

# UNCLASSIFIED

FY 2000 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1999

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 1998 ESTIMATE	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Ship, Submarine & Logistics Technology	43,430	55,456	43,786	42,967	44,744	46,126	47,527	48,831	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides for surface ship, submarine, logistics, and environmental quality applied research that contributes to meeting 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 and cruise missiles to the United States and deployed forces.

(U) Due to the sheer volume of efforts included in this program element, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this program element.

(U) This PE develops affordable hull, mechanical, and electrical (HM&E) technology options for both surface ships and submarines. There are four technology thrusts for both surface ships and submarines: Signature Control, Structural Systems, Power and Automation, and Maneuvering and Seakeeping. They address electromagnetic and acoustic signature reduction, structural and weapon related survivability improvement, electrical and mechanical system efficiency, damage control, hydrodynamics, and alternative propulsion.

(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 offshore facilities. Technology development in these areas responds to a variety of requirements, including: the logistic support needed for amphibious landing, the diagnostic technologies that enable the implementation of a condition-based vs. time-based maintenance philosophy, and long distance logistics supply chains with short reaction time.

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

(U) In addition, affordability for reduced acquisition and life-cycle costs is pursued within all technology thrusts. Concepts that reduce the cost of design, fabrication, outfitting, maintenance, and operation are being developed. This HM&E technology spans various Joint Mission Areas and supports the Joint Warfare Strategy "Forward ...From the Sea."

(U) In fiscal year 1998, funding for Logistics and Environmental Quality technology for ships and Naval infrastructure was transferred from PE 0602233N to this more appropriate PE.

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

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1998 ACCOMPLISHMENTS:

(U) (\$4,246) SURFACE SHIP STRUCTURAL SYSTEMS:

(U) INITIATED:

- (U) Future combatant topside structural concepts. (Topside Structures)
- (U) Fire suppression and flooding prediction for automated damage control. (Damage Control)
- (U) Total ship structural/systems damage prediction from missile impact and penetration. (Weapons Effects)
- (U) Composite structural response prediction to explosion loads transmitted in water or air. (Weapon Effects)

(U) CONTINUED:

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- (U) Demonstration and evaluation of dynamic failure prediction tools for composite hull structures. (Hull Structures)
  - (U) Development of stainless steel advanced double hull concepts. (Hull Structures)
  - (U) Model test studies of the effects of DD-21 hull features on seaway induced loads. (Hull Structures)
  - (U) Development of analytical models to predict fire/smoke transport and flooding progression in naval surface ships. (Damage Control)
- (U) (\$1,116) SURFACE SHIP POWER AND AUTOMATION:
- (U) INITIATED:
- (U) Development of smart, survivable machinery control system concepts. (Mechanical Power and Auxiliary Systems)
  - (U) Development of heat pipe, thermal-electric and other advanced heat removal techniques for high heat load thermal management in distributed machinery and electrical systems. (Mechanical Power and Auxiliary Systems)
- (U) COMPLETED:
- (U) 10 kilowatt (kW) fuel cell system brassboard demonstration to validate analytical models. (Mechanical Power and Auxiliary Systems)
  - (U) Transition of fuel reformer and desulphurization concepts for high power diesel-fed fuel cell to PE 0603508N. (Mechanical Power and Auxiliary Systems)
- (U) (\$4,276) SURFACE SHIP SIGNATURE CONTROL:
- (U) INITIATED:
- (U) Develop mathematical and physical scale model scattering prediction capabilities of surface ship resonance at high frequency (HF) frequencies. (Topside Signature Reduction)
  - (U) Develop testing procedures to evaluate residual ferromagnetic signatures of non-ferrous materials (Underwater Signature Reduction)
- (U) CONTINUED:
- (U) Evaluation of high-performance ship hull concepts, which meet low-observable (LO) requirements. (Topside Signature Reduction)

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- (U) Development of lightning protection system concepts for composite structures. (Electromagnetic Compatibility)
- (U) Development of eddy current prediction modeling and advanced sensors (Underwater Signature Reduction)
- (U) COMPLETED:
  - (U) Development of Infrared (IR)/Radar Cross Section (RCS)/Visual signature suppression concepts for exhaust stack systems. (Topside Signature Reduction)
  - (U) Integration of embedded communication sensors into topside exhaust stack structures. (Electromagnetic Compatibility)
  - (U) Mine vulnerability display to allow ship operator to determine vulnerability/survivability in littoral environments. (Underwater Signature Reduction)
- (U) (\$1,634) SURFACE SHIP MANEUVERING & SEAKEEPING:
  - (U) INITIATED:
    - (U) Development of dynamic damage stability method. (Seaway Operability and Survivability)
  - (U) COMPLETED:
    - (U) Development and assessment of a Vertical Axis Propulsor concept (Phase I Engineering assessment). (Advanced Propulsor Concepts)
- (U) (\$3,579) SUBMARINE SIGNATURE CONTROL:
  - (U) INITIATED:
    - (U) Development of Advanced Degaussing methodology based on foreign technologies. (Electromagnetic Silencing)
    - (U) Development of methods to predict/reduce acoustic noise due to flow over appendages. (Hydroacoustics)
  - (U) CONTINUED:
    - (U) Development of technology to predict real-time, far-field acoustic signatures from on-board measurements. (Structural Acoustic)
    - (U) Small scale evaluation of quiet hull concepts. (Structural Acoustics)
    - (U) Demonstration of proof-of-concept for control of near and far-field electromagnetic (EM) signatures in deep and shallow water. (EM Signature Reduction)
    - (U) Develop integrated model for advanced propulsor noise at low/mid frequencies. (Hydroacoustics)

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(U) COMPLETED:

- (U) Testing and evaluation of acoustically transparent sonar bow dome concept; transition concept and design methodology to Naval Sea Systems Command (NAVSEA). (Structural Acoustics)
- (U) Development and evaluation of the integrated model of propulsor noise in high frequency range. (Hydroacoustics)
- (U) Assessment of hydrodynamic wake prediction and mitigation capabilities. (Hydrodynamic Signature Reduction)
- (U) Development of algorithms for far-field EM signature control algorithms. (EM Signature Reduction)

(U) (\$2,024) SUBMARINE STRUCTURAL SYSTEMS:

(U) INITIATED:

- (U) Investigation of double hull concepts. (Advanced Structures)
- (U) Develop monitoring system to balance weight distribution in truss and mount systems to eliminate acoustic shorts and to evaluate shock damage. (Advanced Structures)

(U) CONTINUED:

- (U) Development of quarter-scale shock and acoustic testing requirements for mounts. (Advanced Structures)
- (U) Development of strengthening options and joint flexibility concepts for shock attenuation in machinery support structures. (Advanced Structures)
- (U) Development of front end equipment emulators for shock evaluations. (Advanced Structures)

(U) COMPLETED:

- (U) Development of test capability for quarter-scale shock and acoustic evaluations in air and in water. (Advanced Structures)

(U) (\$2,110) SUBMARINE POWER AND AUTOMATION:

(U) INITIATED:

- (U) Technology assessment and development of alternative emergency power energy storage technologies. (Electrical)

(U) CONTINUED:

- (U) Development of flow visualization and design tools for internal fluid systems. (Machinery)

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Evaluation of power and response performance of candidate electrically powered actuator technologies for reduced cost improved reliability of steering and diving systems. (Electrical)
- (U) Development of adaptive self-energized magnetic bearings for reduced maintenance. (Machinery)
- (U) Development and verification of quiet electric motor analysis and design tools. (Electrical)

(U) (\$2,751) SUBMARINE MANEUVERING AND SEAKEEPING:

(U) INITIATED:

- Inviscid inverse design and turbulent flow analysis of mixed flow propulsor concepts. (Advanced Propulsors)

(U) CONTINUED:

- (U) Laboratory demonstrations of maneuvering concepts with improved control authority and jam resistance. (Maneuvering and Control)
- (U) Simulation of jam resistant maneuvering concepts. (Maneuvering and Control)
- (U) Development of prediction methods of propulsor side forces. (Maneuvering and Control)
- (U) Demonstration of improved ability to simulate maneuvering in extreme conditions. (Maneuvering and Control)

(U) COMPLETED:

- (U) Development of models to predict near-field downstream flow features from hull feature inflow conditions and transition to Hydrodynamics/Hydroacoustics Technology Center. (Maneuvering and Control)
- (U) Radio controlled model tests to validate physics-based maneuvering tools; and transition first version Computational Fluid Dynamics (CFD) codes to Hydrodynamics/Hydroacoustics Technology Center. (Maneuvering and Control)
- (U) Advanced stern performance evaluation. (Advanced Propulsors)

(U) (\$4,739) Power Electronic Building Block (PEBB):

(U) INITIATED:

- (U) Development of third generation PEBB demonstration modules for form, fit, and function. (Advanced Concept Electrical Systems)

(U) CONTINUED:

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Transition PEBB science and technology to support active quieting of motors and other electrical components. (Advanced Concept Electrical Systems)
- (U) COMPLETE:
- (U) Proof of concept of second-generation PEBB modules that demonstrate form and function; transition modules to PE 0603508N for Technology Demonstrations. (Advanced Concept Electrical Systems)
  - (U) Demonstration of computational testbed for advanced concept electrical system simulation. (Advanced Concept Electrical Systems)
- (U) (\$5,413) LOGISTICS:
- (U) INITIATED:
- (U) Development of a micro-electromechanical system (MEMS) diagnostic sensor net. (Maintenance)
  - (U) Development of virtual sensors for diagnostics and prognostics. (Maintenance)
  - (U) Develop and implement sensor technology that qualify for built-in calibration (BIC) integration that currently use a MEMS sensor technology base.
- (U) CONTINUED:
- (U) Development of magnetostrictive actuators for cargo/weapons elevator doors. (Replenishment)
  - (U) Development of metrology for high-speed optical interconnections. (Maintenance)
  - (U) Development of IR focal plane array test set. (Maintenance)
  - (U) Enhancement of crane control technologies resulting in reduced manpower and increased equipment performance. (Replenishment)
  - (U) Development of prognostics for real-time status monitoring and troubleshooting for high-power microwave tubes in combat systems. (Maintenance)
  - (U) Development of nondestructive techniques coupled with computer modeling to rapidly assess pier capacity to resist lateral loads. (Infrastructure)
  - (U) Development of technologies required for an easily transported, high sea state modular platform system. (Amphibious Logistics)
  - (U) Development of an autonomous marine booster pump. (Amphibious Logistics)

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PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of technology to significantly improve throughput by providing lighterage the ability to moor alongside ships and piers enabling cargo transfer in higher sea states. (Amphibious Logistics)
- (U) Development of a collaborative infrastructure assessment tool. (Amphibious Logistics)
- (U) COMPLETED:
  - (U) Development of electroset desktop manufacturing of parts. (Amphibious Logistics)
  - (U) Development of rapid nearshore geotechnical survey technology. (Amphibious Logistics)
- (U) (\$3,491) ENVIRONMENTAL QUALITY TECHNOLOGY:
  - (U) INITIATED:
    - (U) Assessment of need for oil pollution control technology for submarine external systems. (Environmentally Compliant Platforms)
    - (U) Development of non-fouling coatings for shipboard ceramic membrane oily wastewater treatment systems. (Environmentally Compliant Platforms)
    - (U) Development of process control technology for shipboard waste processing systems. (Environmentally Compliant Platforms)
    - (U) Development of surface ship pollution prevention technologies. (Environmentally Compliant Platforms)
    - (U) Development of submarine heat exchanger fouling control technologies. (Environmentally Compliant Platforms)
    - (U) Development of the Navy RDT&E needs for contaminated sediments and their impact on ship/shore facilities operations. (Environmentally Compliant Shore Facilities)
  - (U) CONTINUED:
    - (U) Development of enhanced copper speciation and fate methodology as an alternate approach to meet copper discharge regulations. (Environmentally Compliant Shore Facilities)
    - (U) Electrochemical pre/post treatment technology development for shipboard non-oily wastewater. (Environmentally Compliant Platforms)
    - (U) Development of near critical fluid extraction technology for shipboard bilgewater treatment. (Environmentally Compliant Platforms)

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PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of automated dry dock ship painting, application, overspray control and collection technologies. (Environmentally Compliant Shore Facilities)
  - (U) Development of decontamination cleaning of surfaces technology of Polychlorinated Biphenyls (PCBs) and other toxic substances. (Environmentally Compliant Shore Facilities)
  - (U) Development of Industrial Wastewater Treatment Plant (IWTP) technologies for pollution prevention. (Environmentally Compliant Shore Facilities)
  - (U) Development of environmentally sound substitute for steam catapult lubricants. (Environmentally Compliant Platforms)
- (U) COMPLETED:
- (U) Development of molecular recognition (MRT), advanced reverse osmosis (ARO) and electro dialysis (ED) technologies for IWTPs and transitioned to Environmental Security Technology Certification Program (ESTCP) and 6.4 programs for technology demonstration/validation and certification. (Environmentally Compliant Shore Facilities)
  - (U) Initiation Decision Report (IDR) for development of technology for control of pollution from submarine external hydraulic systems (Environmentally Compliant Platforms)
- (U) (\$5,687) PEBB TECHNOLOGY CONGRESSIONAL PLUS-UP:  
(U) COMPLETED:
- (U) Complete Phase I virtual testbed (equipment simulation and analysis) and successfully incorporate it into virtual PEBB-2 design. (Advanced Concept Electrical Systems)
- (U) (\$1,418) POWER NODE CONTROL CENTERS CONGRESSIONAL PLUS-UP:  
(U) COMPLETED:
- (U) Design and cost analysis of the Power Node Control Center prototypes. (Advanced Concept Electrical Systems)
- (U) (\$946) UNDERWATER VEHICLE DERIVED CONTROL TECHNOLOGY CONGRESSIONAL PLUS-UP:  
(U)COMPLETED:

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Using Component Level Intelligent Distributed Control Systems (CLIDCS) develop and demonstrate concepts for intelligent, reconfigurable networks that control HM&E systems.

2. (U) FY 1999 PLAN:

(U) (\$5,050) SURFACE SHIP STRUCTURAL SYSTEMS:

(U) INITIATE:

- (U) Design tool for integrated composite topside structures. (Topside Structures)
- (U) Development of survivable DC sensor/system principles. (Weapons Effects)

(U) CONTINUE:

- (U) Development of improved design criteria and tools for analysis of composite primary hulls. (Hull Structures)
- (U) Development of stainless steel advanced double hull concepts. (Hull Structures)
- (U) Future combatant topside structural concepts. (Topside Structures)
- (U) Composite structural response prediction to explosion loads transmitted in water or air. (Weapon Effects)
- (U) Fire suppression and flooding prediction for automated damage control. (Damage Control)

(U) COMPLETE:

- (U) Transition of probabilistic hull strength design methods to NAVSEA. (Hull Structures)
- (U) Development of magazine protection concepts to reduce probability of mass detonation. (Weapons Effects)
- (U) Physical modeling studies of hull features versus seaway loading. (Hull Structures)
- (U) Methodology for predicting local hull response to near hull weapons detonation. (Weapons Effects)
- (U) Advanced damage control flooding prediction sensor technology. (Damage Control)
- (U) Total ship structural/systems damage prediction from missile impact and penetration. (Weapons Effects)
- (U) Demonstration and evaluation of dynamic failure prediction tools for composite hull structures. (Hull Structures)

(U) (\$1,456) SURFACE SHIP POWER AND AUTOMATION:

(U) INITIATE:

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Dynamic modeling and simulation of fuel cell based power systems for shipboard use. (Mechanical Power and Auxiliary Systems)
- (U) Simulation of machinery plant control system. (Mechanical Power and Auxiliary Systems)
- (U) CONTINUE:
  - (U) Development of heat pipe, thermal-electric and other advanced heat removal techniques for high heat load thermal management in distributed machinery and electrical systems. (Mechanical Power and Auxiliary Systems)
  - (U) Development of smart, survivable distributed machinery control concepts. (Mechanical Power and Auxiliary Systems)
- (U) COMPLETE:
  - (U) Shock and vibration testing of reduced scale fuel cell power systems. (Mechanical Power and Auxiliary Systems)
  - (U) Salt contamination testing of reduced scale fuel cell power systems. (Mechanical Power and Auxiliary Systems)
- (U) (\$4,789) SURFACE SHIP SIGNATURE CONTROL:
  - (U) INITIATE:
    - (U) Development of next generation topside signature control concepts (Topside Signature Reduction)
    - (U) Development of double hull signature reduction technologies for underwater electromagnetic signatures (Underwater Signature Reduction)
  - (U) CONTINUE:
    - (U) Mathematical and physical scale model scattering prediction analyses for surface ship resonance at high frequencies. (Topside Signature Reduction/Electromagnetic Compatibility)
    - (U) Testing procedures to evaluate residual ferromagnetic signatures of non-ferrous materials (Underwater Signature Reduction)
    - (U) Evaluation of high-performance ship hull concepts, which meet low-observable requirements. (Topside Signature Reduction)
    - (U) Development of eddy current prediction modeling and advanced sensors (Underwater Signature Reduction)
  - (U) COMPLETE:
    - (U) Assessment of the vulnerability of surface ships to eddy current signatures. (Underwater Signatures)

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PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of lightning protection system concepts for composite structures. (Electromagnetic Compatibility)
- (U) (\$1,343) SURFACE SHIP MANEUVERING & SEAKEEPING:
- (U) INITIATE:
- (U) Development of numerical methods for predicting ship loads. (Seaway Maneuverability, Motions and Loads)
  - (U) Development of an integrated propulsor/hull concept to improve signature behavior. (Integrated Propulsor/Hull)
- (U) COMPLETE:
- (U) Development and validation of dynamic damage stability method. (Seaway Maneuverability, Motions and Loads)
- (U) (\$4,341) SUBMARINE SIGNATURE CONTROL:
- (U) INITIATE:
- (U) Development of coating concepts to reduce submarine detection from active acoustic interrogation. (Structural Acoustics)
  - (U) Development of next generation structural acoustics numerical modeling capability. (Structural Acoustics)
  - (U) Develop models for wake signatures for littoral parameter ranges. (Hydrodynamic Signature Reduction)
  - (U) Development of sensors/electronics concepts to embed in exterior coating materials to assess technology impact/advantages of sampling the EM field exterior to the hull. (Electromagnetic Signature Reduction)
- (U) CONTINUE:
- (U) Demonstration of proof-of-concept for controlling near-field electromagnetic signatures in shallow water. (EM Signature Reduction)
  - (U) Development of advanced degaussing based on foreign technology assessments. (Electromagnetic Signature Reduction)
  - (U) Assess first generation experimental results and revise concept and analysis methods for hull structural concepts with intrinsic acoustic benefit. (Structural Acoustics)
  - (U) Development of methods to predict/reduce acoustic noise due to flow over appendages. (Hydroacoustics)
  - (U) Develop integrated model for advanced propulsor noise at low/mid frequencies. (Hydroacoustics)

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- (U) Development of technology to predict far-field acoustic signature in real-time from on-board measurements. (Structural Acoustics)
- (U) COMPLETE:
- (U) Evaluation of the control methodologies for far-field EM signatures in deep and shallow water. (EM Signature Reduction)
- (U) Small scale evaluation of quiet hull concepts. (Structural Acoustics)
- (U) (\$2,540) SUBMARINE STRUCTURAL SYSTEMS:
- (U) CONTINUE:
- (U) Investigation of double hull concepts. (Advanced Structures)
- (U) Development of equipment emulators for aft end shock and acoustic applications. (Advanced Structures)
- (U) Develop system requirements and sensor configurations to implement structural monitoring system. (Advanced Structures)
- (U) (\$2,400) SUBMARINE POWER AND AUTOMATION:
- (U) INITIATE:
- (U) Integrated modeling and simulation of electric motor with mounting, shaft, propulsor and machinery support systems to investigate shipboard overall acoustic noise reduction. (Machinery)
- (U) CONTINUE:
- (U) Technology assessment and development of alternative emergency power energy storage technologies. (Electrical)
- (U) Verification of design tools for internal fluid systems. (Machinery)
- (U) Development of most promising electrically powered actuator technologies for reduced cost improved reliability steering and diving systems. (Machinery)
- (U) Development and validation analysis of 3-D design tools for quiet electric motors. (Electrical)
- (U) COMPLETE:
- (U) Validation of 2-D analysis and design tools for quiet electric motors; transition to NAVSEA. (Electrical)
- (U) Transition adaptive self-energized magnetic bearing technology to NAVSEA. (Electrical)

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- (U) Development of measurement techniques for electrical motor dynamics. (Electrical)

(U) (\$3,639) SUBMARINE MANEUVERING AND SEAKEEPING:

(U) INITIATE:

- (U) Development of maneuvering effectors to increase control authority at low speeds. (Maneuvering Systems)
- (U) Hydroacoustic design and analysis for mixed flow propulsors. (Advanced Propulsors)
- (U) Active control for hydroacoustics. (Advanced Propulsors)
- (U) Validate propulsor side force technology and transition to Hydrodynamics/Hydroacoustics Technology Center. (Maneuvering and Control)

(U) CONTINUE:

- (U) Demonstration of improved ability to simulate maneuvering in extreme conditions. (Maneuvering and Control)

(U) COMPLETE:

- (U) Simulation of jam resistant maneuvering concepts. (Maneuvering and Control)
- (U) Laboratory demonstrations of maneuvering concepts with improved control authority and jam resistance.
- (U) Inviscid inverse design and turbulent flow analysis of mixed flow propulsor concepts. (Advanced Propulsors)

(U) (\$5,567) PEBB:

(U) INITIATE:

- (U) Development of advanced PEBB fast turn off modules. (Advanced Concept Electrical Systems)
- (U) Development of system regulation and stability concepts, algorithms. (Advanced Concept Electrical Systems)
- (U) Development of energy generation and storage concepts and components. (Advanced Concept Electrical Systems)

(U) CONTINUE:

- (U) Evaluation of third-generation modules to demonstrate form, fit, and function of PEBB. (Advanced Concept Electrical Systems)

(U) COMPLETE:

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- (U) Proof of concept for third-generation modules to demonstrate form, fit, and function of PEBB. (Advanced Concept Electrical Systems)
- (U) Transition of third-generation PEBB modules to PE 0603508N to support Electrically Re-configurable Ship demonstration. (Advanced Concept Electrical Systems)

(U) (\$6,459) LOGISTICS:

(U) INITIATE:

- (U) Investigate concepts to provide mooring and fendering systems, which would safely, control or reduce the relative motion in sea state 3 conditions. (Amphibious Logistics)
- (U) Development of the use of existing assets to provide for mobile piers. (Amphibious Logistics)
- (U) Development of seabased logistics communications link. (Amphibious Logistics)

(U) CONTINUE:

- (U) Development of a high power microwave built-in test set. (Maintenance)
- (U) Development of a collaborative infrastructure assessment tool. (Infrastructure)
- (U) Improvement of throughput in higher sea states by identifying and developing new and emerging technologies that can be applied to critical lighterage operations. (Amphibious Logistics)
- (U) Development of micro-electrical mechanical sensor systems. (Maintenance)
- (U) Development of virtual sensors. (Maintenance)
- (U) Development of BIC of MEMS. (Maintenance)

(U) COMPLETE:

- (U) Development of magnetostrictive actuators for cargo/weapons elevator doors. (Replenishment)
- (U) Development of advanced shipboard crane technology. (Replenishment)
- (U) Development of metrology for high-speed optical interconnections. (Maintenance)
- (U) Development of an infrared focal plane array test set. (Maintenance)
- (U) Development of a diagnostic rule extraction technology. (Maintenance)
- (U) Development of nondestructive techniques coupled with computer modeling to rapidly assess pier capacity to resist lateral loads. (Infrastructure)

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DATE: February 1999

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of technologies required for and easily transported, high sea state modular platform system. (Amphibious Logistics)
  - (U) Development of an autonomous marine booster pump. (Amphibious Logistics)
  - (U) Development of technology to significantly improve throughput by providing lighterage the ability to moor alongside ships and piers enabling cargo transfer in higher sea states. (Amphibious Logistics)
- (U) (\$3,860) ENVIRONMENTAL QUALITY TECHNOLOGY:
- (U) INITIATE:
- (U) Development of technology for management of contaminated marine sediments. (Environmentally Compliant Shore Facilities)
  - Development of miniaturized acoustic data logging technology for marine mammals. (Environmentally Compliant Platforms)
  - Development of acoustic integration technology for projecting 3-D marine mammal tracks to generate noise exposure data for risk assessment predictions. (Environmentally Compliant Platforms)
- (U) CONTINUE:
- (U) Development of enhanced methodology for alternate approach to meet copper discharge regulations. (Environmentally Compliant Shore Facilities)
  - (U) Pollution prevention technology development for surface combatants. (Environmentally Compliant Platforms)
  - (U) Development of automated dry dock ship paint application, overspray control and collection technologies. (Environmentally Compliant Shore Facilities)
  - (U) Development of submarine heat exchanger fouling control technology. (Environmentally Compliant Platforms)
  - (U) Development of decontamination cleaning technology for PCBs (Environmentally Compliant Shore Facilities)
- (U) COMPLETE:
- (U) Electrochemical treatment technology development for shipboard non-oily wastewater polishing; transition to Demonstration/Validation (DEM/VAL) (NAVSEA 03R16) for advanced development. (Environmentally Compliant Platforms)
  - (U) Technology development of near-critical CO2 extraction for ship bilgewater treatment; transition to EQ DEM/VAL program (NAVSEA 03L1) and PMS 400D for advanced development. (Environmentally Compliant Platforms)

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of technologies for Industrial Wastewater Treatment Plants (IWTP); transition to NAVFAC (15R) for integration and implementation. (Environmentally Compliant Shore Facilities)
- (U) Development of environmentally acceptable lubricant for carrier catapult systems; transition to NAVAIR PMA 251 for qualification and implementation. (Environmentally Compliant Platforms)
- (U) Development of non-fouling coatings for shipboard ceramic membrane oily wastewater treatment systems; transition to NAVSEA for DEM/VAL and integration. (Environmentally Compliant Platforms)
- (U) Development of neural network algorithm for shipboard oil content monitors; transition to NAVSEA 03L for integration and implementation (Environmentally Compliant Platforms)

(U) (\$1,500) STAINLESS STEEL DOUBLE HULL CONGRESSIONAL PLUS-UP:

(U) INITIATED:

- This effort will entail a large scale testing to validate material, corrosion, coatings, and structural guidelines for stainless steel.

(U) (\$2,000) CONTROL SYSTEMS FOR AUTONOMOUS UNDERWATER VEHICLES CONGRESSIONAL PLUS-UP:

(U) INITIATED:

- (U) This program will demonstrate the viability of Component Level Intelligent Distributed Control Systems (CLIDCS) through laboratory demonstration on a representative marine system.

(U) (\$5,000) CURVED PLATE TECHNOLOGY CONGRESSIONAL PLUS-UP:

(U) INITIATED:

- (U) Develop, design, construct and test high precision fabrication technology for large steel structural components requiring curvatures and precise dimensional control to be used in advanced ship designs.

(U) (\$5,000) BIOENVIRONMENTAL HAZARDS CONGRESSIONAL PLUS-UP:

(U) INITIATED:

- (U) An integrated bioenvironmental hazards program will be conducted to develop biosensors and biomarkers for human and ecological bioenvironmental problems.

(U) (\$512) SMALL BUSINESS INNOVATION RESEARCH:

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C.638.

3. (U) FY 2000 PLAN:

(U) (\$5,653) SURFACE SHIP STRUCTURAL SYSTEMS:

(U) INITIATE:

- (U) Develop shock/acoustic mount design methods and energy absorbing structures. (Weapons Effects)

(U) CONTINUE:

- (U) Development of improved design criteria and tools for analysis of composite primary hulls. (Hull Structures)
- (U) Development of stainless steel advanced double hull concepts. (Hull Structures)
- (U) Composite structural response prediction to explosion loads transmitted in water or air. (Weapon Effects)
- (U) Design tool for integrated composite topside structures. (Topside Structures)

(U) COMPLETE:

- (U) Fire suppression and flooding prediction for automated damage control. (Damage Control)
- (U) Development of survivable DC sensor/system principles. (Weapons Effects)
- (U) Future combatant composite topside structural concepts. (Topside Structures)

(U) (\$1,161) SURFACE SHIP POWER AND AUTOMATION:

(U) INITIATE:

- (U) Demonstration of advanced thermal management techniques for heat load machinery and electrical. (Mechanical Power and Auxiliary Systems)
- (U) Demonstration of smart, survivable distributed machinery control concepts on reduced scale systems. (Mechanical Power and Auxiliary Systems)

(U) CONTINUE:

- (U) Dynamic modeling and simulation of fuel cell based power systems for shipboard use. (Mechanical Power and Auxiliary Systems)

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Simulation of machinery plant control system. (Mechanical Power and Auxiliary Systems)
- (U) Development of smart, survivable distributed machinery control concepts. (Mechanical Power and Auxiliary Systems)

(U) (\$5,175) SURFACE SHIP SIGNATURE CONTROL:

(U) INITIATE:

- (U) Advanced integrated topside reduction and EM compatibility prediction capabilities for LO structures. (Topside Signature Reduction/EM Compatibility)

(U) CONTINUE:

- (U) Develop testing procedures to evaluate residual ferromagnetic signatures of non-ferrous materials. (Underwater Signature Reduction)
- (U) Evaluation of high-performance ship hull concepts, which meet low-observable requirements. (Topside Signature Reduction)
- (U) Development of double hull signature reduction technologies for underwater electromagnetic signatures. (Underwater Signature Reduction)
- (U) Development of next generation topside signature control concepts. (Topside Signature Reduction)

(U) COMPLETE:

- (U) Development of eddy current prediction modeling and advanced sensors. (Underwater Signature Reduction)
- (U) Develop mathematical and physical scale model scattering prediction capabilities of surface ship resonance at high frequencies. (Topside Signature Reduction/Electromagnetic Compatibility)

(U) (\$1,529) SURFACE SHIP MANEUVERING & SEAKEEPING:

(U) CONTINUE:

- (U) Development of numerical methods for predicting ship loads. (Seaway Maneuverability, Motions and Loads)
- (U) Development of an integrated propulsor/hull concept to improve signature behavior. (Integrated Propulsor/Hull)

(U) (\$4,283) SUBMARINE SIGNATURE CONTROL:

(U) INITIATE:

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Develop noise model version for reduced complexity propulsors. (Hydroacoustics)
- (U) CONTINUE:
- (U) Develop models for wake signatures for littoral parameter ranges. (Hydrodynamic Signature Reduction)
  - (U) Development of hull structural concepts with intrinsic acoustic benefit; integrate acoustic coatings and double hull concepts. (Structural Acoustics)
  - (U) Development of sensors/electronics concepts to embed in exterior coating materials to assess technology impact/advantages of sampling the EM field exterior to the hull. (Electromagnetic Signature Reduction)
  - (U) Development of active and passive degaussing control techniques based on double hull construction. (Electromagnetic Signature Reduction)
- (U) COMPLETE:
- (U) Development integrated model for advanced propulsor noise at low/mid frequencies. (Hydroacoustics)
  - (U) Development of methods to predict reduction of acoustic noise due to flow over appendages. (Hydroacoustics)
  - (U) Development of technology to predict far-field acoustic signature in real-time from on-board measurements. (Structural Acoustics)
  - (U) Demonstration of proof-of-concept for controlling near-field electromagnetic signatures in shallow water. (EM Signature Reduction)
- (U) (\$3,438) SUBMARINE STRUCTURAL SYSTEMS:
- (U) CONTINUE:
- (U) Investigation of double hull concepts. (Advanced Structures)
- (U) COMPLETE:
- (U) Development of equipment emulators for aft end shock and acoustic applications. (Advanced Structures)
  - (U) Develop system requirements and sensor configurations to implement structural monitoring system. (Advanced Structures)
- (U) (\$2,517) SUBMARINE POWER AND AUTOMATION:
- (U) INITIATE:

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FY 2000 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Investigation of electric power distribution and machinery system automation for improved system performance and reduced manning. (Machinery and Electrical)
- Reduced scale demonstration of advanced control and motor design techniques. (Electrical)
- (U) CONTINUE:
  - (U) Development of alternative emergency power energy storage technologies. (Electrical)
  - (U) Integrated modeling and simulation of electric motor with mounting, shaft, propulsor and machinery support systems to investigate shipboard overall acoustic noise reduction. (Machinery)
  - (U) Development of most promising electrically powered actuator technologies for reduced cost improved reliability steering and diving systems. (Machinery)
  - (U) Development and validation analysis of 3-D design tools for quiet electric motors. (Electrical)
- (U) COMPLETE:
  - (U) Technology assessment and development of alternative emergency power energy storage technologies. (Electrical)
- (U) (\$3,281) SUBMARINE MANEUVERING AND SEAKEEPING:
  - (U) INITIATE:
    - (U) Validation of advanced maneuvering prediction codes. (Maneuvering Systems)
  - (U) CONTINUE:
    - (U) Demonstration of improved ability to simulate maneuvering in extreme conditions. (Maneuvering and Control)
    - (U) Development of maneuvering effectors to increased control authority at low speeds. (Maneuvering Systems)
    - (U) Hydroacoustic design and analysis for mixed flow propulsors. (Advanced Propulsors)
    - (U) Active control for hydroacoustics. (Advanced Propulsors)
  - (U) COMPLETE:
    - (U) Validate propulsor side force technology and transition to Hydrodynamics/Hydroacoustics Technology Center. (Maneuvering and Control)
- (U) (\$6,358) PEBB:
  - (U) INITIATE:

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- Development of advanced energy management and control concepts based on advanced regulation, stability, generation and storage concepts and components. (Advanced Concept Electrical Systems)
- (U) CONTINUE:
- (U) Development of advanced PEBB fast turn off modules. (Advanced Concept Electrical Systems)
  - (U) Development of system regulation and stability concepts, algorithms, and components. (Advanced Concept Electrical Systems)
  - (U) Development of energy generation and storage concepts. (Advanced Concept Electrical Systems)
- (U) COMPLETE:
- (U) Transition Cost and efficiency models for advanced electrical systems and solid-state components to PE 0603508N to support Electrically Re-configurable Ship Demonstrations. (Advanced Concept Electrical Systems)
- (U) (\$7,274) LOGISTICS:
- (U) INITIATE:
- (U) Development of a submersible cache for prepositioning equipment. (Amphibious Logistics)
- (U) CONTINUE:
- (U) Development of expeditionary mooring technology. (Amphibious Logistics)
  - (U) Development of sea-based logistics communications link. (Amphibious Logistics)
  - (U) Development of existing assets for mobile piers. (Amphibious Logistics)
  - (U) Development of micro-electrical mechanical sensor systems. (Maintenance)
  - (U) Development of virtual sensors. (Maintenance)
  - (U) Development of BIC of MEMS. (Maintenance)
- (U) COMPLETE:
- (U) Development of high power microwave built-in test set. (Maintenance)
  - (U) Development of collaborative infrastructure assessment tool. (Infrastructure)
- (U) (\$3,117) ENVIRONMENTAL QUALITY TECHNOLOGY:
- (U) INITIATE:

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

- (U) Development of advanced air pollutant emissions control and treatment technologies for ships. (Environmentally Compliant Platforms)
  - (U) Development of advanced waste treatment system process control technology for surface ships and submarines. (Environmentally Compliant Platforms)
  - (U) Development of ballast water non-indigenous species control technology for ships and submarines. (Environmentally Compliant Platforms)
  - (U) Development of enhanced display technology for marine mammal information systems. (Environmentally Compliant Platforms)
  - (U) Development of pollutant sensor technology for Navy wastewater treatment/control systems. (Environmentally Compliant Shore Facilities)
- (U) CONTINUE:
- (U) Development of technologies for management of Navy contaminated marine sediments. (Environmentally Compliant Shore Facilities)
  - (U) Development of submarine heat exchanger fouling control technology. (Environmentally Compliant Platforms)
  - (U) Development of acoustic data logging technology for marine mammals. (Environmentally Compliant Platforms)
  - (U) Development of marine mammal sound exposure model. (Environmentally Compliant Platforms)
  - (U) Development of automated dry dock paint application, overspray control, collection and treatment technologies. (Environmentally Compliant Shore Facilities)
- (U) COMPLETE:
- (U) Development of surface ship pollution prevention technologies; transition to NAVSEA. (Environmentally Compliant Platforms)
  - (U) Development of enhanced methodology for alternative approach to meet copper discharge regulations; transition to NAVFAC (FAC 15R) for implementation. (Environmentally Compliant Shore facilities)
  - (U) Development of decontamination cleaning technology for PCBs; transition to NAVFAC (ISR) and NAVSEA 07 for advanced development. (Environmentally Compliant Shore Facilities)

B. (U) PROGRAM CHANGE SUMMARY:

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BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
(U) FY 1999 President's Budget:	48,865	43,177	44,775
(U) Appropriated Value:	-	56,677	-
(U) Adjustments from FY99 PRESBUD:	-5,435	+12,279	-989
(U) FY 2000 PRESBUDG Submission:	43,430	55,456	43,786

(U)CHANGE SUMMARY EXPLANATION:

(U)Funding: FY 1998 changes reflect Small Business Innovative Research reduction (-\$1,267) and actual update adjustments (-\$4,168). FY 1999 changes reflect Congressional Undistributed Reductions (-\$221), Comparability adjustment (-\$1,000) with P.E. 0602232N and Congressional Plus ups: Intelligent Distributed Control Systems (+\$1,500), Stainless Steel Double Hull (+\$2,000), Bioenvironmental Hazards (+\$5,000) and Curved Plate Technology (+\$5,000). FY 2000 reduction reflects program balance adjustment (-\$949), outsourcing adjustment (-\$103), Navy Working Capital Fund (NWCF) rate adjustments (+\$397) and civilian personnel pay adjustments (-\$334).

(U)Schedule: Not applicable.

(U)Technical: Not applicable.

C.(U)OTHER PROGRAM FUNDING SUMMARY:

(U)OTHER APPROPRIATION FUNDS: Not applicable.

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PROGRAM ELEMENT: 0602121N

PROGRAM ELEMENT TITLE: Ship, Submarine & Logistics Technology

(U)RELATED RDT&E:

- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602131M (Marine Corps Landing Force Technology)
- (U) PE 0602233N (Human Systems 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 (Surface Ship & Submarine HM&E Advanced Technology)
- (U) PE 0603513N (Shipboard System Component Development)
- (U) PE 0603514N (Ship Combat 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 (DARPA S&T Program)
- (U) PE 0603573N (Advanced Surface Machinery Systems)
- (U) PE 0603712N (Environmental Quality & Logistics Advanced Technology)
- (U) PE 0603721N (Environmental Protection)
- (U) PE 0603726N (Merchant Ship Naval Augmentation Program)
- (U) PE 0603792N (Advanced Technology Transition)
- (U) PE 0604558N (New Design SSN Development)
- (U) PE 0604561N (SSN-21 Development Program)
- (U) Under the Tri-Service Reliance Agreement, the Navy has the lead for this Navy-unique program.

D.(U) SCHEDULE PROFILE: Not applicable.

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