BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602236N
PROGRAM ELEMENT TITLE: WARFIGHTER SUSTAINMENT APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
WARFIGHTER SUSTAINMENT APPLIED RESEARCH	91,808	131,030	82,856	97,000	73,328	72,024	78,318	77,958

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE supports the Future Naval Capabilities (FNCs) of Expeditionary Logistics, Littoral Combat/Power Projection, and Total Ownership Cost (TOC) Reduction; and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower and personnel; naval systems training; expeditionary logistics; littoral combat and power projection capabilities; advanced naval materials; medical technologies; environmental quality; biocentric technologies; high speed sealift; cost reduction technologies; and seabasing technologies. Within the Naval Transformation Roadmap, this investment supports eight transformational capabilities within the "Sea Strike", "Sea Shield", and "Sea Basing" operational concepts; the critical human system, "Sea Warrior"; and Naval business efficiencies within "Sea Enterprise."

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

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602236N
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PROGRAM CHANGE SUMMARY:

	FY 2004	FY 2005	FY 2006	FY 2007
FY 2005 President's Budget Submission	100,645	63,726	74,244	66,583
Cong Rescissions/Adjustments/Undist. Reductions	0	-1,268	0	0
Congressional Action	0	68,600	0	0
Execution Adjustments	-6,272	0	0	0
FNC Realignment	0	0	8,581	5,636
Non-Pay Inflation Adjustments	-93	0	4	6
Program Adjustments	0	-28	-77	-78
Program Realignment	0	0	82	24,685
Rate Adjustments	0	0	22	168
SBIR Assessment	-2,472	0	0	0
FY 2006/2007 President's Budget Submission	91,808	131,030	82,856	97,000

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

BUDGET ACTIVITY: 02
PROGRAM ELEMENT: 0602236N PROGRAM ELEMENT TITLE: WARFIGHTER SUSTAINMENT APPLIED RESEARCH
PROJECT TITLE: WARFIGHTER SUSTAINMENT APPLIED RESEARCH

COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
WARFIGHTER SUSTAINMENT APPLIED RESEARCH	91,808	131,030	82,856	97,000	73,328	72,024	78,318	77,958

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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2004	FY 2005	FY 2006	FY 2007
MANPOWER/PERSONNEL	4,097	2,385	2,286	3,471

These technologies enhance the Navy's ability to select, assign, and manage its people by responding to a variety of requirements, including: managing the force efficiently and maintaining readiness with fewer people and smaller budgets; providing warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems while managing individual workload and supporting optimal manning.

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FY 2004 Accomplishments:

- Continued and completed Training Analysis for Land Attack Human-Computer-Interaction (HCI) prototype.
- Continued Cognitive Agents Technologies for Sailor-command negotiation in making job assignments.
- Completed psychometrics of measures, non-cognitive metrics for identifying individual differences.
- Completed adaptability screening for military service, a battery of non-cognitive metrics to ascertain the probability of attrition as it relates to military culture and environment.
- Completed testing a cohort in the Recruit Training Center and A-School and completed the data analysis from the cohort testing for the person-organization fit program.
- Completed experiments that apply auction theory to Navy incentive allocation problems in order to measure sailor preferences in volunteering for hard-to-fill jobs.
- Completed enterprise management system approach to manpower and personnel management.
- Demonstrated new microfluidic mixing and sheath flow components for atmospheric monitoring and personnel protection (NRL).

FY 2005 Plans:

- Complete Cognitive Agents Technologies reliability testing and optimization of member/command agents.
- Initiate applicant cultures and values program to test the practicality and predictive validity of socialization measures for selection into the military.
- Initiate modeling integration of forecasting/trend analysis models across the personnel enterprise.
- Initiate and complete Land Attack Training Tool analysis and design.
- Deliver optimized microfluidic components for miniaturizing and automating medical diagnostic procedures for personnel protection. (NRL)

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete modeling integration of forecasting/trend analysis models across the personnel enterprise.
- Initiate modeling integration methodologies for sailor/marine members’ cognitive agents and distribution and assignment system portal.

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FY 2007 Plans:

- Complete applicant cultures and values program to assess the practicality and predictive validity of socialization measures for selection into the military.
- Complete modeling integration methodologies for sailor/marine members' cognitive agents and distribution and assignment system portal.

	FY 2004	FY 2005	FY 2006	FY 2007
TRAINING TECHNOLOGIES	7,839	9,135	12,594	13,435

Training technologies enhance the Navy's ability to train effectively and affordably in classroom settings, in simulated environments, and while deployed, and to operate effectively in the complex, high-stress, information-rich and ambiguous environments of modern warfare. Technology development responds to a variety of requirements, including providing more affordable approaches to training and skill maintenance. The increase in funding from FY05 to FY06 is due to rebalancing of funds and the initiation of planned projects.

FY 2004 Accomplishments:

- Continued development of optimized strategies for performance aiding and training.
- Continued training aid research for Close Quarters Battle (team training), immersive interaction applications, and Computer Generated Forces (CGF) for improving training effectiveness in Virtual Environments.
- Continued research to support students (of intelligence analysis) in becoming independent users of broad-based information.
- Continued task to develop multi-agent based architectures for modeling human behavior.
- Continued program on intelligent agents for objective-based training.
- Continued development of measures to link shared cognition with team performance.
- Continued CGF task aimed at improved techniques for human cognitive and behavioral modeling.
– Completed task to improve the capability of CGF as instructional agents.
- Completed physics tutor project, including associated studies of tutoring strategies.
- Continued work on effective feedback in artificially intelligent tutoring for dynamic task environments such as anti-air warfare, instrument flying and other characteristic military tasks.

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– Initiated task to test (in a military context) newly developed techniques for automating significant parts of the processes of knowledge acquisition and engineering with the goal of reducing these activity costs by 50%.
– Initiated modeling of the integration of different military domains into a distributed Virtual Technologies and Environments Full Spectrum Combat simulation.

FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Complete work on effective feedback in artificially intelligent tutoring for dynamic task environments such as anti-air warfare, instrument flying and other characteristic military tasks.
- Complete research to support students (of intelligence analysis) in becoming independent users of broad-based information.
- Complete development of measures to link shared cognition with team performance.
- Initiate a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring.
- Initiate work on software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring.
- Initiate task to apply recently developed learning techniques that can be used in a model interacting with its application environment to extend or refine its knowledge base and behavioral competence.
- Initiate and complete experiments evaluating the training effectiveness of algorithms.
- Initiate and complete development of user design guidelines related to mobile computing for maintenance and report detailing hardware tools to support mobile maintenance.
- Initiate and complete development of Super Manual related tools and interim report on Super Manual progress and testing results.

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete training aid research for Close Quarters Battle (team training), immersive interaction applications, and Computer Generated Forces for improving training effectiveness in Virtual Environments.
- Complete task to develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates.
- Initiate field studies and user tests evaluating new features and job aiding tools.

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FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Complete development of optimized strategies for performance aiding and training.
- Complete program on intelligent agents for objective-based training.
- Complete modeling of the integration of different military domains into a distributed Virtual Technologies and Environments Full Spectrum Combat simulation.

	FY 2004	FY 2005	FY 2006	FY 2007
EXPEDITIONARY LOGISTICS	0	1,980	0	0

Expeditionary Logistics addresses surface distribution considerations and supported efforts in logistics modeling and simulation. Investment focus is on replenishment in an open seaway and interfacing to commercial shipping as a force multiplier, and internal Seabase material and cargo handling and conveyance mechanisms for selective off-load. Expeditionary logistics will begin to merge this warfighting functional information and knowledge into FORCENet, focusing at the operational and tactical level. Only one year of funding was added by PBD.

FY 2004 Accomplishments:

- Not applicable.

FY 2005 Plans:

- Initiate and complete effort on integration of logistics for knowledge project and readiness.

FY 2006 Plans:

- Not applicable.

FY 2007 Plans:

- Not applicable.

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	FY 2004	FY 2005	FY 2006	FY 2007
LITTORAL COMBAT / POWER PROJECTION	264	6,361	10,927	7,553

This activity provides technologies which enhance the ability of the Navy-Marine Corps team to assure access and sustained operations in the littorals. The Littoral Combat/Power Projection Future Naval Capability (FNC) considers all the critical functions of warfighting: command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); fires; maneuver; sustainment; and force protection. Funding increased from FY04 to FY05 due to program growth. Funding increased from FY05 to FY06 due to program maturation, testing and demonstrations and the FY07 funding decrease is due to program transitions.

FY 2004 Accomplishments:

– Initiated efforts for laser safety testing of Streak Tube Imaging Light Detection and Ranging (LIDAR) technology being developed as part of the obstacle avoidance system for the Expeditionary Fighting Vehicle (EFV). (FY 05 funding by PE 0602131M)
– Initiated and completed testing of the stabilization algorithms and auto-tracker software developed for the EX-45 Stable Gun Mount for use on Marine Corps riverine craft. Transitioned to acquisition.

FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Continue development of advanced weapons materials technology for use in artillery and mortar systems. (Concurrently funded by PE 0602131M).
- Continue development of Organic Light Emitting Diode (OLED) display technology for shipboard and Marine use. (Previous effort funded by PE 0602131M; concurrent effort funded by PE 0602782N; FY 06 funding by PE 0602782N)
- Initiate development of improved lightweight fire control systems interface technologies.
- Initiate development of landmine countermeasure insensitive munitions technology. (Concurrent effort funded by PE 0602131M)
- Initiate program to develop oxygen, water vapor and temperature measurement capability for safety during littoral combat (NRL).

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FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Continue development of advanced weapons materials technology for use in artillery and mortar systems. (FY 07 effort funded by PE 0602131M)
- Continue development of light weight fire control systems interface technologies. (FY 07 effort funded by PE 0603640M)
- Continue development of advanced fires coordination and interoperability to enable MAGTF/Joint fires. (Previous effort funded by PE 0602131M)
- Continue development of network monitoring and management tools technology. (Previous efforts funded by PE 0602131M)
- Continue development of secure mobile network/secure wireless LAN technology. (Previous efforts funded by PE 0602131M)
- Complete development and transition innovative relays Beyond-Line-of-Sight (BLOS) in the areas of wideband communications and advanced modular systems. (Previous efforts funded by PE 0602131M)
- Develop carbon monoxide and hydrogen fluoride measurement capability (NRL).

FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Continue development of hostile fire detection and counterfire technology (Gunslinger). (Previous efforts funded by PE 0602131M)
- Initiate development of advanced naval fires technology spiral 1.
- Initiate development of improvised explosive device (IED) mitigation technology spiral 2.
- Develop fuel vapor measurement capability (NRL).

	FY 2004	FY 2005	FY 2006	FY 2007
ADVANCED NAVAL MATERIALS	7,124	13,205	11,899	12,405

Advanced Naval Materials efforts include: advanced, lightweight materials; processes to reduce weight and cost; and enhanced sonar transducers. The decrease in FY06 is due to some of the investments previously reported under this activity being reported under a new activity entitled Cost Reduction Technologies. The funding increase from FY04 to FY05 is due to NRL Core research being now included.

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PROJECT TITLE: WARFIGHTER SUSTAINMENT APPLIED RESEARCH

FY 2004 Accomplishments:

– Continued development of ultra light, blast resistant metallic and composite structural materials.
– Continued low cost phthalonitrile based organic resin material and hybrid composite development with improved fire resistance; and process development of fiber reinforced foam material.
– Continued development of nanotube reinforced composite materials for the improvement of their out-of-plane mechanical properties.
– Continued development of friction stir welding of steels; high strength, high toughness, affordable ship steels for weight reduction; weld processing of stainless steel; improved welding consumables; and the modeling and process control development for reduced distortion and residual stresses for affordable construction of reduced weight, survivable ships.
– Continued development of multifunctional transducer material, high-force high-strain actuators; and evaluation of advanced transducer single crystal high strain materials.
– Continued multi-laser-processing technique development for the fabrication of ultra hard materials for wear resistance applications.
– Completed development of hybrid composite materials for future Naval structures.
– Completed process development of fiber reinforced foam material for Naval application.
– Completed innovative crystal growth methodologies for low-cost high-quality single-crystal piezoelectrics.
– Completed development of electrospark deposited coatings and scratch/hole fillers for corrosion and wear applications.
- Demonstrated feasibility of cellular metal (with embedded ceramics) armor capable of defeating Kinetic Energy (KE) threats with reduced aerial density versus Rolled Homogenious Armor (RHA) armor.
– Demonstrated ability to defeat USS Cole-level underwater blasts with cellular metal panels of component aerial density comparable to current hull-materials.
– Initiated and completed a comprehensive shipboard coating study.
– Initiated development of advanced, cost-efficient joining of titanium for >25% weight reduction of large seaborne structures.
– Initiated development of advanced composites and polymers with fire resistance for ship structures.
– Initiated development of acceptance testing methodologies for advanced transducer single-crystal high-strain materials. Define standardized materials properties and composition ranges.
– Initiated development of fiber-optic Bragg grating demodulation system for structural health monitoring of ships and submarines.
– Initiated fabrication studies of pultruded sandwich structures for low cost ship structural applications.
- Developed bioactive, catalytic materials that efficiently degrade chemical agents upon contact. (NRL)

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FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
– Complete development of phthalonitrile based organic resin material and hybrid composite with improved fire resistance.
– Complete development of modeling and process control for reduced weld distortion and residual stresses, reducing fabrication costs associated with welding and flame-straightening by a factor of 40%.
– Complete development of weld processing of stainless steel for non-magnetic, damage tolerant ships.
– Complete development of multifunctional transducer materials.
– Initiate development of cellular metal blast resistant panels.
– Initiate development of cellular metal ballistic armor.
– Initiate development of new environmentally friendly, affordable and structurally sound bio-composite materials and genetic manufacturing routes to enable unprecedented structural and functional qualities using conventional fabrication methods.
– Initiate development of compositional tuning of single-crystal, high-strain transducer materials, for specialized naval system applications.
– Initiate development of integrated structural composites with blast resistance, manufacturing technologies, and low-cost organic resins with improved fire resistance.

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete development of fiber-optic Bragg grating demodulation system for structural health monitoring of ships and submarines.
- Initiate development of novel processing technologies for increasing the fatigue strength and corrosion resistance of weldments for ship structures with reduced weight and maintenance requirements.
- Initiate development of iron-based structural amorphous alloys for coatings, laminates and graded structures providing improved formability and corrosion resistance with excellent strength.
- Initiate marine titanium alloy design and development, exploiting anticipated cost reductions for high performance, reduced maintenance naval applications.
- Initiate development of continuous single wall carbon nanotube composite materials for next generation air and naval platforms.

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FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
– Complete development of high-force high-strain actuators.
– Complete fabrication studies of pultruded sandwich for low cost, high performance ship structural applications.
– Complete cellular metal blast resistant materials with full section ship hull blast evaluation.
– Initiate development of innovative sonar transducers based on high-strain, high-coupling piezoelectric single crystals.

	FY 2004	FY 2005	FY 2006	FY 2007
MEDICAL TECHNOLOGIES	14,449	11,001	8,005	8,574

This program supports the development and demonstration of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care, or the logistics of providing self/buddy-carried, life saving technologies for massive battlefield wounds. The National Institutes of Health (NIH) focuses on disease processes, not product demonstration. Programs are complementary with those of the Army and are coordinated through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee to prevent duplication of effort. Funding decrease in FY06 is due to efforts transferred to PE 0603729N.

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FY 2004 Accomplishments:

- Continued study of drugs and devices for uncontrolled hemorrhage. Blood loss is the leading cause of preventable death of Marines in combat.
- Continued study of analgesics without adverse effects. Naval casualties are expected to “stay in the fight” as long as possible and the use of morphine removes that capability.
- Continued efforts on resuscitative fluids to increase cardiovascular function and tissue perfusion in combat casualties. Focus is to reduce mortality and morbidity from multiple organ failure, as well as reducing logistical burden associated with supplying resuscitative fluids.
- Continued applied research into medical devices for casualty monitoring. This will improve triage decisions and allocation of medical evacuation resources.
- Continued characterization of therapeutics to protect against hemorrhagic shock. Such protection would reduce the need for resuscitative fluids and relieve the logistical burden for Naval forces.
- Continued developing tests for confirmation of vaccination and diagnosis of diseases and toxin exposure. Goal is to create noninvasive tests that produce results in minutes, not hours or days.
- Continued work on shipboard injury, exposure guidelines, and engineering specifications for preventing shock-related injury. Reducing neck, spine and musculoskeletal injury will increase force readiness.
- Continued work on hearing protection systems and on improved treatment for restoring Noise-Induced Hearing Loss (NIHL). Compensation for hearing loss currently costs DoN over $70M per year.
- Continued studies on decompression sickness, to include novel approaches to the prevention, detection and treatment of decompression sickness, particularly by non-recompressive methods.
- Continued efforts to develop prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes.
- Continued work on predictive measures for oxygen-induced seizures in Navy and Marine Corps divers. Real-time prediction of hyperbaric oxygen-induced seizures will improve operational capability.
- Continued efforts to assess the impact of thermal (i.e., heat and cold) stress on operational performance. Underwater thermal extremes can affect diver performance and alter risk of incurring decompression sickness.
- Completed work on standards for personal armor systems to protect from Behind Armor Blunt Trauma (BABT).
- Demonstrated waterborne microbial array (NRL).

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FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Complete study of drugs and devices for uncontrolled hemorrhage.
- Complete study of analgesics without adverse effects.
- Complete efforts on resuscitative fluids to increase cardiovascular function and tissue perfusion in combat casualties.
- Complete applied research into medical devices for casualty monitoring.
- Initiate study to characterize therapeutic interventions in wound management. Focus is to reduce morbidity resulting in a quicker return to duty and a reduction in medical resource requirements.
- Initiate studies related to optimization of diver performance. Operational performance in the undersea environment can be hampered by a variety of environmental stressors.
- Validate microbial array at the Centers for Disease Control and transition to an advanced concept technology demonstration (NRL).

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete work on predictive measures for oxygen-induced seizures in Navy and Marine Corps divers.
- Refine microbial array capability to accelerate commercial transition pathway (NRL).

FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Complete studies related to optimization of diver performance.

	FY 2004	FY 2005	FY 2006	FY 2007
ENVIRONMENTAL QUALITY	2,663	2,475	3,269	3,647

Environmental Quality technologies enable sustained world-wide Navy operations in compliance with all local, state, regional, national and international laws, regulations and agreements, and support the Navy Transformational Roadmap in the areas of Sea Basing, Sea Strike and Sea Warrior. Compliant operations enable training evolutions and exercises that are critical for maintaining readiness.

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FY 2004 Accomplishments:

- Completed development of “hardened” copper biosensor technology.
- Continued efforts in Navy ship ballast water exchange efficacy evaluation, evaluation of novel membranes, bioreactor startup package, development and testing of environmentally benign marine antifouling (AF) coatings, air and noise pollution abatement technologies, and automated underwater hull surface preparation.
- Initiated development and testing of new aqueous film forming foam (AFFF) formulations (without perfluoroctanylsulfonates, PFOS), studies to accurately determine input of copper into harbor environments from Navy ship hull coatings, preliminary studies for development of robotic hull bug technology for prevention of fouling, and development of non-chlorofluorocarbon/hydrochlorofluorocarbon (CFC/HCFC) cooling methodologies.

FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Complete CFC/HCFC cooling methodologies, Navy ship ballast water exchange efficacy evaluation, evaluation of novel membranes, and bioreactor startup package.
– Initiate far-term noise and air pollution emissions abatement technology for unrestricted operations, and microwave technology for RF plasma torch applications.

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete evaluation of porous inserts for noise and air emissions reduction from gas turbine engines and emission control technologies for control of emissions from marine diesels.
– Initiate development of new, advanced, environmentally benign AF/AC coating systems for Navy platforms.

FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Complete evaluation of AFFF without PFOS, studies to determine copper input into harbors from Navy ship hull coatings and microwave plasma torch development.
– Initiate development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems.

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	FY 2004	FY 2005	FY 2006	FY 2007
BIOCENTRIC TECHNOLOGIES	1,065	0	1,081	1,083

Biocentric technologies provide novel solutions for naval needs based upon the applications of biosensors, biomaterials, and bioprocesses. This program brings the power of modern biotechnology methods to bear on naval problems and reduces the technical risk associated with basic research advances by conducting demo-centric technology development programs. Topic areas include advanced sensors for force protection against weapons of mass destruction, chemical sensing in the marine environment for unexploded ordnance detection, and novel energy sources for chemical and biological sensors deployed in the littorals. There are no funds available for this activity in FY 2005.

FY 2004 Accomplishments:

- Completed investigation in development of engineered proteins for detection of trinitrotoluene (TNT) and decomposition products in seawater.
- Completed efforts in development of electrochemical methods for detection of TNT as payload to autonomous underwater vehicle.
- Completed experimental investigation of plume dynamics.
- Initiated development of sensor system for detection of explosive compounds using engineered proteins.

FY 2005 Plans:

- There are no funds available for this activity in FY 2005.

FY 2006 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Initiate studies based on lessons learned from the Chemical Sensing in the Marine Environment Program (chemical sensing from autonomous underwater vehicles) for Special Forces operations.
- Initiate the development of novel biomimetic propulsion systems for autonomous underwater vehicles.

FY 2007 Plans:

- Continue all efforts of FY2006.

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	FY 2004	FY 2005	FY 2006	FY 2007
HIGH SPEED SEALIFT	0	9,602	10,639	12,474

Fast sealift continues to be a military priority. However, friction drag reduction is increasingly essential for long-range, large-payload Navy ships to travel at high speeds (50+ knots). The High Speed Sealift effort focuses on the design of a hydrodynamic experimentation capability to resolve questions pertaining to full-scale implementation of friction drag reduction procedures. This effort was added by OSD PDM in 2005.

FY 2004 Accomplishments:

- Not applicable.

FY 2005 Plans:

- Initiate and complete procurement of major components required to modify the existing flow facility at the William B. Morgan Large Cavitation Channel (LCC) operated by Naval Surface Warfare Center-Carderock Division in Memphis, Tennessee. These components will be used to provide increased flows and pressures within the LCC to meet the goals of high-speed drag reduction experimentation.
- Initiate development of experimentation test plans, management procedures, and system requirements.
- Initiate high-speed sea lift system studies.

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete development of experimentation test plans, management procedures, and system requirements.
- Initiate and complete installation of major components in the LCC.
- Initiate and complete testing and certification of performance.
- Initiate experiments for high speed drag reduction.
- Initiate designs for large-scale testing of technologies, concepts, and systems.

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FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Complete experiments for high speed drag reduction.
- Complete high-speed sealift system studies.
- Complete designs for large-scale testing.
- Initiate and complete large-scale assembly and testing.

	FY 2004	FY 2005	FY 2006	FY 2007
COST REDUCTION TECHNOLOGIES	6,456	6,936	8,272	9,727

Cost Reduction Technology efforts include: ultrareliable materials and sensors to reduce cost by enabling condition-based and zero maintenance capabilities; and airframe and ship corrosion efforts for advanced cost effective prevention and life cycle management technologies. This activity includes the Navy's share of the Versatile, Affordable, Advanced Turbine Engine (VAATE) program. Investments under this activity were previously reported under Advanced Naval Materials. This new activity breakout provides improved clarification of the overall investment scope.

FY 2004 Accomplishments:

- Continued development of durable new materials and thermal barrier coatings for naval gas turbine hot sections; environmental barrier coatings for ceramics/composites for gas turbine engines; new thermal barrier technology; materials and processes for high temperature turbine disks; and higher temperature aluminum alloys for propulsion.
- Continued development of road test methodology and coating test metrics for the USMC vehicles; longer-life, enhanced-performance self-priming topcoat and corrosion preventive compounds (CPC) for aircraft; and spectral imaging/thermography technology.
- Continued development of single coat corrosion control coatings for potable water ship tanks.
- Continued development of spectral imaging/thermographic Nondestructive Inspection (NDI) for aircraft.
- Continued the development of single coat corrosion control coatings for fuel tanks.
- Continued the development of single coat corrosion control coatings for collect/hold/transfer (CHT) tanks.
- Completed the development of a Nondestructive Evaluation (NDE) Technique for corrosion detection in ship pipes without the need for removal of lagging material.

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- Completed development of oxidation resistant molybdenum alloys to provide major enhancement in performance and fuel economy for gas turbines.
- Completed the development of single coat corrosion control coatings for ballast ship tanks.
- Completed Accelerated Simulated Mission Endurance Testing (ASMET) of thermally-fatigue resistant gas turbine engine of the cooling plate.
- Completed development of longer-life, low-maintenance Modular Hybrid Pier (MHP).
- Demonstrated six times improvement in erosion-resistant coating (in gas turbine compressor blades) compounded with titanium nitride coatings.
- Completed development of corrosion and corrosivity monitoring sensors for aircraft.
- Initiated the development and evaluation of a composite propeller distributed structural health monitoring system.
- Initiated development of ultrasonic imaging NDI for aircraft.
- Initiated development of magneto-resistive NDI for aircraft.

FY 2005 Plans:

- Continue all efforts of FY2004 less those noted as completed above.
- Complete longer-life, enhanced-performance, self-priming top coat and CPC.
- Complete the development of single coat corrosion control coatings for potable water tanks.
- Complete development of spectral imaging/thermographic NDI for aircraft.
- Complete development of a next generation composite propeller distributed structural health monitoring system.
- Initiate development of ceramic matrix composite turbine blades for gas turbine engines.
- Initiate development of calcium magnesium aluminum-silicate (CMAS) resistant thermal barrier coatings.
- Initiate development of portable, real-time, wide area NDI technology for heat damage detection in composite materials.
- Initiate development of nickel-aluminized thermal barrier coating which will be phase compatible with turbine blade alloys.

FY 2006 Plans:

- Continue all efforts of FY2005 less those noted as completed above.
- Complete the development of single coat corrosion control coatings for fuel tanks.

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FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.
- Complete development of standardized road test methodology and coating test metrics for the USMC vehicles.
- Complete development of single coat corrosion control coatings for CHT ship tank.
- Complete development of ultrasonic imaging NDI for aircraft.
- Complete development of magneto resistive NDI for aircraft.
- Complete development of portable, real-time, wide area NDI technology for heat damage detection in composite materials.

	FY 2004	FY 2005	FY 2006	FY 2007
SEA BASING TECHNOLOGIES	0	0	13,884	24,631

This activity includes development and advancement of technologies to support Sea Basing enablers and the future development of Sea Basing innovative naval prototypes. Areas include: advanced hull forms, propulsion, and materials to support high speed, shallow draft, and beachable connectors; innovative connector interface and transfer technologies; advanced wave and position sensors and autonomous controls to support vessel to vessel interfaces; and autonomous conveyance systems to support automated and integrated warehousing.

FY 2004 Accomplishments:

- No funds were available for this activity in FY 2004.

FY 2005 Plans:

- No funds were available for this activity in FY 2005.

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FY 2006 Plans:

- Initiate feasibility studies for beachable, high speed craft concepts, innovative vessel to vessel connector and transfer concepts, and automated and integrated warehousing concepts.
- Initiate concept design studies.
- Initiate applied research of selected emerging Sea Basing technologies which would support prototype design. Technologies include lift cushion seal challenges such as lightweight, high strength, long wear materials, variable geometry/retractability, sea state four capability as well as lighter weight, more efficient lift fans, automatic connector/mating systems, innovative seal systems, vertical/horizontal transition of conveyance and autonomous, low power consumption intraship transport systems.

FY 2007 Plans:

- Continue all efforts of FY2006 less those noted as completed above.

CONGRESSIONAL PLUS-UPS:

	FY 2004	FY 2005
ADVANCED FOULING AND CORROSION CONTROL COATINGS FOR NAVAL VESSELS	5,384	5,547

In this effort, combinatorial research techniques are used to synthesize new polymers and formulate libraries of coatings to be evaluated for ship hull antifouling, fouling release, or anticorrosion coatings.

	FY 2004	FY 2005
ADVANCED MATERIALS AND INTELLIGENT PROCESSING CENTER	1,204	2,081

For FY04, this effort developed a resin molding process utilizing both sensor and model-based approaches. New materials provided the Navy with the capability to produce battle damage-resistant aircraft with improved stealth characteristics. For FY05, this effort develops the underlying science of Liquid Injection Processing when a multitude of material constituents are present.

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	FY 2004	FY 2005
ADVANCED REINFORCED MATERIALS AND NEW MATERIALS RESEARCH FOR AIRCRAFT TIRES	0	990

Efforts supports Advanced Reinforced Materials and New Materials Research for aircraft tires.

	FY 2004	FY 2005
AGILE VACCINOLOGY	3,951	2,972

For FY04, this effort conducted investigations on modern vaccine technologies, including DNA-based vaccines such as the malaria DNA vaccine effort that compared various vaccination strategies in animal models. For FY05, explore different genetic vaccine modalities (e.g., viral vectored, viral replicons, plasmid) for response in vitro and in animal models of infection for anthrax, plague, malaria, and dengue. Emphasis is on discovery of novel antigenic sequences in the pathogens and rapid, flexible deign of corresponding vaccines which will ultimately enable DOD to rapidly respond to threats posed by emerging pathogens or biowarfare agents.

	FY 2004	FY 2005
ALUMINUM FABRICATION UTILIZING THREE DIMENSIONAL PRINTING	1,345	1,387

In FY04, this effort defined, developed and demonstrated a three dimensional printing (3DP) system on specific DOD applications. This effort advances the potential use of the 3DP process and its unique capabilities for the manufacture of components in an e-manufacturing environment. In FY05, the objective is to expand on FY04 work.

	FY 2004	FY 2005
ATMOSPHERIC WATER HARVESTING	0	990

Effort supports Atmospheric Water Harvesting.

	FY 2004	FY 2005

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	FY 2004	FY 2005
BIOENVIRONMENTAL HAZARDS RESEARCH PROGRAM	961	0

This effort assessed the adverse impacts of Navy operations and training activities on the environment as well as the adverse health effects of contaminated environments on Naval personnel.

	FY 2004	FY 2005
BIOSENSORS FOR DEFENSE APPLICATIONS - AUTONOMOUS SENSOR PLATFORMS FOR BIOSENSING	0	1,981

Effort supports developing advanced technology for autonomous sensor platforms in marine environments.

	FY 2004	FY 2005
CARBON FOAM PROGRAM	2,046	0

This effort developed carbon foam materials for Navy use. Such advanced materials have significantly improved mechanical, thermal, and fire-resistant properties that permitted their use in man-rated areas aboard ships and submarines.

	FY 2004	FY 2005
COASTAL AREA TACTICAL MAPPING SYSTEMS	1,923	0

This effort provided the Marine Expeditionary Forces (MEF) with the next-generation airborne-scanning laser-mapping system in support of quick and decisive amphibious assaults. To deliver resources from sea to land, the MEFs require timely, highly accurate imagery of both the surface and underwater environment in order to detect obstacles and mines. Recent advances provided the means to develop a next-generation airborne-scanning laser-mapping system, optimized for deployment on an unmanned aerial vehicle.

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	FY 2004	FY 2005
COATING AND POLYMERIC FILMS FOR NAVAL APPLICATIONS	1,519	990

This effort included the development of natural polymers based on filled soybean protein/vegetable oil derivatives for possible use in a chaff cartridge; the preparation of polylactic acid/cellulose acetate blends that optimize softening point and biodegradability considerations; and the development of novel exfoliated clay reinforcements to provide physical and thermal reinforcement and a mechanism to encourage biodegradation in high salt environments.

	FY 2004	FY 2005
CUTTING TOOLS FOR AEROSPACE MATERIALS	1,808	3,368

For FY04, this effort created a virtual, collaborative environment connecting the military, industrial, and academic materials communities to support state-of-the-art aerospace materials research focused on Naval aviation issues. The primary focus was to develop and construct the user base and to integrate a consortium of partners into an electronic web-based portal. In FY05, the objective is to expand on FY04 work.

	FY 2004	FY 2005
DIAGNOSTIC TOOL FOR BIOWARFARE-INFLICTED INFECTIOUS DISEASE	1,923	0

This effort developed a mass spectrometric-based diagnostic tool capable of early, sensitive, and agent-specific detection of infectious disease for large numbers of exposures. This automated diagnostic equipment will be activated quickly after an attack to perform triage and recommend treatment.

	FY 2004	FY 2005
DURABILITY OF COMPOSITE MATERIALS AND STRUCTURES	0	1,287

Effort establishes the durability characteristics of composite materials used in Naval structures in the severe marine environment.

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	FY 2004	FY 2005
FIBROUS MONOLITH MATERIALS	2,402	0

This effort developed fibrous monolithic composite materials for application in turbine engines and missiles. The new high temperature materials will replace current metal and composite materials. The applications for these materials are rocket components such as fuel shields and turbine engine components.

	FY 2004	FY 2005
FORMABLE ALIGNED CARBON THERMOSTATS (FACTS)	1,205	0

This effort advanced formable aligned carbon thermosets (fiber stretch breaking) by refining material fabrication processes, developing part-forming processes, and fabricating complex parts. Complex parts were formed from materials other than composites resulting in parts that are heavy, expensive, and subject to corrosion.

	FY 2004	FY 2005
HIGH PERFORMANCE LONG LASTING LO MATERIAL FOR NAVY STEALTH APPLICATIONS	4,332	2,972

For FY04, this project developed high performance, long lasting conductive polymeric materials for Naval aircraft gap sealants for stealth applications. Conductive gap sealants based on polymers loaded with carbon nanotube offer the potential for significant improvements over current technology, specifically in weight-savings, increased absorption/deflection potential, service life, and cost. In FY05, the objective is to expand on FY04 work.

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	FY 2004	FY 2005
HUMAN SYSTEMS TECHNOLOGY	961	990

For FY04, this effort included human-centered display and interfaces to enable non-pilot operators to successfully operate unmanned combat air vehicles; supported psychophysical studies of combining tactile interfaces designed for sensory substitution (e.g. sight) and for sensory augmentation in complex dynamic environments such as aviation; developed two classes of advanced Boolean algorithms that support solutions to practical problems (e.g. scheduling, cryptography, network design); and developed data mining and optimization techniques for Navy personnel data. For FY05, this effort will support research on advanced visual displays, advanced tactile displays, and improved algorithms for knowledge discovery and data mining from large data sets.

	FY 2004	FY 2005
HYDRATE DESALINATION TECHNOLOGY	0	2,081

Effort develops a novel method to desalinate seawater using gas hydrate crystals.

	FY 2004	FY 2005
INTEGRATED BIODEFENSE RESEARCH INITIATIVE	961	0

This effort supported applied research to develop state-of-the-art, integrated biowarfare defense capabilities.

	FY 2004	FY 2005
INTEGRATED WMD DETECTION AND COLLECTION SYSTEM	0	990

Effort supports Integrated WMD Detection and Collection System.

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	FY 2004	FY 2005
LOW VOLUME PRODUCTION	1,925	0

This effort developed an eximer laser-based welding capability for the repair of worn and/or corroded ship components. The laser system eliminated the high heat associated with conventional welding that can distort the critical size and shape of the ship components.

	FY 2004	FY 2005
MARINE MAMMAL RESEARCH PROGRAM	1,059	1,090

For FY04, this effort investigated the effects of noise on dolphin hearing (Temporary Threshold Shift) and dolphin biosonar capabilities. Additional efforts included joint visual and acoustic surveys of humpback whales in Kauai, and an internationally recognized summer graduate course in Bioacoustical Oceanography. For FY05, an assessment of dolphin hearing sensitivity using electrophysiological measurements will be conducted.

	FY 2004	FY 2005
MICROSYSTEM FUZE/SAFE & ARM DEVICES	0	990

Effort develops and implements advanced micro-system testing, characterization, and modeling and design to establish and ensure reliability standards specifically for application in Micro Electrical Mechanical Systems (MEMS) based fuzing, safety, and arming components and packaging.

	FY 2004	FY 2005
MOTION COUPLED VISUAL ENVIRONMENT (MOCOVE) FOR MOTION SICKNESS RELIEF	0	990

Effort supports Motion Coupled Visual Environment (MOCOVE) for Motion Sickness Relief (transferred from Title IV-DHP). Initiate study to test technologies for reducing the impact of motion sickness on performance in environments such as land-based Command and Control vehicles and shipboard Command Information Centers.

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	FY 2004	FY 2005
NATIONAL UNMANNED UNDERSEA VEHICLE (UUV) TEST AND EVALUATION CENTER (NUTEC)	2,687	5,844

For FY04, this effort supported the development of an integrated unmanned underwater vehicle (UUV) testbed environment to meet the broad needs of current and future UUV programs. The test center will serve technology development, multi-mission UUV test and evaluation, fleet training and UUV system support. For FY05, Provide UUV test capability upgrades, for use by all Navy UUV programs, in four areas: (1) UUV ground-truth measurement and sensor stimulation upgrades, including tracking and target systems; (2) UUV test data management and communication systems, including remote site testing capabilities and UUV analysis systems; (3) UUV launch and recovery support systems and portable in-water test support equipment; and (4) environmental monitoring systems and upgrades to the NUTEC Test Environment Assessment Laboratory and to support UUV testing in mission-specific environments.

	FY 2004	FY 2005
NAVAL TRAINING, PERFORMANCE, AND EXPERTISE	482	990

For FY04, this effort supported applied research to improve Naval training, performance, and expertise. The primary objectives for FY05 are: 1) disseminate current and create new state-of the-art "how to" handbooks to train and educate sailors and Marines, and 2) continue research on the use of expertise models to enhance situational awareness of combat pilots under stress.

	FY 2004	FY 2005
NONLINEAR SYSTEMS RESEARCH CENTER	0	1,287

The new research institute focused in the broad area of nonlinear dynamics with specific research topical areas such as chaos-excited nondestructive evaluation, micromechanical/microfluidic devices, adaptive antenna arrays, and autonomous vehicle controls. In FY05, the damage detection effort will develop a novel device to detect damage in materials using chaotic forcing and fiber optic readout to discover changes in a material’s response. The MEMS gyros array effort is a working on-chip surface emitting laser technology for displacement sensing of a MEMS gyro array.

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	FY 2004	FY 2005
NOVEL MATERIALS SYNTHESIS AND CHARACTERIZATION	2,369	3,467

For FY04, this effort established a compact experimental facility/capability to use magnetically induced dynamic pressure for acquiring dynamic material property data over a broad range of loading conditions considerably faster and at less expense than with existing methods. This capability is exploited to determine the time scales and loading conditions associated with the initiation of mechanically stimulated metal/polymer reactions, characterize the material properties of novel structural and reactive materials, and extend the characterization capabilities to very high dynamic loading regimes. For FY05, complete assembly and integration of pulse power device. Establish and integrate time-resolved instrumentation, including multipoint visar and spectroscopic capabilities, to the pulsed power device. Conduct and implement target chamber design. Develop analytical methods to analyze wave profile data obtained from experimental measurements. Conduct material characterization experiments to determine the time scales and loading conditions associated with the initiation of mechanically stimulated metal/polymer reactions, material properties of novel structural and reactive materials. Extend the characterization capabilities to very high dynamic loading regimes.

	FY 2004	FY 2005
OPTIMIZING ADAPTIVE WARRIOR PERFORMANCE	2,017	2,081

For FY04, this effort developed a National Center for Cognitive Science recognized for excellence in manpower, personnel, and training research. The effort focused on understanding cognitive mechanisms that support adaptive warrior cognition and action. For FY05, procure dedicated magnetic resonance imaging system and conduct training and initial studies.

	FY 2004	FY 2005
PARTNERSHIP SIMULATION LAB FOR HEALTH PROFESSIONS EDUCATION	0	2,476

Effort delivers an entire authoring system for subject matter experts to create high-fidelity, persistent world simulation content that is pedagogically structured for deep and rapid experience-based learning.

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	FY 2004	FY 2005
POROUS MATERIALS RESEARCH	964	0

This effort supported applied research in porous materials important to Naval operations.

	FY 2004	FY 2005
PORTABLE LANGUAGE TRANSLATION SYSTEM AND COMPUTING PLATFORMS	2,017	0

This effort developed a portable, two-way, voice translation system. This work leveraged current Navy programs that seek to provide field translation (e.g. remote, wireless) capabilities for military applications. The effort was motivated by strong DoD and Homeland Defense anti-terrorism issues coupled with a lack of trained translators.

	FY 2004	FY 2005
RAPID AND HIGHLY SENSITIVE DETECTION OF BIOWARFARE AGENTS	1,442	1,188

For FY04, this effort developed an inexpensive, sensitive, and reliable detector for biowarfare agents. The detector utilizes synthetic polymers incorporating molecular imprints that recognize and bind biowarfare agents and quartz crystal surfaces that, when acoustically vibrated, can detect characteristic noise generated by a bound bioagent. For FY05, semi-conducting metal oxide (SMO)-based sensors will be modified to increase sensitivity and reduce power requirements. These portable, low cost sensors will be evaluated with toxicant simulants to assess their theoretical parts-per-billion sensitivity.

	FY 2004	FY 2005
RAPID DETECTION AND RESPONSE SYSTEMS FOR BIODEFENSE	0	2,081

This effort developed technologies for rapid detection of, and response to, airborne biological and chemical agents in battlefield and key urban environments. This work supported the development of antibody-based and DNA-based detection systems in a ChemArray Chip (impedance imaging sensing system), and of data/models to predict the proper placement of real-time sensors in indoor environments for antiterrorism applications.

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	FY 2004	FY 2005
SENSORNET-COMMON DATA HIGHWAY FOR COMPREHENSIVE INCIDENT MANAGEMENT FOR CBRNE THREATS	0	11,887

Effort supports the continued design and development of an information technology infrastructure toward realization of a national comprehensive incident management system. The ultimate goal of this incident management system, called SensorNet, is to provide near-real-time, reliable and secure, collection, processing, management, and dissemination of sensor data (weather, radiological, chemical and video).

	FY 2004	FY 2005
TITANIUM BASED LIQUID METAL ALLOY FOR ADVANCED AEROSPACE APPLICATIONSS	0	1,387

Effort supports identifying bulk amorphous titanium alloy compositions with high glass formability and to develop melting, casting and processing techniques to optimize alloy microstructure. Microstructural optimization will likely require controlled devitrification of crystalline regions within an amorphous matrix and processing to achieve the balance of microstructural features required for the increased ductility necessary in naval aircraft applications. This class of alloys could offer very high strength to weight ratios for use as structural members in naval aircraft, if the damage tolerance of these materials can be improved significantly.

	FY 2004	FY 2005
TITANIUM MATRIX COMPOSITES	964	1,585

For FY04, this effort developed titanium metal matrix composites to enhance future engine designs (rotating engine parts such as disks and spacers) by permitting greater thrust output to weight ratios than are achievable today with currently available materials. The application of titanium metal matrix composites will aid in achieving vertical/short take off and landing (V/STOL) aircraft designs without weight penalties. For FY05, the effort identifies bulk amorphous titanium alloy compositions with high glass formability and to develop melting, casting and processing techniques to optimize alloy microstructure.

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	FY 2004	FY 2005
VIRTUAL CLINICAL LEARNING LAB (VCLL) FOR NURSING AND OTHER HEALTH PROFESSIONS	0	1,981

This effort supports construction of an active virtual environment infrastructure using game-based technologies and development techniques to serve as the organizing framework of a platform for post/co-didactic learning and training simulations where students and practitioners in the healthcare disciplines acquire and practice critical experiential skills.

C. OTHER PROGRAM FUNDING SUMMARY:
NAVY RELATED RDT&E:

PE 0308601N Modeling and Simulation Support
PE 0601103N University Research Initiatives
PE 0601152N In-House Laboratory Independent Research
PE 0601153N Defense Research Sciences
PE 0602123N Force Protection Applied Research
PE 0602747N Undersea Warfare Applied Research
PE 0603236N Warfighter Sustainment Advanced Technology
PE 0603512N Carrier Systems Development
PE 0603640M USMC Advanced Technology Demonstration (ATD)
PE 0603721N Environmental Protection
PE 0603724N Navy Energy Program
PE 0604561N SSN-21 Developments
PE 0604703N Personnel, Training, Simulation, and Human Factors
PE 0604771N Medical Development
PE 0605152N Studies and Analysis Support, Navy
PE 0708011N Industrial Preparedness

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NON-NAVY RELATED RDT&E:

PE 0408042N.SEA National Defense Sealift Fund
PE 0601102A Defense Research Sciences
PE 0602105A Materials Technology
PE 0602211A Aviation Technology
PE 0602303A Missile Technology
PE 0602601A Combat Vehicle and Automotive Technology
PE 0602705A Electronics and Electronic Devices
PE 0602709A Night Vision Technology
PE 0602716A Human Factors Engineering Technology
PE 0602785A Manpower/Personnel/Training Technology
PE 0602786A Warfighter Technology
PE 0602787A Medical Technology
PE 0603002A Medical Advanced Technology
PE 0603003A Aviation Advanced Technology
PE 0601102F Defense Research Sciences
PE 0602102F Materials
PE 0602202F Human Effectiveness Applied Research
PE 0602203F Aerospace Propulsion
PE 0602204F Aerospace Sensors
PE 0602702F Command Control and Communications
PE 0603216F Aerospace Propulsion and Power Technology
PE 0603716D8Z Strategic Environmental Research Program
PE 0602712E Materials and Electronics Technology
PE 0603851D8Z Environmental Security Technical Certification Program

D. ACQUISITION STRATEGY:
Not applicable.