTS) and tactical reconnaissance and surveillance data will greatly improve asset allocation, precision targeting and execution of strike missions.

2. (U) Advanced Targeting -- the PSTS is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time target identification and precision targeting information, sensor-to-shooter target updating, and Battle Damage Assessment. PSTS will enhance the tactical utility/applicability of existing national assets and provide the tactical commander with performance improvements in terms of targeting accuracy, targets of interest, timeliness, and target identification. Technical challenges include development of advanced signal processing and data fusion algorithms for target detection and classification; and exploitation of multiple signal characteristics for specific emitter identifications.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the ADVANCED DEVELOPMENT Budget Activity because it encompasses design, development, simulation, or experimental testing or 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 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
X2091 Space and Electronic Warfare (SEW) Advanced Technology	2,710	9,744	15,792	17,387	20,765	17,758	18,224	18,706	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Demonstrate advanced technology components, subsystems and systems that will improve the Navy's Command, Control and Communications (C3) distributed networks in areas such as high data rates, optimization and automation of network resources, multi-level access and security of databases and the ability to transmit and receive multi-media data (voice/data/video) over narrow bandwidth communication circuits. Capabilities realized from these efforts will contribute to the Navy's ability to maintain an accurate situational assessment and tactical picture in near-real-time through shared knowledge of threatening situations which can then be communicated to all forces in near-real-time. Projects will be conducted in the following areas: (1) Automated Integrated Communication Systems (AICS) that utilizes digital networking techniques to integrate wideband data (voice/data/video) for transmitting over narrowband communication links; (2) Specification Tool for Software Requirements (STSR) for verification of software specifications; (3) Multi-Level Secure (MLS) systems that provide embedded security for communicating at multi-security levels; (4) Supporting technologies; e.g., Multi-Mission Broadband Antennas (MMBA) and C3 Embedded Training (CET); (5) Real-Time Support for Joint Power Projection Operations (RTS/JPP) that provides collaborative strike force planning and mission execution for Joint service system.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS:

- (U) ($504) AICS: Completed design of full Tactical Digital Information Exchange System node to integrate MLS processing capabilities into external communications. Evaluated technology solutions for integrated net management.

- (U) ($833) STSR: Completed software requirements specification, module decomposition, abstract interfaces, and user design of toolset to apply formal methods to specifying software requirements. Developed a prototype consistency checker to analyze software specifications for completeness, consistency, state transition, and deterministic behavior of safety-critical systems and fire control applications.
- (U) ($673) MLS: Developed system prototype designs and began assembling test configurations allowing the Navy to develop "trusted" MLS Data Systems for a secure Copernicus architecture.
- (U) ($700) MMBA: Initiated risk-reduction studies for MMBA.

2. (U) FY 1995 PLAN:

- (U) ($600) AICS: Demonstrate system connectivity from platform to platform across multinet media. Demonstrate system Information Security solutions.
- (U) ($610) STSR: Complete report on toolset's software design. Extend specification editor and simulator. Develop initial version of mechanical verifier. Demonstrate simulator and verifier.
- (U) ($750) MLS: Evaluate test configurations against security policy. Evaluate impact of tested MLS technology on reducing overall system risks.
- (U) ($1,394) MMBA: Complete risk-reduction studies of individual module design, emphasizing Transmit and Receive (T/R) module interference. Investigate signal processing and beam steering risks associated with over 20 thousand T/R module design. Review contractor preliminary design proposals.
- (U) ($3,000) RTS/JPP: Conduct joint strike planning demonstrations at Washington, DC sites (Naval Research Laboratory and Washington Planning Center), operational and training sites (USACOM and Navy Strike Warfare Center) that includes two modules: (1) force level rehearsal module for rapid, collaborative planning, three dimensional visualization, rehearsal and replanning of a strike mission plan enhanced with radar terrain masking, tactical situation display, and environmental and electronic warfare effects and (2) target analysis module for target visualization and access to intelligence databases. Interface the rehearsal module with existing Joint planning and execution systems such as the Tomahawk Strike Coordination Module (TSCM), Contingency Tactical Air Planning System, and Joint Maritime Command Information System (JMCIS) for initial test and validation.
- (U) ($2,400) RTS/JPP: Conduct F/A-18 flight simulation of in-air strike offensive and devensive mission management, including rerouting, replanning, retargetting and receipt of sensor data from joint sensors.
- (U) ($990) RTS/JPP: Design an Asynchronous Transfer Mode/Synchronous Optical Network based Scalable High Performance local-area-network (LAN) laboratory demonstration at 155 megabit per second rate. Evaluate

performance in land-based site with multi-protocol shipboard interfaces.

3. (U) FY 1996 PLAN:

- (U) ($1,132) STSR: Conduct a full-scale demonstration of the STSR toolset, the specification editor, the consistency and completeness checker, the simulator, and the initial verifier. Extend mechanical verifier. The extended verifier will handle larger software specifications and verify several more classes of application properties. Develop "target" software requirements specification to support system demonstration.
- (U) ($1,442) AICS: Demonstrate integrated ship and shore system that shows distributed, layered network control and management. Demonstration will include operational rule-based implementation.
- (U) ($1,117) MLS: The high assurance, locally distributed MLS strike planner developed in FY 1995 will be used to explore different security architecture for MLS strike planning.
- (U) ($4,601) RTS/JPP: Integrate at Navy operational site new technology modules for strike planning and execution with collaborative planning and query services and other technology efforts directed toward Global Command and Control System development. Modules will be installed on fleet workstations that will allow collaborative planning, rehearsal and monitoring of a strike operation. With optimized distributed algorithms, collaborative planning tools, a scalable high performance shipboard LAN, and tactical aircraft workstations, simulated tactical information can be utilized to demonstrate in real-time, optimized planning and routing of a strike mission coordinated from the JMCIS.
- (U) ($3,000) RTS/JPP: Conduct simulated and flight demonstrations of advanced real-time information flow to the cockpit with synthetic environments and advanced visualization technology demonstrations.
- (U) ($1,500) RTS: Demonstrate a 155 megabit per second LAN with interfaces to shipboard comunication systems as a shipboard prototype.
- (U) ($3,000) MMBA: Evaluate capabilities of candidates technologies and specify characteristics for shipboard prototype multi-mode multimission broadband antenna capable of receiving multiple satellite communications and intelligence data links. Award industry contract for shipboard prototype.

4. (U) FY 1997 PLAN:

- (U) ($4,070) RTS/JPP: Demonstrate plan optimization and multiple interdependent routing algorithms in Navy demonstration site. Conduct joint multi-laboratory field demonstrations of interoperable planning and execution

systems for Commander Joint Task Force and Joint Air Force Component Command power projection planning and exercise of joint strike assets.

- (U) ($2,600) RTS/JPP: Conduct Joint Navy/Air Force flight demonstration of advance cockpit information management, synthetic environment and helmet-mounted display technology.
- (U) ($2,000) RTS/JPP: Demonstrate and test 2.4 gigabit per second LAN in a shipboard prototype.
- (U) ($5,800) MMBA: Continue development of broadband antenna and begin testing for at-sea use. Emphasize simulation in support of coherent C3 system.
- (U) ($1,959) AICS: Demonstrate Joint systems that shows integrated interface with JCS required global and theater level network control and management. Demonstration will include operational interface with US Army developed Joint communication and planning system.
- (U) ($958) MLS: Network security requirements (i.e., distributed identification and authentication, encryption, key management, and operating system support) resulting from the FY 1996 MLS Strike planning security architecture comparisions will be evaluated and tested against the assurance strategy/security architecture and security policy.

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	2,711	15,807	XXX	XXX
(U) FY 1995 Appropriated:	0	10,707	XXX	XXX
(U) Adjustments from Appropriated/PRESBUDG:	-1	-963	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	2,710	9,744	15,792	17,387

FY 1996 RDT&E,N BUDGET JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

PROJECT NUMBER: X2091
PROJECT TITLE: Space & Electronic Warfare (SEW) Advanced Technology

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustment in FY 1994 is for End-of-Year execution (-1) to reflect below threshold reprogramming. Fund Adjustments in FY 1995 are for: Congressional Undistributed Cuts for University Research (-285); Consulting Services Support Reduction (-411); Travel (-22); and, an assessment for Small Business Innovative Research (-245).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

(U) PE 0301567G (Computer Security Program)
(U) PE 0303140N (Information Systems Security Plan)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0604231N (Tactical Command Systems)
(U) PE 0604574N (Navy Tactical Computer Resources)

D. (U) SCHEDULE PROFILE: Not applicable.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1994 ACTUAL	FY 1995 ESTIMATE	FY 1996 ESTIMATE	FY 1997 ESTIMATE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
R2239 Advanced Targeting	0	10,098	11,002	13,320	8,753	995	995	995	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Precision Signals Intelligence (SIGINT) Targeting System (PSTS) addressed in the Director of Defense, Research, and Engineering Global Surveillance and Communications Thrust is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time specific target identification and precision targeting information, sensor-to-shooter target updating and Battle Damage Assessment. The proposed system will enhance the tactical utility and application of existing national assets so as to provide the tactical commander involved in future conflicts with significant performance improvements, resulting in a total surveillance network which is more responsive to changing world economic and political threats in terms of targeting accuracy, targets of interest, timeliness, and target identification. PSTS will develop Joint Service/Defense Agency cooperative precision targeting site enhancements and Global Concept of Operations for optimal asset cooperative utilization and minimal operational impact. Technical challenges include development of advanced signal processing and data fusion algorithms for target detection and classification methodology; exploitation of multiple signal characteristics for specific emmiter identification; modeling and simulation to assure optimal resource allocation for coopertive precision targeting and primary mission performance; and data compression technologies. Further details are available at a higher level of classification.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1994 ACCOMPLISHMENTS: Available above SECRET level of classification.

2. (U) FY 1995 PLAN: Available above SECRET level of classification.

3. (U) FY 1996 PLAN: Available above SECRET level of classification.

4. (U) FY 1997 PLAN: Available above SECRET level of classification.

FY 1996 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1995

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N
PROGRAM ELEMENT TITLE: C3 Advanced Technology

PROJECT NUMBER: R2239
PROJECT TITLE: Advanced Targeting

B. (U) PROGRAM CHANGE SUMMARY:

	FY 1994	FY 1995	FY 1996	FY 1997
(U) FY 1995 President's Budget:	0	10,749	XXX	XXX
(U) FY 1995 Appropriated:	XXX	10,749	XXX	XXX
(U) Adjustments from Appropriated/FY 1995 PRESBUDG:	0	-651	XXX	XXX
(U) FY 1996/97 PRESBUDG Submit:	0	10,098	11,002	13,320

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Fund adjustments in FY 1995 are for: Congressional Undistributed Cuts for University Research (-286); Travel (-15); and, an assessment for Small Business Innovative Research (-350).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Available above SECRET level of classification.

(U) RELATED RDT&E: Available above SECRET level of classification.

D. (U) SCHEDULE PROFILE: Not applicable.

THIS PAGE INTENTIONALLY LEFT BLANK