

UNCLASSIFIED

FY 2000 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET

DATE: February 1999

BUDGET ACTIVITY: 3

PROGRAM ELEMENT: 0603794N

PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	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
X2091 Space and Electronic Warfare (SEW) Advanced Technology	13,612	20,800	22,022	22,528	23,030	23,583	24,142	24,722	CONT.	CONT.
R2239 Advanced Targeting	8,276	928	1,786	6,487	3,848	3,562	6,246	6,540	CONT.	CONT.
R2601 Dominant Battlespace Awareness	0	2,993	0	0	0	0	0	0	0	2,993
R2602 National Technology Alliance	0	14,965	0	0	0	0	0	0	0	14,965
TOTAL	21,888	39,686	23,808	29,015	26,878	27,145	30,388	31,262	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) develops Command, Control and Communications (C³) technologies which enhance battle targeting for naval forces in Navy, Joint and Coalition operations. The tasking of this PE is executed in accordance with the Information Technology Management Reform Act (ITMRA) of 1996. This PE is being restructured to support the Navy's high priority technology needs for Navy implementation of network centric warfare and Joint Vision 2010. Primary products include technology for dynamic, reconfigurable, secure, radio frequency networks; high data rate, radio frequency communications; multi-function apertures; high assurance systems; distributive, collaborative,

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planning and execution; complex information processing support for deliberate precision weapons engagements; and algorithms for specific target identification.

(U) This PE primarily supports the following Joint Mission Areas and Support Areas: Land Attack (comprised of precision strike and naval surface fire support functions), Amphibious Warfare, Information Warfare, Anti Air Warfare, Maritime Dominance, Theater Ballistic Missile Defense and Readiness/Training. The focus is on development and demonstrations of next-generation C³ systems with high quality and certifiable quality of service to support joint war fighting operations, involving land units, ships, aircraft, and submarines. C³ capabilities in the 21st century are key to the success of all aspects of military operations including force level planning and rehearsal quality as well as unit level battlespace awareness and weapons engagement execution.

1. (U) SEW Advanced Technology (X2091) -- This project is pursuing work in dynamic, reconfigurable, secure, radio frequency networks; high data rate, radio frequency communications; multi-function apertures; high assurance systems; and distributive, collaborative planning and execution. Efforts will develop:

(a) Low observable, high data rate apertures. Ships, aircraft and submarines in the 21st century must have signature-controlled apertures to enhance operational effectiveness. Apertures must provide connectivity between satellites, ships, aircraft and submarines and land units as well as provide for surveillance and active and passive electronic warfare.

(b) State-of-the-art telecommunications technologies for high data rate over the air communications with low probability of intercept and robustness with regard to jamming.

(c) High capacity Radio Frequency (RF) information networks using commercially developed advanced information handling techniques such as Asynchronous Transfer Mode (ATM) or modifications thereto for multi-media communications that meet unique military data transfer requirements and environments. These systems must be able to satisfy the full range of Quality of Service requirements including certifiable low latency for weapons engagements and critical equipment control. Commercial off-the-shelf (COTs) adapted, high speed, secure local area networks (LANs) will enhance the ability to perform collaborative strike planning, battlespace awareness and time sensitive fire support execution using real-time information from sources such as the Precision Signals Intelligence (SIGINT) Targeting System (PSTS) and tactical reconnaissance and surveillance sources.

(d) Automated command, control, communications, computers, intelligence sensors and reconnaissance (C4ISR) systems to minimize manning requirements e.g. an intelligent communications resource manager capable of adjusting bandwidth/frequency to

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balance system loading. Expert systems including intelligent databases and tactical decision aids, for processing, correlation and fusion of large amounts of information which can allow a single operator to be more effective. Tools for ensuring information is available when required. Modified COB collaborative software for military missions.

(e) Tools to ensure integrity, validation, and verification of COTS and other software as well as aids for development. Techniques to ensure integrity or networks and information on networks.

(U) This program will match maturing information technologies with operational warfighting requirements to procure modern C4ISR capability based on an accelerated acquisition cycle.

2. (U) Advanced Targeting (R2239) -- This project is pursuing evaluation of current and emerging technologies to improve communications, surveillance and targeting capabilities for airborne, ground, and shipbased forces.

(a) The Precision Sigint Targeting System (PSTS): Is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time target identification and precision targeting information, sensor to-shooter target updating, and Battle Damage Assessment. PSTS will enhance the tactical utility/applicability of existing national assets and provide the tactical commander with performance improvements in terms of targeting accuracy, targets of interest, timeliness, and target identification. Technical challenges include development of advanced signal processing and data fusion algorithms for target detection and classification; and exploitation of multiple signal characteristics for specific emitter identifications.

(b) The advanced multifunction RF system will provide the capability to radiate and receive arbitrary communications, electronic warfare, and radar waveforms from common apertures which will reduce the antenna farms on Naval platforms, reduce life cycle costs, increase stealth characteristics of platforms, and enhance the effectiveness of the RF capabilities of the platforms for warfighting.

3. (U) Dominate Battle Space Command (R2601) -- This project is pursuing evaluation of visualization software and computer technologies to improve battlespace awareness, shorten the command and control decision-making cycle and interface with existing C4ISR systems, data links, and networks. Efforts include: networks that will provide the Command and Control (C2) operator with a real time interactive 3D visualization of the battle space; timely and dynamic management of intelligent, surveillance and reconnaissance (ISR) resources; and rapid and dynamic replanning.

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4. (U) National Technology Alliance (R2602) -- This project is pursuing identification and applicability of current and emerging satellite, commercial and consumer technologies to enhance Naval warfighting systems performance and capability while reducing costs. Navy decision-makers need to understand the impact of these technologies in order to employ the best solutions, plot a technology development course, and map out procurement strategies. The end result will be to develop systems that will support joint and future naval operations in the 21st Century by providing seamless access to tailorable information for warfighters, planners, decision makers and analyst at all echelons.

(U) JUSTIFICATION FOR BUDGET ACTIVITY: This program is budgeted within the Advanced Technology Budget Activity because it encompasses design, development, simulation, or experimental testing of prototype hardware and software to validate technological feasibility and concept of operations and reduce technological risk prior to initiation of a new acquisition program or transition to an ongoing acquisition program.

(U) PROGRAM CHANGE SUMMARY:

	FY 1998	FY 1999	FY 2000
(U) FY 1999 President's Budget	21,619	22,294	22,922
(U) Appropriated Value		40,294	
(U) Adjustments from FY 1999 PRESBUDG	+269	+17,392	+886
(U) FY 2000 PRESBUDG Submission	21,888	39,686	23,808

(U) CHANGE SUMMARY EXPLANATION:

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(U) Funding: FY1998 adjustments reflect a Small Business Innovative Research reduction (-277) and an actual update adjustment (+546). FY1999 adjustments reflect the Congressional Plus-Up Dominant Battlespace Command Initiative (+3,000), Congressional Plus-Up National Technology Alliance Program (+15,000); Congressional undistributed reductions (-124), and execution adjustment (-484). FY2000 adjustments reflect Science & Technology rate adjustment (+884); Navy Working Capital Fund (NWCFF) rate adjustment (+258); Civilian Pay Rates (+88), and Non Pay Inflation reduction(-344).

(U) Schedule: Not applicable.

(U) Technical: Not applicable.

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PROGRAM ELEMENT TITLE: C3 Advanced Technology

(U) COST: (Dollars in thousands)

PROJECT NUMBER & TITLE	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
X2091 Space and Electronic Warfare (SEW) Advanced Technology	13,612	20,800	22,022	22,528	23,030	23,583	24,142	24,722	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project demonstrates advanced technology components, subsystems and systems that will improve the Navy's management and operational use of time-critical command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) data with certifiable assurance functionality, high data rates, optimization and automation of network resources, multi-level access and security of databases and the ability to transmit and receive multi-media data (voice/data/video) over high data rate communication circuits. Capabilities realized from these efforts will contribute to the Navy's ability to maintain an accurate situation assessment and tactical picture with required accuracy and timeliness to allow all forces to have detailed knowledge of the battlespace. This project is being restructured to support the Navy's high priority technology needs for Navy implementation of network centric warfare and Joint Vision 2010. Primary technology focus areas include dynamic reconfigurable secure radio frequency networks, high data rate radio frequency communications, multi-function apertures, high assurance systems, and distributive collaborative planning and execution. The highest emphasis is currently multifunction radio frequency (RF) apertures as these are absolutely essential. As funding is available over the FYDP the issues in the other key areas will be addressed

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1998 ACCOMPLISHMENTS:

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PROGRAM ELEMENT TITLE: C3 Advanced Technology

PROJECT TITLE: (SEW)

ADVANCED TECHNOLOGY

- (U) (\$829) High Assurance Systems: The focus of this technology is verification & validation of mission critical systems. Designed and developed an approach and an initial capability for building customized system prototypes from a systems requirements specification. This Java-coded capability was used to build two small interfaces. Developed prototype implementation of formal techniques that automatically reduce requirements specification. Developed initial capability tool for generating test sets from system requirements specifications. Analyzed requirements specifications for Programmable Embeddable INFOSEC Product (PEIP) system and began interface builder for validation.
- (U) (\$3,220) Multi-function Apertures: This technology addresses a unique Navy need for improved antenna aperture, reduced radar cross-section, and reduced numbers of shipboard antennas. Developed elements for multi-functional multi-beam broadband antenna. Elements cover extra high frequency (EHF) Satellite Communications (SATCOM)/Global Broadcast System (GBS) two-dimensional (2D) Receive Only Antenna sub-array. Conducted ultra high frequency (UHF) SATCOM/International Maritime Satellite (INMARSAT) sub-array demonstration to include hybrid reliability study and tracking/hand-off demonstration. Continued design of UHF/L/K/Q Band Planar Phased Array SATCOM antennas
- (U) (\$1,520) Dynamic Reconfigurable Secure radio frequency (RF) Networks: This activity focuses on the Navy's critical need for management of heterogeneous network environments supporting mobile forces and land units in maritime operations. Conducted operational demonstration of Asynchronous Transfer Mode (ATM) hardware and associated software on the USS Abraham Lincoln during Joint Task Force Exercises 98-1. A Java applet and Java-based server were developed in support of Advanced Digital Network System.. Initiated a remote pier-side monitoring effort to support Commander in Chief, Pacific Fleet (CINCPACFLT) and the Joint Maritime Communications System (JMCOMS). Developed an autonomous network management application to perform functions specific to the Navy's pier-side network hook-up devices and applications. Supported successfully a Joint Command Information System (JCIS) network management demonstration in support of the Sea Based Battle Lab, particularly providing management of the ATM local area networks (LANs), including multicast and flow control. Transitioned results to JMCOMS.

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PROJECT TITLE: (SEW)

ADVANCED TECHNOLOGY

- (U) (\$1,012) High Data Rate RF Communications: This technology focuses on the Navy's critical need for increased RF communications throughput for planning and execution in Joint Operations aboard all platforms. Purchased and tested components of a small aperture (approx. 1 meter diameter) Ku Band SATCOM system using a Code Digital Multiplexing Analysis (CDMA) MODEM for multi-terminal networked applications, in support of the Navy's Commercial SATCOM Communication Initiative (CSCI). Identified and modified spread spectrum modems. Performed initial antenna pointing and link margin testing. Performed antenna pedestal testing on a ship motion simulator. Tested power amplifiers and transceivers. Conducted technology assessments for RF communications in network centric warfare. Developed concepts and models, and demonstrated in Global 98 War Game.
- (U) (\$7,031) Distributive Collaborative Planning and Execution: This area supports the Navy's need for increased speed and accuracy in collaborative planning and execution, conduct of distributed maritime operations with reduced staffs, and improved Joint service situational assessment, planning, and execution. Developed and demonstrated leading edge information processing and display technologies in an open system, advanced, multi-modal workstation environment that supports collaborative planning staff operations, tactical decision making and information management. Delivered the Beta release of hardened collaborative software for distributed group planning. Began installation and experimentation with the Joint Maritime Command Information System (JMCIS) program office personnel in the customer segment areas of training, planning and logistics; and with Commander, Third Fleet (COMTHIRDFLT) in support of the Undersea Warfare collaboration efforts in conjunction with carrier task force (CTF) 12. Supported Pacific Rim (RIMPAC) exercise. Developed transitionable advanced DII-COE applications for conducting a major integrated demonstration of real-time planning and execution capabilities in conjunction with Command Control Communication Computers, Intelligence (C4I)/Combat System Advanced Concepts-21 (ADCON-21) demonstration. Evaluated information timeliness, consistency, and quality of service from multiple sensor-shooter perspectives. In conjunction with Navy and Joint programs, integrated advanced C4I suite for conducting in-flight demonstration of real time coordination software for special warfare planning and pilot rescue in H-60R at Navy Strike and Air Warfare Center, Fallon, Nevada. Identified and incorporated advanced correlation, fusion, and video registration tools to demonstrate a tactical display for integration of real-time Intelligence, Surveillance, and Reconnaissance (ISR) sources for shore sites and surface combatants. The display provides data from real-time classified information sources, off-board communications links, and improved information integration to support over-the-horizon targeting in Joint littoral operations.

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PROJECT TITLE: (SEW)

ADVANCED TECHNOLOGY

2. (U) FY 1999 PLAN:

- (U) (\$19,524) Multi-function Apertures: This technology addresses a unique Navy need for improved antenna aperture, reduced radar cross-section, and reduced numbers of shipboard antennas. Complete design and begin fabrication and testing of UHF/L/K/Q Band Planar Phased Array SATCOM antennas. Complete construction of lightweight, low signature Multi-function Electromagnetic Radiating System (MERS) antenna that integrates into a compact design the functions of the existing UHF line of sight (LOS) Communications, Joint Tactical Information Distribution System (JTIDS), Combat Direction Finding (DF), and Identification Friend/Foe (IFF) apertures to permit platform space for Cooperative Engagement Concept (CEC). Conduct sea trials and transition. Develop a design for an advanced multifunction RF system which will enable all RF functions Radar, Communications, and Electronic Warfare to be integrated into common apertures.
- (U) (\$1,276) Distributive Collaborative Planning and Execution: This area supports the Navy's need for increased speed and accuracy in collaborative planning and execution, conduct of distributed maritime operations with reduced staffs, and improved Joint service situational assessment, planning, and execution. Conduct in-flight demonstration and complete documentation and transition of the real-time ground/air coordination software for special warfare planning and pilot rescue. Perform analysis of further C4ISR architectures based on recent technology advances in computer and sensor technologies.

3. (U) FY 2000 PLAN:

- (U) (\$1,245) High Assurance Systems: The focus of this technology is verification & validation of mission critical systems. Develop, assess and demonstrate software tools and techniques to provide software process improvements, and network/system enhancements to improve existing and provide for additional network centric warfighting capability. With Carnegie Mellon collaboration develop a synchronized, reliable, real time, simultaneous upgrade capability for systems software on multiple tactical units.

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PROGRAM ELEMENT TITLE: C3 Advanced Technology

PROJECT NUMBER: X2091
PROJECT TITLE: (SEW)
ADVANCED TECHNOLOGY

- (U) (\$20,777) Multi-function Apertures: This technology addresses a unique Navy need for improved antenna aperture, reduced radar cross-section, and reduced numbers of shipboard antennas. Complete full UHF/INMARSAT-B/GBS/EHF SATCOM antenna fabrication, performance land-based testing and develop a ship installation package. Continue the development of the multifunction receive aperture for the multifunction radio frequency system.
- B. (U) PROGRAM CHANGE SUMMARY: See total program change summary for Program Element.
- C. (U) OTHER PROGRAM FUNDING SUMMARY: Not applicable.
(U) RELEATED RDT&E:
(U) PE 0301567G (Computer Security Program)
(U) PE 0303140N (Information Systems Security Plan)
(U) PE 0601153N (Defense Research Sciences)
(U) PE 0602232N (Space and Electronic Warfare (SEW) Technology)
(U) PE 0602234N (Materials, Electronics and Computer Technology)
(U) PE 0604231N (Tactical Command Systems)
- D. (U) SCHEDULE PROFILE: Not applicable.

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R2239 Advanced Targeting	8,276	928	1,786	6,487	3,848	3,562	6,246	6,540	CONT.	CONT.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: As addressed in the Director of Defense, Research and Engineering's Global Surveillance and Communications Thrust, the Precision Sigint Targeting System (PSTS) is a Joint Service/Defense Agency effort to develop and demonstrate the capability to provide tactical users with near-real-time precision targeting information and sensor-to-shooter target updating. The proposed system will enhance the tactical utility and application of existing national assets to provide the tactical commander involved in future conflicts with significant performance improvements resulting in a total surveillance network which is more responsive to changing world economic and political threats in terms of targeting accuracy, targets of interest and timeliness. PSTS will develop Joint Service/Defense Agency cooperative precision targeting site enhancements and Global Concept of Operations (CONOPS) for optimal asset cooperative utilization and minimal operational impact. Technical challenges include development of advanced signal processing, data fusion algorithms, exploitation of multiple signal characteristics for target detection and precision geo-location, and modeling and simulation to assure optimal resource allocation for cooperative precision targeting and primary mission performance.

(U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1998 ACCOMPLISHMENTS:

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Project Title: Advanced Targeting

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- (U) (\$5,156) DEMONSTRATION 5: Developmental Test 1 (DT1) was conducted in CONUS in May 1998 to determine system status prior to shipping equipment to Korea. Demonstration 5 was conducted in Korea with the goal of demonstrating all PSTS capabilities. Additional refinements and upgrades to the signal processing and data fusion algorithms based on the results from previous demonstrations were integrated into the processing system.
- (U) (\$2,455) SYSTEMS ENGINEERING: Requirements analysis, operations concept development, test planning and test procedures, and scheduling for Demonstration 5 were completed. System engineering studies required to meet Demonstration 5 and to support technology transition were completed.
- (U) (\$665) TECHNOLOGY TRANSFER: Completed documentation and configuration management of final PSTS systems including the tactical testbed.

2. (U) FY 1999 PLAN:

- (U) (\$909) LOGISTICS SUPPORT: Provided engineering, operations and maintenance support for deployed PSTS systems.
- (U) (\$19) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.

3. (U) FY 2000 PLAN:

- (U) (\$900) LOGISTIC SUPPORT: Provide engineering, operations and maintenance support for deployed PSTS systems.
- (U) (\$886) ADVANCED MULTIFUNCTION RADIO FREQUENCY SYSTEM: Design the advanced multifunction radio frequency system including all apertures, resource allocation manager and other subsystems. The initial test-bed is focused on the 1 to 5 GHz band including functions such as volume search radar, theater ballistic missile discrimination, Challenge Athena, receive noise jamming, deceptive jamming, and high probability of intercept electronic surveillance. Initial development will begin.

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The approach, which is applicable to functions at lower and higher frequencies, will provide the Navy with a low cross-section and low life cycle cost approach to the proliferation of apertures and antennae on Naval platforms.

- B. (U) PROGRAM CHANGE SUMMARY: See total program change summary for Program Element.
- C. (U) OTHER PROGRAM FUNDING SUMMARY: Available above SECRET level of classification.
(U) RELATED RDT&E: Available above SECRET level of classification.
- D. (U) SCHEDULE PROFILE: Not applicable.

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