FY 2003 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: February 2002

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: PE 0602435N
PROGRAM ELEMENT TITLE: Ocean Warfighting Environment Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2001 ACTUAL	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	FY 2006 ESTIMATE	FY 2007 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
N/A	75,375	62,035	55,180	55,570	55,480	56,568	55,715	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE)-previously named Oceanographic and Atmospheric Technology - provides the unique, fundamental programmatic instrument by which basic research on the natural-environment is transformed into technology developments that provide new or enhanced warfare capabilities for the Battlespace Environment (BSE). Natural-environment and BSE are used interchangeably; each term is to be understood to potentially encompass aspects of the ocean, atmosphere, space, or land.

(U) This PE also provides technologies that form the natural-environment technical base on which all systems development and advanced technology depend. This PE contains the National Oceanographic Partnership Program (NOPP)(Title II, subtitle E, of Public Law 104-201) enacted into law for FY 1997. A major component of the program supports Organic Mine Countermeasures (MCM). The objectives of the PE are met through measuring, analyzing, modeling and simulating, and applying environmental factors affecting naval material and operations in the BSE.

(U) This PE provides for BSE technology developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff. Major efforts of this PE are devoted to (1) gaining real-time knowledge of the BSE, (2) determining the natural-environment needs of regional warfare, (3) providing the on-scene commander the capability to exploit the environment to tactical advantage, and (4) developing atmospheric research related to detection of sea-skimming missiles and strike warfare.

(U) This PE provides natural-environment applied research for all fleet operations and for current or emerging systems. Major developments are routinely transitioned to the Fleet Numerical Meteorology and Oceanographic Command where they are used to provide timely information about the natural environment for all fleet operations. This PE supports virtually all the Joint Mission Areas/Support Areas with primary emphasis on Joint Littoral Warfare and Joint Strike Warfare.

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(U) Joint Littoral Warfare efforts address issues in undersea, surface, and air battlespace. Programs include ocean and atmospheric prediction for real-time description of the operational environment, shallow water acoustics and multiple-influence sensors for undersea surveillance and weapon systems, and influences of the natural environment on mine countermeasure (MCM) systems.

(U) Joint Strike Warfare efforts address issues in air battlespace dominance. Programs include influences of the natural environment on electromagnetic (EM)/electro-optic (EO) systems used in the targeting and detection of missile weapon systems as well as improvements in tactical information management about the BSE.

(U) These efforts support the Joint Warfare Strategy "Forward From the Sea." This program fully supports the Director of Defense Research and Engineering's Science and Technology Strategy and is coordinated with other DoD Components through the Defense Science and Technology Reliance process. Work in this PE is related to and fully coordinated with efforts in accordance with the ongoing Reliance joint planning process. There is close coordination with the US Air Force and US Army under the Reliance program in the Battlespace Environment categories of Lower Atmosphere, Ocean Environments, Space & Upper Atmosphere, and Terrestrial Environments.

(U) The Navy program includes projects that focus on, or have attributes that enhance, the affordability of warfighting systems.

(U) Due to the breadth of efforts included in this PE, the programs described in the Accomplishments and Plans sections are representative selections of the work included in this PE.

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

B. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 2001 ACCOMPLISHMENTS:

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- (U)($8,335) BSE Sensors and Data: (This thrust encompasses efforts to develop new, or enhance existing, shipboard, in-situ, airborne, and spaceborne sensors and appropriate inversion techniques and data handling techniques to obtain/store/manage environmental data. Data on a variety of processes in the environment are essential for several reasons: the data can serve as input to computer prediction schemes; data can be used to provide characterizations of processes for use in other developments; and data can be used in testing/validating current understanding of ocean and atmospheric behavior.) Efforts were extended in: a Global Data Assimilation Experiment, advanced ocean wave prediction, development of a bioluminescence sensor, field data for physics-based models for hyperspectral imaging sensors, naval impact of natural environmental processes (especially in the littoral zone), and AUV sensors and technology for oceanography and mine countermeasures. Preliminary field tests of a new digital bioluminescence sensor were completed as well as completion of Phase I of testing the utility of synthetic aperture sonar for increased ranges.

- (U)($25,699) BSE Concept Enablers: (Concept enablers for the battlespace environment represent technology developments that are expected to provide revolutionary, enabling capabilities but require a long period of development. Generally, the concept enablers represent ideas of wide applicability for which the basic research has been accomplished with indications as to a high payoff to naval warfare interests.) Efforts were advanced aimed at providing naval battlespace awareness, precise time/time interval for precision location, geoclutter, the National Oceanographic Partnership Program, biosensor technology, SecNav/CNO Ocean Chairs, and collaborative efforts with the basic research programs. An effort was initiated in Air-Sea Interaction because of the importance of this area to both better ocean and atmospheric forecasts. An effort was also initiated on "capturing uncertainty" in environmental predictions. Environmental predictive models have reached a point of maturity where one can now deal with the role of incomplete or imperfect input data, the aim being to give the user a better idea as to reliability of predictions. A completed effort dealt with the dual-use radar and weather effort which demonstrated that tactical radars could be used to determine weather and also to reduce clutter in the tactical display that owes its origin to weather features. Completed FY98 Broad Agency Announcement NOPP projects, which represent partnership efforts between several federal agencies, state and local governments, universities, and industry; these NOPP projects encompassed several methodologies for ocean observing. Completed NOPP projects in the following technology development efforts: Operational Technique Development-Float Technology Development; Planning for a National Community Sediment Transport Model; A Renewal of the Ocean systems from chemical, Optical, and Physical Experiments (O_Scope) Program; Ocean Acoustic Observatory Federation; Completion and Field Demonstration of a Portable Coastal Observatory; Innovative Coastal-Ocean Observing Network, and Autonomous Profilers for Carbon-system and Biological

Observations. These NOPP efforts established important bases for future developments in the areas of research "observatories," a "commons" for ocean information (i.e., a community-wide linked "system" of resources, collaborations, and elements for ocean observing and predicting activities), as well as other critical areas of oceanography. A report to Congress on the National oceanographic Partnership Program was prepared and submitted in March 2001. An Ocean.US Office of NOPP was chartered in FY 2001 to serve as a central focal point in the development of a national, integrated, sustained ocean observing system. A report was prepared and submitted in response to the Office of Science and Technology on a "Strategic Vision for Achieving Sustainable Marine Resources Within the US EEZ."

- (U)($13,277) Ocean and Atmospheric Modeling/Prediction and Effects: (The battlespace environment represents a critical factor in naval warfare and in any naval operation, often resulting in a "go" or "no-go" decision for any contemplated action. The extent to which this environment can be modeled through computational models, that can be used to then make predictions of characteristics of the environment, provides an important means by which naval forces can gain mastery over the environment and deny an adversary "home field" advantage.) Further developments were made with ocean model nowcast/forecast at a variety of scales (global, regional, semi-enclosed seas, local), including relocateable and nested models; a variety of scales are necessary because of the differing types of application in which differing resolutions arise. Nested models are needed to allow for a larger domain ocean model to set boundary conditions for a smaller domain model. Further developments occurred in advanced on-board ocean models where the aim is to maximize the on-board forecast capabilities available to the on-scene commander. Model testing/validation represent an on-going activity in this technology area, often with the joint participation of the Fleet Numerical Meteorological and Oceanographic Command (where models will ultimately be used by the Fleet for operational use). Coupled ocean/atmosphere models received further development to allow for more accurate ocean and atmospheric models. Nested atmospheric models (global, regional, local) and on-scene weather prediction received additional development. Efforts also advanced capabilities in prediction of atmospheric effects on electromagnetics/electro-optics because of the central importance of electromagnetic and electro-optic propagation to so many modern warfare systems. Construction of an end-to-end observation/analysis/prediction system for coastal aerosol and dust has become a recent focus of activities in atmospheric effects. A "rough evaporation duct" atmospheric field program was conducted to gain data on the atmospheric effects on electromagnetic/electro-optic propagation and for validating models.

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- (U)($11,861) Naval Warfare System-Focused Efforts: (This program element is the only applied research program element dedicated to determination of the impact of the natural environment on naval warfare and naval operations. As such, many questions about the impact of the natural environment on either operational systems or on naval warfare systems under development and their performance become technical issues for this program element. Where feasible, joint field work was conducted with system developers to maximize the opportunity to focus on the question of impact of the environment on the system and performance prediction. The littoral zone has been the natural environment of greatest interest; aspects of this environment that greatly impact naval warfare are the generally shallow waters of the littoral zone, the consequent closeness and physical significance of the ocean bottom, and the complexities inherent to potentially rapid changes of the ocean structure as well as the ocean bottom.) In acoustic processing techniques experiments were conducted on the New Jersey Shelf to support inversions for seabed inhomogenities using chirp sonar; such inhomogenities may impact underwater acoustic waves used in mine countermeasures or anti-submarine warfare. Additional development occurred in remote sensing techniques, especially hyperspectral imaging technology, for the littoral zone because of their very promising potential to allow inference of littoral ocean characteristics and overcome the problem of "denied" waters.
- Several aspects of underwater acoustics received focused development because of their general importance to acoustic systems: for environmental impact on acoustics, measurements were performed through the ONR ASIAEX Experiment necessary to validate horizontal coherence models; for soliton internal wave packet predictions established and validated a method for simulating an acoustic field through an ocean model soliton realization for comparison to propagation through actual soliton data; and determination of internal wave/coastal front influences on acoustic propagation.

(U) FY 2001 Congressional Plus-Ups:

- (U)($9,660) Chemical, Optical and Physical Sensor Systems for MCM and other Applications: This effort was focused on the development of a variety of sensor systems that can be utilized on autonomous vehicle platforms, especially in littoral regions. Considerable advances have been made in demonstrating the utility of such sensor systems with some of the technology transitioned to higher category programs. The Navy has recently initiated a Future Naval Capability in Autonomous Operations which will benefit from advances achieved through this plus-up.

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- (U)($2,899) Distributed Marine Environment Forecast System (DMEFS): DMEFS represents a technology area with the objective of performing marine environment forecasts through use of computational resources that exist on a variety of computer systems, located at different sites which may be either operational or research-oriented. Computational resources would include computer forecast models, computer software development, computer architecture, databases, and specialist and operational personnel. Technology efforts have advanced capabilities in this challenging area of technology whereby distributed marine environment forecast resources are "brought together" for the purpose of making marine forecasts for fleet operations.

- (U)($1,939) Littoral Acoustic Demonstration Center: Advances have been made in development of better strategies for monitoring underwater acoustic ambient noise with specific application to marine mammal identification and movement or tracking, unpredictability of shallow water acoustic propagation, statistical characterization of shallow water ambient noise, acoustic monitoring and mitigation techniques for marine mammals, and ocean measurement/experimentation.

- (U)($1,705) South Florida Ocean Measurement Center (SFOMC): The SFOMC represents a special resource in terms of a number of university partners with interests in marine vehicle research and a littoral ocean test range which has advantages for developing and demonstrating autonomous underwater vehicle technology. The SFOMC has been used to demonstrate technology development of use to on-going Navy programs, especially in the context of autonomous underwater vehicle technology and mine countermeasure technology.

2. (U) FY 2002 PLAN:

- (U)($7,453) BSE Sensors and Data: (A background description of the nature of the BSE Sensors and Data thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the thrust are expected to remain unchanged. However, consideration is routinely given to the basic research available in Sensors and Data to determine if new opportunities exist that can be exploited to rapidly advance toward the goals of the BSE Sensors and Data thrust.) Additional focus is given to the Global Data Assimilation Experiment, bioluminescence sensor, field data for physics-based models for hyperspectral imaging sensors, naval impact of natural environmental processes (especially for the littoral zone), and autonomous underwater vehicle sensors and technology for oceanography and mine countermeasures. A completion that occurs is the advanced ocean wave prediction development which improves the

predictive capability of wave prediction in the littoral region and establishes a mechanism by which other developments in wave prediction can easily transition to the fleet.

- (U)($20,057) BSE Concept Enablers: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the BSE Concept Enablers thrust are expected to remain unchanged. However, consideration is routinely given to the goals to ensure that they are adequate for the presumed naval warfare needs as reflected in higher level Navy Science and Technology strategy. This particular thrust is most sensitive to opportunities as represented by breakthroughs in the basic research domain which may represent new opportunities for achieving goals of the BSE Concept Enablers thrust.) Efforts are advanced aimed at providing naval battlespace awareness, precise time/time interval for precision location, geoclutter, the National Oceanographic Partnership Program, SecNav/CNO Ocean Chairs, and collaborative efforts with basic research programs. The National Oceanographic Partnership Program solicits proposals for a FY2002 BAA for Ocean Biogeographical Information System (OBIS) (this is the outcome of an earlier decision by the Science Ministers of 29 countries to establish a Global Biodiversity Information Facility; NOPP and the Sloan Foundation seek through the BAA to capitalize here on an initial effort begun in FY 2000 in this topic). Further development occurs in air-sea interaction because of the importance of this area to better both ocean and atmospheric forecasts. Efforts further advance an effort on capturing uncertainty in environmental predictions as a means of giving the user an idea of the reliability of those predictions. The biosensor technology effort completes. The question of the impact of noise, as generated by naval activities, on marine mammals has become of increasing concern; consequently an effort is initiated to participate in a jointly conducted marine mammal program to focus on the effect of noise on marine mammals and to provide tools to detect and mitigate effects. In the National Oceanographic Partnership Program, efforts begin in the following efforts: Real-Time Forecasting System of Winds, Waves, and Surge in Tropical Cyclones; PARADIGM: The Partnership for Advancing Interdisciplinary Global Modeling; and a Partnership for Modeling the Marine Environment of Puget Sound, Washington.

- (U)($12,057) Ocean and Atmospheric Modeling/Prediction and Effects: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the Ocean and Atmospheric Modeling/Prediction and Effects thrust are not expected to change. However, consideration is routinely given to the nature of developments in Ocean and Atmospheric Modeling/Prediction and Effects to ensure that that the technical efforts take appropriate measure of developments in basic research and represent the most effective means of achieving progress toward the goals of the Ocean and Atmospheric Modeling/Prediction thrust.) Efforts continue

in ocean model nowcast/forecast at a variety of scales (global, regional, semi-enclosed seas, local), including relocateable and nested models; a variety of scales are necessary because of the differing types of application in which differing resolutions arise. Nested models are needed to allow for a larger domain ocean model to set boundary conditions for a smaller domain model. Make additional developments in advanced on-board ocean models to maximize the on-board forecast capabilities available to the on-scene commander. Model testing/validation represent an on-going activity in this technology area, often with the joint participation of the Fleet Numerical Meteorological and Oceanographic Command (where models will ultimately be used by the Fleet for operational use). Coupled ocean/atmosphere models receive additional development based on past advances to allow for more accurate ocean and atmospheric models. Nested atmospheric models (global, regional, local) and on-scene weather prediction are advanced toward more efficient schemes for operational evaluation and use. Also progress is sought in development of atmospheric effects on electromagnetics/electro-optics because of the central importance of electromagnetic and electro-optic propagation to so many modern warfare systems. Construction of an end-to-end observation/analysis/prediction system for coastal aerosol and dust has become and remains a recent focus of activities in atmospheric effects.

- (U)($10,722) Naval Warfare System-Focused Efforts: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the Naval Warfare System-Focused Efforts thrust are expected to remain unchanged. However, continual evaluation is given to the state of naval warfare systems to ensure that technology development in the Naval Warfare System-Focused Efforts thrust reflects the optimum choices for greatest impact of the work on naval systems.) Efforts advance in 3-D geoacoustic predictions and inversion of chirp sonar data for seabed inhomogeneities through comparisons of geoacoustic inversion data with core measurements, mathematical transform methods, and high frequency bottom techniques. Further advances are pursued in remote sensing techniques, especially hyperspectral imaging technology, for the littoral zone because of their very promising potential to allow inference of littoral ocean characteristics and overcome the problem of "denied" waters. Several aspects of underwater acoustics receive additional development because of their general importance to acoustic systems: for environmental impact on acoustics, acquired acoustic data are used to determine the time-dependent array performance degradation; joint field experiments are performed with SACLANTCENTRE aimed at better characterization of soliton internal wave packets; and for determination of internal wave/coastal front influences on acoustic propagation, environmental reconstruction of large experimental areas (hundreds of meters horizontally) are completed and utilized.

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(U) FY 2002 CONGRESSIONAL PLUS-UPS:

- (U)($991) Bioluminescence Truth Data and Signature Detection: Advances in basic research over several years on bioluminescence in the ocean have enabled the development of a fundamental understanding of the phenomena and the Navy operations that may be affected. Affordable, compact, efficient sensors that allow ease of deployment and permit the rapid measurement of bioluminescence in the ocean now seem feasible. The work supported by this plus-up aims to develop affordable, compact sensors: instruments for use on general survey ships or underwater vehicles for background bioluminescence data, instruments for use on autonomous platforms for application in mine warfare and anti-submarine warfare, instruments for use in Navy special warfare operations.

- (U)($991) Littoral Acoustic Demonstration Center: Advance development in the area of better strategies for monitoring underwater acoustic ambient noise with specific application to marine mammal identification and movement or tracking, unpredictability of shallow water acoustic propagation, statistical characterization of shallow water ambient noise, acoustic monitoring and mitigation techniques for marine mammals, and ocean measurement/experimentation.

- (U)($2,974) Multiple Intelligent Distributed Underwater Vehicles and Sensors: Underwater vehicle technology and sensor development has recently demonstrated many successes in applications to oceanography and mine countermeasures. Past development has basically focused on single-vehicle development and application. This plus-up focuses on the development of technology appropriate to the use of multiple intelligent distributed underwater vehicles and related sensor developments. Such vehicles must be endowed with the capability of making intelligent decisions about their operations, capable of communication with each other, and able to function in a network configuration for application to a variety of oceanographic applications. Tasks of interest span a broad spectrum of measurements to define the oceanographic state, including nature of the bottom topography and of the bioluminescence/chemical aspects of the ocean. Applications of interest are: measuring ocean conditions for input to ocean models for near real-time ocean nowcast/forecast; use of multiple intelligent vehicles in mine countermeasure operations; use of multiple intelligent vehicles in covert ocean survey operations to gain information about the ocean battlespace and deny an adversary "home-field" advantage.

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- (U)($5,055) Oceanographic Sensors for MCM: Develop further capabilities in oceanographic sensor technology, and related platform technology (such as autonomous underwater vehicle technology) for application especially in littoral regions to mine countermeasures. The primary aim is to demonstrate capabilities through joint field work with other programs. The expectation is that further developments in this area will lead to additional transitions to higher category programs as well as to the recently initiated FNC in Autonomous Operations.

- (U)($1,735) South Florida Ocean Measurement Center: Utilize the capabilities offered by the components of the South Florida Ocean Measurement Center (a consortium of universities and agencies with oceanographic expertise) to join with applied naval development efforts to further advance underwater vehicle technology and its application to naval warfare problems.

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3. (U) FY 2003 PLAN:

• (U)($8,501) BSE Sensors and Data: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the BSE Sensors and Data thrust are expected to remain unchanged. However, consideration is routinely given to the nature of the technical efforts to ensure that they represent the most effective means of achieving progress. Developments in the BSE Sensors and Data thrust are of importance to littoral oceanography, mine countermeasures, and anti-submarine warfare. A main emphasis of work in this thrust remains the littoral ocean which continues to be seen as the primary battlespace of future conflicts.) Further developments are pursued in Global Ocean Data Assimilation Experiment, bioluminescence sensor, field data for physics-based models for hyperspectral imaging sensors, naval impact of natural environmental processes (especially for the littoral zone), and autonomous underwater vehicle sensors and technology for oceanography and mine countermeasures.

• (U)($22,084) BSE Concept Enablers: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the BSE Concept Enablers thrust are expected to remain unchanged. However, continual evaluation is given to concept enabling technologies that emerge from basic or applied research and may lead to modifications of on-going efforts. The ever-recurring theme of the BSE Concept Enablers thrust is to advance technologies that offer the warfighter the greatest capabilities for gaining "advantage" over the natural environment to increase his warfighting ability.) Efforts further advance precise time/time interval for precision location, a capability of great importance in littoral regions which may contain numerous obstacles to passage.

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Additional development is given to geoclutter, as a means of developing better insights into how the sub-sediment seafloor may contribute to acoustic clutter. Further emphasis is given to an effort on capturing uncertainty with the ultimate goal of providing the user of environmental predictions some idea as to the reliability of the predictions. Air-sea interaction measurements and theory receive additional development; efforts here are expected to have an impact on better ocean models and better atmospheric models as well as better understanding of how aerosols are injected into the lower atmosphere where they have a decisive influence on electromagnetic and electro-optic propagation. Further advances occur in the National Oceanographic Partnership Program (which now involves 14 governmental agencies) and the Ocean.US Office, SecNav/CNO Ocean Chairs, and collaborative efforts with the basic research program. Consideration will be given to the solicitation of additional NOPP projects to further advance toward an integrated ocean observing and prediction system.

- (U)($13,398) Ocean and Atmospheric Modeling/Prediction and Effects: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the Ocean and Atmospheric Modeling/Prediction and Effects thrust are expected to remain unchanged. However, consideration is routinely given to basic research developments in this active technology area that are ready for incorporation in this applied research program. Critical new developments in computer technology, especially main frames computers, must be monitored for their potentially significant implications in terms of this thrust. Capabilites in this thrust area have rapidly matured over the past several years and similar maturation is expected to continue in future developments, all to the benefit of modeling/prediction needs for naval warfare. Therefore, the expectation is to achieve better decision capabilities relative to "go" or "no-go" decisions for contemplated actions; also expected is an improved means by which naval forces can gain mastery over the environment and deny an adversary "home field" advantage.) Further advances are sought in ocean model nowcast/forecast at a variety of scales (global, regional, semi-enclosed seas, local), including relocateable and nested models; a variety of scales are necessary because of the differing types of application in which differing resolutions arise. Nested models are needed to allow for a larger domain ocean model to set boundary conditions for a smaller domain model. Further development occurs in advanced on-board ocean models to maximize the on-board forecast capabilities available to the on-scene commander. Model testing/validation represent an on-going activity in this technology area, often with the joint participation of the Fleet Numerical Meteorological and Oceanographic Command (where models will ultimately be used by the Fleet for operational use). Coupled ocean/atmosphere models receive additional development to allow for more accurate ocean and atmospheric models. Nested atmospheric models (global, regional, local) and on-scene weather prediction are under continued development. Also further developments occur in atmospheric effects on electromagnetics and

electro-optics because of the central importance of electromagnetic and electro-optic propagation to so many modern warfare systems. Construction of an end-to-end observation/analysis/prediction system for coastal aerosol and dust continues to be a recent focus of activities in atmospheric effects, primarily due to the significance of these components of the atmosphere (as demonstrated in the Persian Gulf conflict). Efforts also aim to build on recent successes of the application of atmospheric modeling demonstrated in the Persian Gulf conflict.

- (U)($11,197) Naval Warfare System-Focused Efforts: (A background description of the nature of this thrust is given under the FY01 ACCOMPLISHMENTS section. The goals of the Naval Warfare System-Focused Efforts thrust are expected to remain unchanged. However, consideration is routinely given to the nature of the thrust goals to ensure that the technical efforts represent the most effective means of achieving progress. The expectation is that joint field work with system developers maximizes the opportunity to focus on the question of environmental impact on the system and system performance predictability. The littoral zone remains the natural environment of greatest interest and continues to represent significant challenges in terms of environmental variability and role of the ocean bottom and sub-bottom.) Extensions are sought to 3-D geoacoustic prediction for "stochastic" inversions seeking improvements in speed and accuracy of inversion algorithms. Further development occurs in remote sensing techniques, especially hyperspectral imaging technology, for the littoral zone because of their very promising potential to allow inference of littoral ocean characteristics and overcome the problem of "denied" waters. Several aspects of underwater acoustics receive additional development because of their general importance to acoustic systems: for environmental impact on acoustics, models of horizontal acoustic coherence are validated through oceanographic reconstructions; for soliton internal wave packet predictions, the primitive equation soliton model is modified for the Yellow Sea and the capability is transitioned; for the internal wave/coastal front influences on acoustic propagation, acoustic focusing and the predictability of acoustic energy fluctuations are determined.

C. (U) PROGRAM CHANGE SUMMARY:

	FY 2001	FY 2002	FY 2003
(U) FY 2002 President’s Budget	76,363	50,738	0
(U) Adjustments from FY 02 PRESBUDG:			

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SBIR Reduction	-1,264		
Execution Adjustment	+276		
Congressional Plus-ups		+11,850	
Section 8123 Mgmt Reform Initiative		-553	
(U) FY 2003 President's Budget Request:	75,375	62,035	55,180

(U) CHANGE SUMMARY EXPLANATION:

(U) Schedule: Not Applicable.
(U) Technical: Not Applicable.

D. (U) OTHER PROGRAM FUNDING SUMMARY: The Navy's 6.1 program contributes strongly to this effort.

(U) NAVY RELATED RDT&E:
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602114N (Power Projection Applied Research)
- (U) PE 0602123N (Force Protection Applied Research)
- (U) PE 0602235N (Common Picture Applied Research)
- (U) PE 0602271N (RF Systems Applied Research)
- (U) PE 0602747N (Undersea Warfare Applied Research)
- (U) PE 0602782N (Mine and Expeditionary Warfare Applied Research)
- (U) PE 0603207N (Air/Ocean Tactical Applications)
- (U) PE 0603271N (RF Systems Advanced Technology)
- (U) PE 0603747N (Undersea Warfare Advanced Technology)
- (U) PE 0603782N (Mine & Expeditionary Warfare Advanced Technology)
- (U) PE 0604218N (Air/Ocean Equipment Engineering)

(U) NON NAVY RELATED RDT&E:
- (U) PE 0602601F (Space Technology)
- (U) PE 0602784A (Military Engineering Technology)
- (U) PE 0603410F (Space Systems Environmental Interactions Technology)

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E. (U) SCHEDULE PROFILE: Not applicable.