FY 2002 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: June 2001

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

(U) COST: (Dollars in Thousands)

PROJECT NUMBER & TITLE	FY 2000 ACTUAL	FY 2001 ESTIMATE	FY 2002 ESTIMATE	
	**	**	83,557	CONT.

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work descried in FY 2000 & 2001 was funded in PE(s) 0602232N, 0602270N, 0602233N.

(U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This PE supports Naval missions ranging from expeditionary and littoral warfare to theater level collaborative planning and execution. The need is to develop Common Picture technologies that provide a capability to do theater wide collaborative target tracking and situational awareness for major Command Centers, surface, subsurface, space and air platforms including the warfighter ashore. Applied research in this program focuses on the location, extraction, fusion/multi-source integration and management of relevant, time sensitive, critical information. This information is tailored for distribution across robust Naval communications/ information networks to decision makers at various Command echelons. Technology developments within this PE include: high assurance information systems; advanced/asymmetric networking protocols; dynamic bandwidth and network management techniques; network centric battle management architecture and infrastructure; knowledge based software agents; image processing and exploitation; multi-source integration; interoperable cooperative engagement networking; advanced decision support tools; optimized resource management; interactive collaborative tools; advanced visualization displays, intuitive human computer interaction, virtual and augmented reality and multi-modal interaction with very large screen wall-displays; and Naval fires coordination, deconfliction and cueing for combat systems. The major goal of this effort is to provide the Navy with the capability for future Battle Space Dominance through a seamless information network of warfighting systems that gather, process, disseminate and use information to formulate a consistent common operational/tactical picture across Command echelons. This program develops technologies in support of Future Naval Capabilities (FNCs) including: Knowledge Superiority and Assurance (KSA), Missile Defense, Littoral Anti-Submarine Warfare and Platform Protection.

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

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

(U) PROGRAMS PLANS AND ACCOMPLISHMENTS:

- (U) COMMUNICATION AND NETWORKS. This area supports development of key wireless communications network technologies for air, ship, submarine and land platforms that are critical to the performance and robustness of Naval communications networks. Technology developments include Quality of Service (QoS) protocols, bandwidth and network management techniques for robust highly dynamic environments, interoperable wireless networks for secure communications, protocols, and bandwidth and network management techniques that can effectively manage and allocate bandwidth across tactical and theater levels in support of wireless network centric operations.

COMMUNICATION AND NETWORKS	FY00	FY01	FY02 ($10,580)
Initiate	• Dynamic Networking for Tactical Data Links • Multicast Congestion Control	• Networking of Phased Arrays • Real Time Composite Networking • Mobility Management for Heterogeneous Networks	• Underwater Surveillance Data Link Network • Asymmetric Secure Network Access for Vulnerable Assets
Continue	• Expeditionary Warfare Mobile Networking	• Dynamic Networking for Tactical Data Links • Multicast Congestion Control	• Dynamic Networking for Tactical Data Links • Networking of Phased Arrays • Real Time Composite Networking • Mobility Management for Heterogeneous Networks • Interoperable networks for Secure Communication

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
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Complete	• High Performance Networking	• Expeditionary Warfare Mobile Networking	• Multicast Congestion Control

• (U) MULTI-SOURCE INTEGRATION AND COMBAT IDENTIFICATION(CID): This thrust focuses on development of Navy's Surface & Aerospace needs for multi-source integration (MSI), fusion, systems architecture, automated sensor management and algorithms to fuse, filter and correlate on-board sensor and off-board battlespace information from tactical data links, satellite communications and interoperable cooperative engagement networks that support Missile Defense Operations. MSI technologies such as platform level, theater level and Combat Identification are currently planned for transition programs for E-2C Airborne Early Warning Aircraft, EP-3 Aircraft, United States Marine Corps (USMC), AEGIS and Amphibious Assault Platforms.

MULTI-SOURCE TECHNOLOGY	**FY00**	**FY01**	**FY02 ($11,453)**
Initiate	• Combat Identification (ID) Technology For Air Defense	• Affordable Ground Based Radar • System Resource Manager for Missile Defense Systems • US/UK Data Fusion Technology for Interoperability	
Continue	• Platform (E-2C) Multi-Source Integration • Corporate Engagement Capability (CEC) P3I/Advanced Sensor Networking Technology (ASNT)	• Platform (E-2C) MSI • CEC P3I/ASNT • Combat ID Technology For Air Defense	• Platform E2-C MSI • CEC P3I/ASNT • Combat ID Technology for Air Defense • Affordable Ground Based Radar • System Resource Manager for Missile Defense Systems • US/UK DATA Fusion Technology for Interoperability

BUDGET ACTIVITY: 2 PROGRAM ELEMENT: 0602235N
PROGRAM ELEMENT TITLE: Common Picture Applied Research

- (U) NETWORKED COMMAND, CONTROL & COMBAT SYSTEMS. The focal point for this effort is development of technologies to network geographically dispersed warfighting elements (computing platforms and systems) to provide a Force multiplier effect through sharing, integrating and correlation of information, thereby improving speed of command and self synchronization of forces in the execution of Naval misions. Technology developments include: dependable information assurance that provides for timely quality of service (QoS), and secure delivery of data; image processing and information exploitation to enhance target detection and identification; visualization and information management technologies that encompass the extraction, distribution, management and presentation of information; tactical decision aids to assist geographically dispersed human decision makers in mission planning (i.e.; task-to-fleet resource allocation, weapon-to-target allocation, route planning and target deconfliction, target tracking and prediction, real-time retargeting and resource allocation); interactive collaborative-planning technologies; and interoperable C2 and Combat System's architecture, interconnected through middleware and software wrappers, to provide a network centric environment capable of operating in real- and non real-time.

NETWORKED COMMAND, CONTROL & COMBAT SYSTEMS	FY00	FY01	FY02 ($23,330)
Initiate	• Collaborative Cryptographic Protocols • Synthetic Aperture Radar (SAR) to Map Registration • Theater Battle Management • Collaborative Mission Planning Testbed • Consistent Network Information System(CNIS)	• Secure Architecture for Intelligent Agents • Intrusion Detection Algorithms • Distributed Computing and Collaboration Framework	• Multimodal Battlefield Interaction • Distributed Situation Assessment • Visualization of Uncertainty • Active Network Defense in Depth • Science and Technology Research In Distributed Experiments (STRIDE) • Assisted Decision Making in a

			Network Centric Environment
Continue	• Rules of Engagement • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Intelligent Information Exploitation and Retrieval • Image Processing Exploitation (IPEX) • Combat Systems Technology • Airborne Battle Management • Case Based Reasoning • Distributed, Interactive Rehearsal Environment • Land Attack Pre-designation • Real Time Execution Decision Support (REDS) • Interactive Planning, Monitoring and Re-planning	• Collaborative Cryptographic Protocols • Theater Battle Management • Collaborative Mission Planning Testbed • Rules of Engagement • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Intelligent Information Exploitation and Retrieval • Combat Systems Technolog Airborne Battle Management • Land Attack Pre-designation	• Secure Architecture for Intelligent Agents • Intrusion Detection Algorithms • Distributed Computing and Collaboration Framework • Collaborative Cryptographic Protocols • Theater Battle Management • Rules of Engagement • Collaborative Mission Planning Testbed • Interoperable, Networked 2D/3D Virtual Displays • Battlefield Augmented Reality • Combat Systems Technology • Airborne Battle Management • Land Attack Pre-designation
Complete	• Information Assurance Software Spec. • Multi-level Secure Workflow Architecture • Distributed Data Fusion • Real-time Cockpit Imagery • Head Motion Tracker	• SAR to Map Registration • IPEX • CNIS • REDS • Interactive Planning, Monitoring and Re-planning • Distributed, Interactive	• Intelligent Information Exploitation and Retrieval

		Rehearsal Environment • Case Based Reasoning	

(U) PLATFORM AWARENESS AND PROTECTION. Current small platforms (both surface and airborne) have no situational awareness or self-protection against threat missile weapon systems. The goal of this effort is to provide for the ability of these platforms to achieve very accurate hemispheric direction-finding. This capability when Integrated with emitter identification, Low Probability of Intercept detection systems will provide netted targeting information and cueing that allows for platform self protection against various threat systems. Developments include utilization of small compact digital electronics, integrated circuits and digital synthesis technology.

PLATFORM AWARENESS AND PROTECTION	FY00	FY01	FY02 ($1,912)
Initiate		• Advanced Anti-Ship Cruise Missile (ASCM) Techniques	• Compact Small Platform Electronic Attack • Compact Small Platform Situational Awareness
Continue	• Force Level Simulation	• Force Level Simulation	• Advanced ASCM Techniques
Complete	• Radio Frequency (RF) & Infrared (IR) Scene Assessment		• Force Level Simulation

• (U) DECISION SUPPORT SYSTEMS. This effort supports the KSA FNC with particular emphasis on the development of operational capabilities in: common consistent knowledge; distributed collaborative planning and execution; and time sensitive decision making. Focused efforts include: Decision aids and Collaborative tools and technologies to aid the tactical decision maker in his mission planning, rehearsal, plan-execution, mission monitoring, re-planning and re-targeting of assets. The network centric environment requires decision aids and decision support techniques that are

distributive, collaborative and interactive among multiple decision makers. Additional technologies include knowlwdge wall displays for situational awareness, environmental visualization software, optimization algorithms for selecting the appropriate resources for executing planned missions, browser based collaboration tools, and real time, distributed, collaborative, mission planning software.

DECISION SUPPORT SYSTEMS	FY00	FY01	FY02 ($26,769)
Initiate			• Knowing What We Know (KNOW) • STORYMAKER Precision Geolocation • Human Alerting & Interuption Logistics (HAIL-SS) • Demonstration of a Scalable Architecture for Common Undersea Picture (CUP) • Environmental Visualization (ENVIRIZ) • Sea Combat Module for Embarking Staff (SCCM) • Comprehensive, Analysis, Real-Time Execution in Joint Air operations (CARTE) • Image Processing and Exploitation Architecture (IPEX) • Real-Times Executable Decision Support (REDS) • Integrated Marine Multi-Agent Command and Control Technology

			• Sea Combat Commanders Module for Embarked Staff (SCCM) • eXtensible Tactical C4I Framework (XTCF) • Air Operations Decision Support (AODS) • Joint Mission Planning System - GATOR Surface Assault Planning • Analytic Support Architecture (ASA) • Cryptologic Mgmt & Analysis Support Sys (CMASS) • Middleware & DII COE Interoperability • Course of action Analysis Tool for Identifying Mobile Time Sensitive Targets (CAAT). • Integrated Decision Support System Product Suite (IDPS) • Universal Data Exchange Manager for Net-Centric Warfare (UDEM) • Tomahawk Land Attack Naval Fire Control System Decision Support Capability • Knowledge Web Technologies (KWT) • Virtual information Center for Open Source Requirements (VICTORII)

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- (U) Human Computer Interface: The goal of this area is to improve platform, task force and battle group operations by developing human-centric decision support factors technology for incorporation into operational systems. General objectives of the area are to enhance human performance effectiveness, improve decision support and decision-making collaboration, improve human-centered design and accelerate insertion of advanced HFE technology into existing and new weapons systems.

Human Computer Interface	FY00	FY01	FY02 ($9,513)
Initiate	• Technology for Command and Control Collaboration • Human Agent Collaboration Architecture	• Hybrid Collaborative Environments • Dynamic task Allocation • Interfaces for Information Analysis • Intelligent Mission Monitoring • Geo-Plot Decluttering • Command 21 • Perspective View Technology • User-centered Design Interaction	• Generative Decision Support Architecture • Effects Based Models for Intelligent Surveilance Reconnaissance • Optimization Algorithms for Joint Operations Center • Knowledge Visualization • Human Centric Decision Support
Continue	• Adaptive Architecture for Command and Control • Advanced Audio • Attention Management Tools • Control Systems Supervisory Support	• Technology for Command and Control Collaboration • Human Agent Collaboration Architecture • Adaptive Architecture for Command and Control • Advanced Audio	• Hybrid Collaborative Environments • Dynamic task Allocation • Interfaces for Information Analysis • Intelligent Mission Monitoring • Geo-Plot Decluttering • Command 21

			• Perspective View Technology • User-centered Design Interaction • Technology for Command and Control Collaboration • Human Agent Collaboration Architecture • Adaptive Architecture for Command and Control • Advanced Audio
Complete	•	• Attention Management Tools • Control Systems Supervisory Support	

(U) PROGRAM CHANGE SUMMARY:

	FY 2000	FY 2001	FY 2002
FY 2001 President's Budget			0
Appropriated Value:			
Adjustments from FY 2001 President's Budget:			
Program Restructure			73,557
NWCF Adjustments			
Program Adjustment			10,000
FY 2002 OSD Submission	**	**	83,557

** The Science and Technology Program Elements (PEs) were restructured in FY 2002. The work descried in FY 2000 & 2001 was funded in PE(s) 0602232N, 0602270N, 0602233N.

(U) CHANGE SUMMARY EXPLANATION:

(U) Funding: Not Applicable.

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(U) Schedule: Not Applicable.

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

(U) NAVY RELATED RDT&E:
(U) PE 0601153N (Defense Research Science)
(U) PE 0602271N (RF Systems Applied Research)
(U) PE 0603114N (Power Projection Advanced Technology)
(U) PE 0603123N (Force Protection Advanced Technology)
(U) PE 0603235N (Common Picture Advanced Technology)
(U) PE 0603271N (RF Systems Advanced Technology)
(U) PE 0603640M (Marine Corps Advanced Technology)

(U) NON NAVY RELATED RDT&E:
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602782A (Command, Control and Communications (C^3) Technology)
(U) PE 0602204F (Aerospace Avionics)
(U) PE 0602702F (Command, Control and Communications)

(U) SCHEDULE PROFILE: Not Applicable.