FY 2004/2005 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2004
Exhibit R-2

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT IN-HOUSE LABORATORY INDEPENDENT RESEARCH

COST: (Dollars in Thousands)

PROJECT NUMBER/ TITLE	FY 2003 ACTUAL	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
	12,878	17,196	17,664	17,891	18,178	18,261	18,640

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This portion of the DON Basic Research Program provides participating Navy Centers and Laboratories with funding for basic research to support execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to Naval problems, to promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and DON laboratories, in particular the corporate Naval Research Laboratory (NRL). Basic biomedical research at the Uniformed Services University for the Health Sciences (USUHS) is supported by providing funding for military-specific medical research that is typically leveraged into over $30 million in new extramural funds each year. The program responds to Science and Technology (S&T) directions of the Department of the Navy (DON) Naval Power 21 (NP21) Transformational Roadmap and Chief of Naval Operations (CNO) N70 Mission Capability Package (MCP) requirements for long term Navy and Marine Corps needs. It is managed by the Chief Scientist of the Office of Naval Research (ONR) and executed by the Commanding Officers (COs) and Technical Directors (TDs) of the Naval Warfare Centers, Naval Personnel Research and Development Center, and Bureau of Medicine and Surgery laboratories. The USUHS component is executed by the President of USUHS.

Navy In-house Laboratory Independent Research (ILIR) procedures were revised in FY00 to further encourage collaboration and the participation of new scientists, to relate the program more closely to the overall DON S&T strategy and the ONR/NRL thrusts, and to strongly encourage projects comprising teams of investigators that are of sufficient scope and risk to have a potentially significant impact on DON priorities. Those procedural changes resulted in additional S&T initiatives between ONR and the Naval Warfare Centers and laboratories in FY02 and the trend continued in FY03. ILIR status, results, and management are reported annually to the Deputy UnderSecretary of Defense (S&T).

ILIR projects are selected by Center/Lab CO’s and TD’s near the start of each Fiscal Year through internal competition. Projects typically last 3 years, and are generally designed to assess the feasibility of new lines of research. Successful efforts attract external, competitively awarded funding. Because the Warfare Centers and Labs encompass the full range of Naval technology interests, the scope of ILIR topics roughly parallels that of PE 0601153N, Defense Research Science. In FY03, about 50 projects were completed and 70 initiated.

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Support for the basic medical research at the USUHS provides the only programmed research funds received by the University. In addition, it facilitates the recruitment and retention of faculty; supports unique research training for military medical students and resident fellows; and allows the University's faculty researchers to collect pilot data in order to secure research funds from extramural sources (estimated $35 million annually). Eighty to one hundred intramural research projects are active each year, including 20-25 new efforts. Projects are investigator-initiated and funded on a peer-reviewed, competitive basis. Results from these studies contribute to the pool of knowledge intended to enable technical approaches and investment strategies within Defense S&T programs. They are designed to answer fundamental questions of importance to the military medical mission of the DON in the areas of Combat Casualty Care (CCC), Infectious Diseases (ID), and Military Operational Medicine (MOM).

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N
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Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. PROGRAM CHANGE SUMMARY:

	FY 2003	FY 2004	FY 2005
FY 2003 President's Submission:	15,992	17,400	17,745
Cong. Rescissions/Adjustments/Undist. Reductions		-194	
Execution Adjustments	-3,017		
Inflation Savings			-57
Rate Adjustments		-10	-24
SBIR Assessments	-97		
FY 2005 President’s Budget Submission:	12,878	17,196	17,664

PROGRAM CHANGE SUMMARY EXPLANATION:

Technical: Not applicable
Schedule: Not applicable

FY 2004/2005 RDT&E, N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2004
Exhibit R-2a

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N PROGRAM ELEMENT TITLE: IN-HOUSE LABORATORY INDEPENDENT RESEARCH
PROJECT TITLE: IN-HOUSE LABORATORY INDEPENDENT RESEARCH

COST: (Dollars in Thousands)

PROJECT NUMBER/ TITLE	FY 2003 ACTUAL	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	FY 2008 ESTIMATE	FY 2009 ESTIMATE
	12,878	17,196	17,664	17,891	18,178	18,261	18,640

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

This portion of the DON Basic Research Program provides participating Navy Centers and Laboratories with funding for basic research to support the execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to Naval problems, to promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and DON laboratories, in particular the corporate Naval Research Laboratory (NRL).

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2003	FY 2004	FY 2005
Ocean/Space Sciences	3,347	3,955	4,063

FY 2003 ACCOMPLISHMENTS:

- Developed a method for analyzing very low frequency back scatter sound propagation measurements from a rippled bottom.
- Developed and applied solutions for large amplitude wave interactions with ships.
- Studied various properties of the ocean environment so that such effects can be compensated for in the propagation of sound underwater.

- Determined the effects of compressibility of surrounding air in the stability properties of a high speed shell of liquid. Observed spatial and temporal turbulent mixing near fronts.

FY 2004 PLANS:

- Identify and study species of graywater bacteria that are important to the efficient operation of graywater membrane bio-reactor treatment systems.
- Apply inverse methods to experimental underwater sound data to understand when three dimensional propagation effects are important and investigate a computationally efficient method for estimating the range and depth of a sound source.
- Develop knowledge supporting development of a vaccine to protect Navy working marine mammals.

FY 2005 PLANS:
- Continue to identify and study species of graywater bacteria that are important to the efficient operation of graywater membrane bio-reactor treatment systems.
- Continue to apply inverse methods to experimental underwater sound data to understand when three dimensional propagation effects are important and investigate a computationally efficient method for estimating the range and depth of a sound source.
- Continue to develop knowledge supporting development of a vaccine to protect Navy working marine mammals.

	FY 2003	FY 2004	FY 2005
Advanced Materials	2,447	2,923	3,003

FY 2003 ACCOMPLISHMENTS:
- Developed polymer engineering guidelines for use in applications where specific ultimate tensile properties are required.
- Developed new, low cost, high strength materials for actuators, transducers, sensors for sonar, noise cancellation, and anti-vibration devices.
- Reproduced and understood the chemical makeup of a recently discovered surface passivation technique so that it can be applied to new types of electro-optic devices.

FY 2004 PLANS:
- Develop amorphous steel compositions and subsequently predict their nucleation and growth of grains into devitrified nano-composite steel.
- Research and develop novel ceramic materials (both dielectrics and electrodes) as candidates for high-voltage/high-frequency/low loss/thermally stable capacitors for use in shipboard power systems.
- Research polymers with ‘self-healing’ properties for use in fuel tanks.
- Investigate the effect of external environmental stimuli on the mechanisms that cause coating system degradation in Naval aircraft.

FY 2005 PLANS:
- Continue to develop amorphous steel compositions and subsequently predict their nucleation and growth of grains into devitrified nano-composite steel.

- Continue to research and develop novel ceramic materials (both dielectrics and electrodes) as candidates for high-voltage/high-frequency/low loss/thermally stable capacitors for use in shipboard power systems.
- Continue to investigate the effect of external environmental stimuli on the mechanisms that cause coating system degradation in Naval aircraft.

	FY 03	FY 04	FY 05
Electronics Sensor Sciences	1,932	2,235	2,297

FY 2003 ACCOMPLISHMENTS:
- Continued to explore new robust waveform designs for use in tactical underwater communications.
- Investigated the effect of thermal, electric, and elastic boundaries on the electromechanical properties of new singe crystal sonar transducers.
- Investigated the advantages of fractal antennas for Navy activities.
- Investigated the potential advantages of the tunable multi-frequency vertical cavity surface emitting laser as a component of a communications system.
- Developed a novel atomic interferometer based on slow moving atoms extracted from a magneto-optical trap.

FY 2004 PLANS:
- Investigate the feasibility of acoustic-optic reception of various in-water, composite signals for communications decoding.
- Investigate the properties of a new gyroscope design that uses both squeezed light to enhance photo-detector sensitivity and Einstein-Podolsky-Rosen correlations that exist between the two squeezed light beams to enhance the interferometric phase sensitivity.
- Investigate the use of the adaptation of control of chaos techniques to develop antennas capable of operating across an enormous bandwidth and the development of non-linear antennas incorporating analog signal processing at the plane of radiation collection to perform beam steering and beam forming.

FY 2005 PLANS:
- Continue to investigate the feasibility of acoustic-optic reception of various in-water, composite signals for communications decoding.
- Continue to investigate the properties of a new gyroscope design that uses both squeezed light to enhance photo-detector sensitivity and Einstein-Podolsky-Rosen correlations that exist between the two squeezed light beams to enhance the interferometric phase sensitivity.
- Continue to investigate the use of the adaptation of control of chaos techniques to develop antennas capable of operating across an enormous bandwidth and the development of non-linear antennas incorporating analog signal processing at the plane of radiation collection to perform beam steering and beam forming.

BUDGET ACTIVITY: 1 PROGRAM ELEMENT: 0601152N PROGRAM ELEMENT TITLE: IN-HOUSE LABORATORY INDEPENDENT RESEARCH
PROJECT TITLE: IN-HOUSE LABORATORY INDEPENDENT RESEARCH

	FY 2003	FY 2004	FY 2005
Human Performance Sciences	1,536	1,892	1,943

FY 2003 ACCOMPLISHMENTS:
- Mapped meteorology and oceanography decision maker information usage into visualization tools and compare that mapping to mappings of other Navies.
- Began development of a vaccine that would protect against one of the major causes of bacterial diarrhea world-wide.
- Studied the interrelationships among bioenergetic and neural determinants of fatigue.
- Studied the changes in the activity and levels of glutamate transporters in response to hyperbaric oxygen treatment.

FY 2004 PLANS:
- Continue development of a vaccine that would protect against one of the major causes of bacterial diarrhea world-wide.
- Investigate the effects of providing uncertainty information on decision making and how the form and format of that information affects performance.
- Evaluate the effectiveness of training using Virtual-Reality environments as compared to training using a real world environment.

FY 2005 PLANS:
- Continue to investigate the effects of providing uncertainty information on decision making and how the form and format of that information affects performance.
- Continue to evaluate the effectiveness of training using Virtual-Reality environments as compared to training using a real world environment.

	FY 2003	FY 2004	FY 2005
Information Sciences	1,555	1,892	1,943

FY 2003 ACCOMPLISHMENTS:
- Investigated the performance of recently developed novel active sonar transmit signal models.
- Characterized the state of network traffic at the individual user and aggregate levels and developed tools that can be used to ascertain the state and health of network traffic.
- Investigated newly derived asynchronous track fusion algorithms.
- Continued to study route planning and control methods for unmanned vehicles.

FY 2004 PLANS:

- Apply newly available advances in tracking and classification based on the continuous-state hidden Markov model.
- Improve active and passive sonar signal processing through the use of non-parametric tolerance intervals.
- Examine ways of protecting computer networks' operating systems by obfuscating information that can be gained through a network scan.

FY 2005 PLANS:

- Continue to apply newly available advances in tracking and classification based on the continuous-state hidden Markov model.
- Continue to improve active and passive sonar signal processing through the use of non-parametric tolerance intervals.
- Continue to examine ways of protecting computer networks' operating systems by obfuscating information that can be gained through a network scan.

	FY 2003	FY 2004	FY 2005
Combat Casualty Care, Infectious Diseases & Military Operational Medicine (USUHS)	*	1,891	1,943

FY 2003 ACCOMPLISHMENTS:
*Executed under 0601101D8Z

FY 2004 PLANS:

- Conduct studies in the following areas (representative projects):
    - Combat Casualty Care (CCC) – Explore the use of energy metabolites in the treatment of hemorrhagic shock and oxidative stress; investigate the function of natural antibodies (chiefly related to B1 cells) in post-ischemic recovery; establish basic science framework for using benzoquinone ansamycin to treat traumatic brain injury.
    - Infectious Diseases (ID) – Investigate the endothelium-related pathogenesis of Ebola and similar potential Weapons of Mass Destruction (WMD); and continue to test novel combinations of antiviral and anti-inflammatory agents to treat influenza in a rat model; and continue to delineate interactions between Shigella proteins and host cells, identifying new targets for effective treatment of dysentery.
    - Military Operational Medicine (MOM) – Delineate the role of the proteasome in neuroprotection from hemorrhagic shock in rates; complete first dose-response study of control of altitude-induced pulmonary hypertension using oral sildenafil; complete study of Immersion precooling on performance during and after warm-water exercise; and explore the long-term neuroendocrine effects of exposure to neurotoxins.

FY 2005 PLANS:

- Conduct continuing studies in the following areas (representative projects listed):

- CCC – Test the ability of nerve growth factor to provide both long-term and acute protection against the effects of trauma to the cerebral cortex; Metabolic Antioxidants and Complement in Rat Hemorrhagic Shock.
- ID – Screen a selected range of Staphylococcus aureus isolates to determine which Deoxyribonucleic acid (DNA) sequence in the accessory gene regulator group underlie the production of its toxins; investigate the adaptations of N. gonorrhea as it infects the female genital tract; and continue to explore the mechanisms of Shiga toxins generated by enterohemorrhagic E. coli.
- MOM – Continue to characterize the expression of photoreceptive melanocytes to the effects of specific wavelengths of electromagnetic radiation upon ocular pigment cells as well as upon the entrainment of circadian rhythms; examine the role of the proteasome in neuroprotection from hemorrhagic shock; and establish the role of the enzyme serine palmitoyltransferase (SPT) in protecting the skin from penetration by noxious environments.

	FY 2003	FY 2004	FY 2005
Naval Platform Design Sciences	1,021	1,204	1,236

FY 2003 ACCOMPLISHMENTS:

- Continued to extend current computational fluid dynamics techniques and computer codes.
- Developed a series of closely integrated hydrodynamic tools for hull form design and optimization.
- Demonstrated the potential of suppressing hydrodynamic cavitation through the use of high-frequency, high-amplitude acoustic noise.

- Investigated the possibility of analytically identifying a limiting range of physical parameters (e.g. elasticity modulus, mass density, layer spacing, thickness, etc.) that will produce a specified level of high acoustic transparency while satisfying low in-plane stress-to-failure strength ratio constraints and optional electromagnetic stealth constraints for a generic layered window configuration.

FY 2004 PLANS:

- Characterize the salient near wake turbulent physics of curved circular cylinders using large-eddy simulation methodology.
- Study the environmental effects on the development of ship air-wakes.
- Investigate the use of Diagonally Implicit Multistage Integration Methods to solve stiff systems of differential equations which frequently arise in modeling and simulation problems associated with Navy research and development.

FY 2005 PLANS:

- Continue to characterize the salient near wake turbulent physics of curved circular cylinders using large-eddy simulation methodology.

- Continue to study the environmental effects on the development of ship air-wakes.
- Continue to investigate the use of Diagonally Implicit Multistage Integration Methods to solve stiff systems of differential equations which frequently arise in modeling and simulation problems associated with Navy research and development.

	FY 2003	FY 2004	FY 2005
Energy Sciences	1,040	1,204	1,236

FY 2003 ACCOMPLISHMENTS:
- Investigated the use of a hydrogen peroxide catholyte in combination with an aluminum node for improved fuel cells.
- Developed a propellant suitable for undersea propulsion with a high concentration of condensable exhaust products.
- Continued to develop and demonstrate new synthetic methodology that lead to the precursors of superior insensitive explosives.
- Continued to investigate the characteristics of novel materials intended for use in lighter/smaller batteries.

FY 2004 PLANS:
- Investigate the synthesis of high-nitrogen salts because of their potential use as propellants.
- Investigate two new approaches to thermal battery technology (an all solid state thermal battery and new molten salt electrolyte thermal battery).
- Evaluate the feasibility of using aluminum as fuel and sea water as oxidizer in an underwater propulsion combustor.

FY 2005 PLANS:
- Continue to investigate the synthesis of high-nitrogen salts because of their potential use as propellants.
- Continue to investigate two new approaches to thermal battery technology (an all solid state thermal battery and new molten salt electrolyte thermal battery).
- Continue to evaluate the feasibility of using aluminum as fuel and sea water as oxidizer in an underwater propulsion combustor.

C. OTHER PROGRAM FUNDING SUMMARY:

NAVY RELATED RDT&E:
PE 0601153N Defense Research Sciences

NON-NAVY RELATED RDT&E:
PE 0601101A In-House Laboratory Independent Research (Army)
PE 0601102F Defense Research Sciences (Air Force)

D. ACQUISITION STRATEGY:

Not Applicable.