BUDGET ACTIVITY: 01
PROGRAM ELEMENT: 0601152N
PROGRAM ELEMENT TITLE: IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)

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
IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)	15,194	19,375	15,500	15,951	16,521	16,957	18,018	18,474

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) accomplishes the following: (a) sustains U.S. Naval Science and Technology (S&T) superiority by providing new technological concepts for the maintenance of naval power and national security and by helping to avoid scientific surprise while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities; and (b) supports basic biomedical research at the Uniformed Services University for the Health Sciences (USUHS) by providing funding for military-specific medical research that is typically leveraged into over $30 million in new extramural funds each year. The Department of Navy (DON) component responds to S&T directions of the DON Integrated Warfare Architecture Requirements for long term Navy and Marine Corps improvements and is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command. It 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, Studies, and Technology Organization, and the Bureau of Medicine and Surgery laboratories. The USUHS component is executed by the President of USUHS.

The vision of the DON S&T strategy is "to inspire and guide innovation that will provide technology-based options for future Navy and Marine Corps Capabilities", where "Innovation is a process that couples Discovery and Invention with Exploitation and Delivery". DON Basic Research, which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental and life sciences, is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in twenty-two research areas. These in turn support the major motivational research focus areas of the Navy and Marine Corps-After-Next: maritime and space environments that impact operational capability; information science/knowledge management in network-centric operations; sensors and electronic systems for surveillance and tactical applications;

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energy/power/propulsion for performance gain and sustainment; advanced air/surface/undersea and multi-environment Naval platforms design/signature reduction; superior human performance/training/care of Sailors and Marines; and combat casualty care/infectious diseases/military operational medicine.

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; developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to Naval problems; promoting hiring and development of new scientists; and encouragement of collaboration with universities, private industry, and other Navy and Department of Defense laboratories, in particular the corporate Naval Research Laboratory (NRL).

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 comprised of 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. The trend continued in FY04. ILIR status, results, and management are reported annually to the Deputy Under-Secretary of Defense (S&T).

ILIR projects are selected by Center/Lab COs and TDs near the start of each Fiscal Year through internal competition. Projects typically last three 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 FY04, about fifty projects were completed and seventy were initiated.

Support for the basic medical research at 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 medical research projects are active each year, including twenty to twenty-five new efforts. Projects are investigator-initiated and funded on a peer-reviewed, competitive basis. Results from these studies contribute to the fund of knowledge intended to enable technical approaches and investment strategies within Defense S&T programs. They are designed to answer fundamental questions of

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importance to the military medical mission of the Department of Defense in the areas of Combat Casualty Care (CCC), Infectious Diseases (ID), and Military Operational Medicine (MOM).

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

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PROGRAM CHANGE SUMMARY:

	FY 2004	FY 2005	FY 2006	FY 2007
FY 2005 President's Budget Submission	17,196	17,664	17,891	18,178
Cong Rescissions/Adjustments/Undist. Reductions	0	-185	0	0
Congressional Action	0	1,900	0	0
Execution Adjustments	-1,860	0	0	0
Non-Pay Inflation Adjustments	-16	0	0	0
Transfer of USUHS to the Defense Health Prog	0	0	-2,379	-2,424
Program Adjustments	0	-4	-17	-14
Rate Adjustments	0	0	5	211
SBIR Assessment	-126	0	0	0
FY 2006/2007 President's Budget Submission	15,194	19,375	15,500	15,951

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Transfer In-house Laboratory Independent Research (ILIR) (RDT&E,N PE 0601152N) Funding and Requirements for Uniformed Services University of the Health Sciences (USUHS)to the Defense Health Program (DHP) in FY 2006 and FY 2007.

Schedule: Not applicable.

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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
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A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project sustains U.S. Naval 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 DON Integrated Warfare Architecture Requirements for long term Navy and Marine Corps improvements. It 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 ONR and executed by the COs and TDs of the Naval Warfare Centers, Naval Personnel Research, Studies, and Technology Organization, Bureau of Medicine and Surgery laboratories and USUHS.

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 Department of Defense laboratories, in particular the corporate NRL.

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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2004	FY 2005	FY 2006	FY 2007
OCEAN/SPACE SCIENCES	3,396	4,024	3,565	3,669

FY 2004 Accomplishments:

• Identified and studied species of graywater bacteria that are important to the efficient operation of graywater membrane bio-reactor treatment systems.
• Began development of a vaccine that would protect against one of the major causes of bacterial diarrhea world wide.
• Applied inverse methods to experimental underwater sound data to understand when three dimensional propagation effects are important and investigated a computationally efficient method for estimating the range and depth of a sound source.
• Completed knowledge supporting development of a vaccine to protect Navy working marine mammals.

FY 2005 Plans:

Continue all efforts of FY04 less those noted as completed above.
• Completed development of a vaccine that would protect against one of the major causes of bacterial diarrhea world wide.

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY05 will focus on supporting the ONR Grand Challenge in Naval Battlespace Awareness, Innovative Naval Prototypes initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Ocean Acoustics and Undersea Weaponry.

FY 2006 Plans:

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY06 will focus on supporting the ONR Grand Challenge in Naval Battlespace Awareness, Innovative Naval Prototypes initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Ocean Acoustics and Undersea Weaponry.

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FY 2007 Plans:

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	FY 2004	FY 2005	FY 2006	FY 2007
ADVANCED MATERIALS	2,604	2,974	2,635	2,711

FY 2004 Accomplishments:

• Completed development of amorphous steel compositions and subsequently predicted their nucleation and growth of grains into devitrified nano-composite steel.
• Completed development of 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.
• Researched polymers with ‘self healing’ properties for use in fuel tanks.
• Completed investigation of the effect of external environmental stimuli on the mechanisms that cause coating system degradation in naval aircraft.

FY 2005 Plans:

Continue all efforts of FY04 less those noted as completed above.

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY05 will focus on supporting ONR Grand Challenges in Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Electromagnetic Gun & and Sea Basing, and National Naval Responsibility Initiatives in Undersea Weaponry and Naval Engineering.

FY 2006 Plans:

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY06 will focus on supporting ONR Grand Challenges in Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Electromagnetic Gun & and

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Sea Basing, and National Naval Responsibility Initiatives in Undersea Weaponry and Naval Engineering.

FY 2007 Plans:

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	FY 2004	FY 2005	FY 2006	FY 2007
ELECTRONICS SENSOR SCIENCES	1,991	2,275	2,015	2,074

FY 2004 Accomplishments:

• Completed investigation of the feasibility of acoustic-optic reception of various in-water, composite signals for communications decoding.
• Completed investigation of 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.
• Completed investigation of 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:

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY05 will focus on supporting ONR Grand Challenges in Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility Initiative in Undersea Weaponry.

FY 2006 Plans:

BUDGET ACTIVITY: 01
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	FY 2004	FY 2005	FY 2006	FY 2007
INFORMATION SCIENCES	1,686	1,924	1,705	1,755

FY 2004 Accomplishments:

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

FY 2005 Plans:

Continue all efforts of FY04.

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY05 will focus on supporting ONR Grand Challenges in Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Undersea Weaponry.

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FY 2006 Plans:

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FY 2007 Plans:

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY07 will focus on supporting ONR Grand Challenges in Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility Initiatives in Undersea Weaponry.

	FY 2004	FY 2005	FY 2006	FY 2007
COMBAT CASUALTY CARE, INFECTIOUS DISEASES & MILITARY OPERATIONAL MEDICINE (USUHS)	1,685	1,924	1,705	1,755

FY 2004 Accomplishments:

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

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FY 2005 Plans:

Continue all efforts of FY04 less those noted as completed above.

ILIR projects are intended to be roughly three years long; therefore, typically 30% of the ILIR projects turn over each year. Projects selected for FY05 will focus on supporting ONR Grand Challenges in Intelligent Naval Sensors, Innovative Naval Prototypes initiatives in Sea Basing, and Navy-unique requirements in medicine and combat care.

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	FY 2004	FY 2005	FY 2006	FY 2007
HUMAN PERFORMANCE SCIENCES	1,686	1,924	1,705	1,755

FY 2004 Accomplishments:

• Completed investigation of the effects of providing uncertainty information on decision making and how the form and format of that information affects performance.
• Evaluated the effectiveness of training using Virtual-Reality environments as compared to training using a real world environment.

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	FY 2004	FY 2005	FY 2006	FY 2007
NAVAL PLATFORM DESIGN SCIENCES	1,073	1,224	1,085	1,116

FY 2004 Accomplishments:

• Completed the characterization of the salient near-wake turbulent physics of curved circular cylinders using large-eddy simulation methodology.
• Studied the environmental effects on the development of ship air-wakes.
• Completed the investigation of 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:

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	FY 2004	FY 2005	FY 2006	FY 2007
ENERGY SCIENCES	1,073	1,224	1,085	1,116

FY 2004 Accomplishments:

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

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CONGRESSIONAL PLUS-UPS:

	FY 2004	FY 2005
NAVY S&T OUTREACH	0	1,882

The Naval Research Science and Technology for America's Readiness (N-Star) effort includes the development of an outreach activity at Navy R&D Centers collaborating with universities, community colleges, high schools, and middle schools to create a pipeline of students who are interested in pursuing careers in science and engineering fields.

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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.