

# UNCLASSIFIED

FY 2000 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1999

BUDGET ACTIVITY: 2

PROGRAM ELEMENT: 0602233N

PROGRAM ELEMENT TITLE: Readiness, Training and Environmental Quality Technologies

(U) COST: (Dollars in thousands)

PROJECT NUMBER & ACTUAL	FY 1998 ACTUAL	FY 1999 ESTIMATE	FY 2000 ESTIMATE	FY 2001 ESTIMATE	FY 2002 ESTIMATE	FY 2003 ESTIMATE	FY 2004 ESTIMATE	FY 2005 ESTIMATE	TO COMPLETE	TOTAL PROGRAM
Readiness, Training and Environmental Quality Technologies	40,405	31,426	30,586	29,631	30,322	31,010	31,749	32,513	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program element (PE) provides generic affordable technologies in support of all Joint Mission Areas/Joint Support Areas (JSA), in particular the JSAs for Readiness; Manpower & Personnel; and Training. These JSAs encompass requirements for manning, operating, and maintaining fleet assets and for providing the necessary training to maintain operating forces in a high state of readiness. The PE also supports the Joint Warfare Strategy "Forward...From the Sea" as well as three of the "Top Five" Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff--in particular, capabilities related to: (a) conducting limited-objective warfare (e.g., technology for enhancing the performance of special forces personnel, aiding decision makers in highly ambiguous situations, and improving casualty care); (b) promptly engaging regional forces worldwide (e.g., technology for deployable training and mission rehearsal); and (c) countering weapons of mass destruction (e.g., technology for responding to chemical and biological threats). This PE encompasses the following areas:

(U) Personnel, Training, and Human Factors technologies enhance the Navy's ability to select, assign, and manage its people; 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 in these areas responds to a variety of requirements, including: providing more affordable approaches to training and skill maintenance; 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.

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(U) Medical technologies increase cost savings; improve safety and enhance personnel performance capabilities under adverse conditions; enhance diagnosis of medical emergencies and treatment of casualties; and prevent costly occupational injury and disease in hazardous environments. Requirements which support technology development in these areas include: improving warfighting capabilities through enhanced supply and long-term storage of prepositioned medical supplies such as blood; providing better stress endurance/control for key personnel; and providing enhanced casualty care onboard amphibious casualty receiving ships.

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

(U) This PE also seeks to strengthen the educational pipeline vital for maintaining a strong technology development capability, by supporting programs at a wide range of educational institutions, including Historically Black Colleges & Universities, and other Minority Institutions. In addition, the PE provides funding for the Navy Science Assistance Program, (NSAP) the purpose of which is to improve the ability of the Navy's science and technology community to respond rapidly to urgent fleet needs. Programs in this PE are jointly planned in the Reliance process with the Air Force and Army via panels of the Joint Directors of Laboratories, the Training & Personnel Systems Science & Technology Evaluation and Management Committee, and the Armed Services Biomedical Research Evaluation and Management Committee.

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

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

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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## 1. (U) FY 1998 ACCOMPLISHMENTS:

- (U) (\$20,817) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - Initiated:
    - (U) development of computer-based tools to improve the Navy's force management capabilities.
    - (U) feasibility evaluation of continuous speech recognition technology for the development of a virtual instructor for training complex team skills.
  - Completed:
    - (U) evaluation of the perceptual effects of altered relationships between visual, haptic and auditory inputs using virtual reality interfaces.
    - (U) development of specifications for a sonar employment training system with improved instructional capability and reduced initial cost, achieved through real-time simulation of tactical sonar signal processing in Commercial Off the Shelf (COTS) hardware.
    - (U) development of guidelines for contextualized, computer based training of Basic Electricity and Electronics skills.
    - (U) development of "non-cognitive" selection tools, such as performance-based measures of personality and motivation, which can predict the future success of naval enlisted personnel.
    - (U) integration of team training strategies into a prototype tactical decision support system, and transition the product into the AEGIS combat system.
    - (U) development of advanced human computer interface technologies for multimedia presentation of tactical information in a Marine Corps combat operations center, thereby improving tactical data fusion and visualization.
    - (U) development of advanced headphone displays for three-dimensional presentation of sonar information to improve target localization.

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- (U) (\$10,838) MEDICAL TECHNOLOGY (INCLUDES CONGRESSIONAL PLUS-UP - \$2,523 SMART AIRCREW INTEGRATED LIFE SUPPORT SYSTEM):
  - Initiated:
    - (U) system for biofeedback control of aircrew physiologic state and integrate with Vehicle Management System.
    - (U) investigation of pharmaceutical rescue of noise-induced hearing loss.
  - Continued:
    - (U) research and development of supportive resuscitation fluids that minimize tissue damage and facilitate stabilization of hemorrhagic and burn casualties.
    - (U) research and development of therapeutic regimens/modalities that prevent reperfusion injuries subsequent to combat trauma and hemorrhage.
    - (U) development of immune modulators for prevention of multiple organ failure.
    - (U) development of neuromodulators for therapy of non-freezing cold injury.
    - (U) programs that extend the diving operational envelope by permitting faster decompression and/or longer bottom times.
    - (U) undersea medicine programs that lead to preventive and treatment methods for oxygen toxicity and enhanced protocols for improving submarine rescue scenarios.
    - (U) investigation of operational durability of G-tolerance due to pilot down time.
    - (U) mechanisms research necessary to prevent performance decrements during sustained operation in extreme environments implementing biomedical and pharmacologic interventions.
    - (U) research to address impact of exposures to induced body currents from radio frequency radiation; develop techniques to protect and/or ameliorate adverse human health effects.
    - (U) research to understand the biomechanisms involved with exposure to select neurotoxicants used in Navy operational environments.
  - Completed:

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- (U) development of recombinant enzymes for removing blood type antigens from red cells to produce universal donor transfusion blood units and transition effective enzymes to industry for universal donor red cells.
- (U) evaluation of AICAR adenosine derivative in treatment of cardiac failure following hemorrhage.
- (U) development of ONR Rinse for treatment of hemorrhagic shock (not beneficial)
- (U) first phase of testing of trans-crocetinate for enhancing tissue oxygen delivery following hemorrhage.
- (U) evaluation of immunoregulatory monoclonal antibodies as adjuvants in inflammatory diseases related to combat injury complications.
- (U) transition polynitroxlyated macromolecule therapies to advanced development for large animal testing.
- (U) (\$1,213) NSAP:
  - (U) continue support to the operational Commands in Command, Control, Communications, Computers, Intelligence Surveillance & Reconnaissance (C4ISR) for deployed assets. Continued refinement of NSAP Global Tactical Technical Information Center, developed Gulf Coast Coalition (GCC) World Wide Web based information server for COMUSNAVCENT Area of Responsibility (AOR), supported C4I Interoperability Workshop in COMSIXTHFLT AOR to address issues with coalition and allied interoperability.
  - (U) provide support to the Fleet/Force in high life cycle cost maintenance areas through application of innovative technologies to reduce maintenance frequency, manpower intensiveness, and incorporation of 'in the field' retro-fixes as applicable. Provided means to reduce High Mobility Medium Wheel Vehicle (HMMWV) box frame corrosion, and evaluated fiber optic lighting in hazardous spaces on Carrier Vessel.
  - (U) addressed Fleet/Force operational readiness issues amenable by demonstration and application of COTs technology solutions. Completed "live fire" evaluation of Ship Deployable Surface Target & Second-Phase development of this system, performed study on feasibility of Unmanned Air Vehicles to meet

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CINCUSNAVEUR needs, developed options for COMSEVENTHFLT Anti-Special Operation Forces, evaluated an Unmanned Surveillance Vehicle for COMMARFORLANT during a Riverine Exercise, deployed system to evaluate ability to perform contraband detection in bulk cargo, developed night vision countermeasures training for COMNAVSPECWAR evaluation, assisted COMNAVSAPECWAR with Bioluminescence software, supported evaluation of a third generation Forward Looking Infrared Radar (FLIR) for Joint Inter-Agency Task Force (JIATF) East, and continued investigation of sports medicine protocols for reduced USMC OCS attrition.

- (U) (\$7,537) SEA-STATE 3 LIGHTERAGE - CONGRESSIONAL PLUS-UP:
  - (U) initiated the development of a joint modular lighter system (JMLS) for ship-to-shore operations in higher sea states and for offloading supplies to beach or at the elevated causeway pier.

2. (U) FY 1999 PLAN:

- (U) (\$20,085) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - Initiate:
    - (U) plans and designs to develop and conduct experiments to systematically investigate the human performance benefit of various perspective view technology features.
    - (U) development of a testbed facility and models to enhance the realism of computer generated forces.
    - (U) general investigation of applied Human Factors in the design of interactive information management and interactive display technology to support user/task centered decision-making.
    - (U) investigate the side effects induced by utilization of virtual environment trainers on shipboard platforms.
    - (U) dynamic assessment and feedback on Tactical Decision performance.
    - (U) distributed debriefing for network centric warfare in an information intense environment.
    - (U) intelligent tutoring for time-stressed system control/interaction.

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- Continue:
    - (U) development and evaluation of unconventional visual, auditory and haptic cueing techniques to enhance learning of complex perceptual-motor skills.
    - (U) development of computer-based tools to improve the Navy's force management capabilities.
    - (U) feasibility evaluation of continuous speech recognition technology for the development of a virtual instructor for training complex team skills.
    - (U) development of a Response Planner and Manager (RPM) authoring tools; develop the Human Computer Interface (HCI) and user dialogue.
    - (U) development of design guidelines for a Combat Supervisory Support System that provides for reduced shipboard manning and increased automation, and supports the use of reconfigurable, collaborative task teams.
  - Complete:
    - (U) laboratory evaluation of candidate instructional strategies and measurement techniques for aircrew situational awareness.
    - (U) demonstration and evaluation of large flat panel displays for use in aviation mission planning, mission rehearsal and training systems.
    - (U) development of measures and models to improve the Navy's ability to predict fleet readiness based on training and manpower resources expended.
    - (U) development and transition of a prototype tactical decision support system to the Joint Maritime Command Information System (JMCIS).
- (U) (\$9,859) MEDICAL TECHNOLOGY (INCLUDES CONGRESSIONAL PLUS-UP - \$2,000 SMART AIRCREW INTEGRATED LIFE SUPPORT SYSTEM):
- Continue:
    - (U) research and development of supportive resuscitation fluids that minimize tissue damage and facilitate stabilization of hemorrhagic and burn casualties

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- (U) research and development of therapeutic regimens/modalities that prevent reperfusion injuries subsequent to combat trauma and hemorrhage.
  - (U) development of immune modulators for prevention of multiple organ failure.
  - (U) development of neuromodulators for therapy of non-freezing cold injury.
  - (U) research to extend the diving operational envelope by permitting faster decompression and/or longer bottom times through novel biochemical based decompression or other means of increasing survivability of Disabled Submarine (DISSUB) personnel and enhancing special warfare operations.
  - (U) undersea medicine programs that lead to preventive and treatment methods for oxygen toxicity and enhanced protocols for improving submarine rescue scenarios and special warfare operations.
  - (U) investigate operational durability of G-tolerance due to pilot down time.
  - (U) investigation of pharmaceutical rescue of noise induced hearing loss.
  - (U) mechanism research to prevent performance decrements during military operations in extreme environments implementing biomedical and pharmacologic interventions.
  - (U) research in chronic or high pulse exposure to induced body currents from radio frequency radiation and develop techniques to ameliorate adverse human health effects through physical and/or biological protections.
  - (U) research to identify biomarkers of cardiac sensitization associated with exposure to refrigerants and fire suppression materials and to develop preventive measures; determine applicability of heart rate variability analysis to identifying adverse impact of toxicants.
- Complete:
- (U) system for biofeedback control of aircrew physiologic state and integrate with Vehicle Management System. Transition to Advanced Technology Crew Station Program (PE 0603216N).
  - (U) second phase of testing of oral interleukin-6 for prevention of intestinal ischemia following hemorrhage.
  - (U) evaluation of interleukin-11 for preservation of intestinal barrier function following hemorrhage
  - (U) optimization of trans-crocetinate delivery following hemorrhage

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- (U) (\$1,165) NSAP:
  - (U) continue support to the operational Commands in C4ISR for deployed assets.
  - (U) provide support to the Fleet/Force in high life cycle cost maintenance areas through application of innovative technologies to reduce maintenance frequency, manpower intensiveness, and incorporation of 'in the field' retro-fixes as applicable.
  - (U) address Fleet/Force operational readiness issues amenable by demonstration and application of COTs technology solutions.
  
- (U) (\$317) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.

3. (U) FY 2000 PLAN:

- (U) (\$21,102) PERSONNEL, TRAINING AND HUMAN FACTORS TECHNOLOGY:
  - Initiate:
    - (U) test and evaluation of models designed to enhance the realism of computer generated forces.
    - (U) develop and evaluate Perspective View Technology (PVT) prototype.
    - (U) demonstrate, test and evaluate After Action Review (AAR) principles in Joint Service exercises.
    - (U) evaluation of an advanced processor for speech recognition.
  - Continue:
    - (U) development and evaluation of unconventional visual, auditory and haptic cueing techniques to enhance learning of complex perceptual-motor skills.
    - (U) demonstrate the efficacy of the framework that specifies how different types of knowledge are presented to decision makers to foster development of appropriate knowledge structures.

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- (U) general investigation of applied Human Factors in the design of interactive information management and interactive display technology to support decision-making.
- (U) dynamic assessment and feedback on Tactical Decision performance.
- (U) distributed debriefing for network centric warfare in an information intense environment.
- (U) intelligent tutoring for time-stressed system control/interaction

- Complete:

- (U) development of the RPM authoring tools, conduct fleet demonstration.
- (U) planning, design, development and conduct of experiments to systematically investigate the human performance benefit of various perspective view technology feature.
- (U) complete mockup and final experiments for a Combat Supervisory Support System that provides for reduced shipboard manning and increased automation, and supports the use of reconfigurable, collaborative task teams.
- (U) experiments for continuous shipboard learning, develop on the job training (OJT) guidelines, and demonstrate transitions to shipboard environment.
- (U) development of a testbed facility to enhance the realism of computer generated forces.
- (U) feasibility evaluation of continuous speech recognition technology for the development of a virtual instructor for training complex team skills.
- (U) investigate the side effects induced by utilization of virtual environment trainers on shipboard platforms.

• (U) (\$8,260) MEDICAL TECHNOLOGY:

- - Continue:

- (U) research and development of supportive resuscitation fluids that minimize tissue damage and facilitate stabilization of hemorrhagic and burn casualties
- (U) research and development of therapeutic regimens/modalities that prevent reperfusion injuries

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- subsequent to combat trauma and hemorrhage.
- (U) development of immune modulators for prevention of multiple organ failure.
- (U) development of neuromodulators for therapy of non-freezing cold injury.
- (U) development of mission preparation and body protection countermeasure techniques to minimize effects of pulsed radiowave energy.
- (U) effects research durability of G-tolerance due to pilot down time.
- (U) investigation of pharmaceutical rescue of noise-induced hearing loss.
- (U) research to extend the diving operational envelope by permitting faster decompression and/or longer bottom times through novel decompression or other means of increasing survivability of DISSUB personnel and enhancing special warfare operations.
- (U) undersea medicine programs that lead to preventative and treatment methods for oxygen toxicity and enhanced protocols for improving submarine rescue scenarios and special warfare operations.
- (U) mechanism research to prevent performance decrements during sustained operations in extreme environments implementing biomedical and pharmacologic interventions.
- (U) research to identify biomarkers of cardiac sensitization associated with exposure to refrigerants and fire suppression materials and to develop preventive measures; determine applicability of heart rate variability analysis to identifying adverse impact of toxicants.
- Complete:
  - (U) industrial transition of trans-crocetinate as additive for resuscitation fluid
  - (U) complete development of interleukins as therapeutics for hemorrhage
  - (U) complete testing of nerve growth factors in non-freezing cold injury.
  - (U) complete testing of guanidine derivative for preservation of mitochondrial function in uncontrolled hemorrhage.
- (U) (\$1,224) NSAP:
  - Complete:

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- (U) continue support to the operational Commands in C4ISR for deployed assets.
- (U) provide support to the Fleet/Force in high life cycle cost maintenance areas through application of innovative technologies to reduce maintenance frequency, manpower intensiveness, and incorporation of 'in the field' retro-fixes as applicable.
- (U) address Fleet/Force operational readiness issues amenable by demonstration and application of COTs technology solutions.

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B. (U) PROGRAM CHANGE SUMMARY:

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
(U) FY 1999 President's Budget Submit:	38,079	29,722	30,915
(U) Appropriated Value:	-	31,722	-
(U) Adjustments from FY 1999 PRESBUDG:	+2,326	+1,704	-329
(U) FY 2000 OSD/OMB Submission:	40,405	31,426	30,586

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: The FY 1998 increase is due to the FY98 Small Business Innovative Research funding (-276), Actual Update adjustment (+2,622) and Federal Technology Transfer (-20). The FY 1999 increase is due to Revised Economic assumption (-73), Civilian Personnel Underexecution (-16), Congressional Add for Smart Aircrew (+2,000) and Contract Advisory and Assistance (-207). FY 2000 decrease is due to Outsourcing Adjustment (-73), Navy Working Capital Fund adjustment (+120), Civilian Pay Rates (+66) and Non Pay Inflation (-442).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.

(U) RELATED RDT&E:

- (U) PE 0601152N (In-House Independent Laboratory Research)
- (U) PE 0601153N (Defense Research Sciences)
- (U) PE 0602232N (Communications, Command and Control Technology)

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- (U) PE 0603706N (Medical Development (Advanced))
- (U) PE 0603707N (Manpower, Personnel and Training Advanced Technology Development)
- (U) PE 0603712N (Environmental Quality and Logistics Advanced Technology)
- (U) PE 0602202F (Human Systems Technology)
- (U) PE 0602205F (Personnel, Training and Simulation)
- (U) PE 0602716A (Human Factors Engineering Technology)
- (U) PE 0602727A (Non-System Training Device Technology)
- (U) PE 0602785A (Manpower, Personnel and Training Technology)
- (U) PE 0602787A (Medical Technology)

This PE adheres to Tri-Service Reliance Agreements on Human Systems Technology, Medical, and CBD Technology. Oversight is provided by the Joint Directors of Laboratories, Training and Personnel Systems Science and Technology Evaluation Management and Armed Services Biomedical Research Evaluation and Management.

D. (U) SCHEDULE PROFILE: Not applicable.

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