

UNCLASSIFIED
 FY 2006/2007 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET
 Exhibit R-2

DATE: Feb 2005

BUDGET ACTIVITY: 04
 PROGRAM ELEMENT: 0604707N
 PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

COST: (Dollars in Thousands)

| Project Name and Title | FY 2004 | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 | FY 2011 |
|---------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Total PE Cost | \$36.614 | \$25.602 | \$44.469 | \$49.412 | \$54.430 | \$60.937 | \$71.501 | \$71.898 |
| 2357 Maritime Battle Center | 19.437 | 14.378 | 32.519 | 36.074 | 40.633 | 43.821 | 57.024 | 57.081 |
| 9364 Advanced Wireless Network | 3.363 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0798 OTH (Over the Horizon) Targeting | 1.566 | 1.692 | 1.620 | 2.007 | 2.095 | 2.148 | 2.209 | 2.267 |
| 2144 SEW Engineering | 9.496 | 9.532 | 10.330 | 11.331 | 11.702 | 11.968 | 12.268 | 12.550 |
| 9365 Coalition Warfare Program | 2.752 | | | | | | | |
| Quantity of RDT&E Articles | | | | | | | | |

- A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:** This Program Element (PE) contains three projects: Maritime Battle Center (MBC), Over-the-Horizon Targeting (OTH-T), and Space and Electronic Warfare (SEW) Engineering. The projects are systems engineering non-acquisition programs with the objectives of developing, testing, and validating Naval Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) architectures to support naval missions in Joint and Coalition Theater. The mission of this PE is carried out by multiple tasks that are used to ensure Naval C4ISR Command and Control Warfare (C2W) components of SEW are effectively integrated into the C4ISR architectures. Additionally the program ensures that (1) the composite operational capabilities of SEW systems (not the individual component systems) conform to the Naval C4ISR architecture as related to the objectives of National Defense Strategy and evolving joint visions and direction, such as Joint Vision 2020 (JV 2020), "Copernicus...C4ISR for the 21st Century," "Forward...From the Sea," C4I For the Warrior, and the Defense Science Board Summer Study Task Force on Information Architecture for the Battlefield and are guided by Commander in Chief (CINC) requirements; and (2) that SEW systems and

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systems integration effort involves leading-edge technology transfer of information processing technologies primarily through integration of government and commercial off-the-shelf (GOTS/COTS) products to enhance the Navy's operational capability, interoperability, flexible reconfiguration, as well as reduce costs; and (3) that SEW systems integration efforts support Expeditionary C5 Grid (EC5G) to provide the foundation for FORCEnet and the Navy's contribution to the Global Information Grid (GIG). The MBC is a distributed organization focusing on experimentation concept development and analysis tasks are coordinated by the Navy Warfare Development Command (NWDC). The MBC will also act as the Navy representative to the Joint Battle Center and the Battle Labs of other services.

PROGRAM CHANGE SUMMARY:

| | <u>FY 2004</u> | <u>FY 2005</u> | <u>FY 2006</u> | <u>FY 2007</u> |
|---|----------------|----------------|----------------|----------------|
| FY 2005 President's Budget Submission | 37,172 | 25,943 | 28,025 | 32,438 |
| Cong Rescissions/Adjustments/Undist. Reductions | 0 | -336 | 0 | 0 |
| Contracting/Management Support Adjustments | 0 | 0 | -420 | -485 |
| Execution Adjustments | -261 | 0 | -1,400 | 0 |
| Federal Technology Transfer | -8 | 0 | 0 | 0 |
| Non-Pay Inflation Adjustments | -24 | 0 | 50 | 72 |
| Program Adjustments | -265 | -5 | 18,181 | 17,208 |
| Rate Adjustments | 0 | 0 | 33 | 179 |
| FY 2006/2007 President's Budget Submission | 36,614 | 25,602 | 44,469 | 49,412 |

PROGRAM CHANGE SUMMARY EXPLANATION:

Technical: Not applicable.

Schedule: Not applicable.

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 PROJECT NUMBER: 2357 PROJECT TITLE: MARITIME BATTLE CENTER

COST: (Dollars in Thousands)

| Project Number & Title | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate |
|-----------------------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 2357 MARITIME BATTLE CENTER | 19,437 | 14,378 | 32,519 | 36,074 | 40,633 | 46,821 | 57,024 | 57,081 |

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The mission of the MBC is to execute the Naval Warfare Innovation Process. The process takes concepts developed by the Strategic Studies Group and approved by the Chief of Naval Operations into Fleet Battle Experiments (FBE); conducts preliminary sub-scale experiments and technological demonstrations focused on the advanced engineering and operational system development of systems related to all conflict levels of Littoral Battlespace. The MBC environment is a network centric environment that links the existing "core" Naval facilities to the Marine Corps Warfighting Lab (MCWL), the Joint Battle Center/Federated Battle Lab, and technologists in industry and academia. The MBC is essential to the evolution of combat capabilities since it is the engine for validating the new network centric warfare techniques in conjunction with the Sea Based Battle Laboratories (SBBL), Science & Technology (S&T) initiatives and other initiatives that originate with the operating forces. The MBC supports the early and sustained involvement of Joint Warfighters in refining the technology to meet the tactics, techniques, and procedures needed for 2010-2020 Littoral Battlespace. The MBC will have multiple roles since it is a crosscutting organization involved in several facets of concept, platform, weapons, weapon systems and Information Technologies (IT), Information System (IS) and Information Management (IM) systems development and integration. These include collaborative planning, operational experimentation planning and execution, technology transition/acquisition support, systems engineering and integration, technology assimilation and operational demonstrations.

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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|--|---------|---------|---------|---------|
| Fleet Battle Experiment (FME) ANALYSIS AND CORE SUPPORT | 19,437 | 14,378 | 32,519 | 36,074 |

NWDC, at the direction of Commander Fleet Forces Command (CFFC), will provide the SEA TRIAL Executive Steering Group (STESG) a cross pillar consolidated experimentation plan that recommends funding specific experiments that are keyed to Fleet priorities, the Concept Development and Experimentation Plan (CD&E Plan).

FY 2004 Accomplishments:

- Completed Agent Based Computing Limited Objective Experiment (LOE)
- Completed Sea Viking 04 Advanced Warfight Experiment
- Completed Joint Force Maritime Component Commander Workshop
- Completed Joint Force Maritime Component Commander War Game
- Completed Distributed Collaborative Environment Limited Objective Series (3 events)
- Completed Medical LOE
- Completed Theater Anti-Submarine Warfare Concept of Operations (CONOPS) Development Experiment
- Completed 40+ Knot Expeditionary Maneuver Warfare CONOPS Development Experiment
- Completed Littoral Combat Ship CONOPS Development Experiment
- Completed Counter Small Boat CONOPS Development Experiment
- Participated in Silent Hammer LOE
- Participated in Dominant Undersea Warfare LOE
- Participated in Littoral Combat Ship Mission Module LOEs
- Participated in High Speed Vessel LOEs
- Participated in Undersea Warfare Wargame

FY 2005 Plans:

- Design, Plan and Execute the Maritime Command and Control LOE Series
- Design, Plan and Execute the Anti-Submarine Warfare Limited Objective Experiment

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- Design, Plan and Execute the Digital Time Sensitive Strike LOE
- Develop Rail Gun Concepts of Operations for experimentation
- Design, Plan and Execute the Information Management Toolset LOE
- Design, Plan and Execute the Cross Domain Solution LOE Series
- Design, Plan and Execute the Agent Based Computing LOE
- Design, Plan and Execute the Unified Quest 05 War Game
- Continue participation in Joint Forces Command, (JFCOM) experimentation continuum
- Execute Sea Trial Experiments, War Games, and Seminars

FY 2006 Plans:

- Resume Fleet Battle Experiment Series
- Continue participation in JFCOM experimentation continuum
- Continue LOE
- Continue CONOPS Development Experiments
- Execute Sea Trial Experiments, War Games, and Seminars

FY 2007 Plans:

- Resume Fleet Battle Experiment Series
- Continue participation in JFCOM experimentation continuum
- Continue LOE
- Continue CONOPS Development Experiments
- Execute Sea Trial Experiments, War Games, and Seminars

C. OTHER PROGRAM FUNDING SUMMARY:

Not applicable.

D. ACQUISITION STRATEGY:

Not applicable.

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 PROJECT NUMBER: 2357 PROJECT TITLE: MARITIME BATTLE CENTER

| Exhibit R-3 Cost Analysis (page 1) | | | | | | | | | | Date: February 2005 | | |
|---------------------------------------|------------------------|--------------------------------|--------------------------|------------|------------------|------------|------------------|------------|------------------|---|------------|--------------------------|
| APPROPRIATION/BUDGET ACTIVITY RDT&E,N | | | PROGRAM ELEMENT 0604707N | | | | | | | PROJECT NAME AND NUMBER Maritime Battle Center 2357 | | |
| Cost Categories | Contract Method & Type | Performing Activity & Location | Total PYs Cost | FY-05 Cost | FY-05 Award Date | FY-06 Cost | FY-06 Award Date | FY-07 Cost | FY-07 Award Date | Cost To Comp. | Total Cost | Target Value of Contract |
| System Test and Evaluation | Various | Various | 97122 | 11900 | Various | 26546 | Various | 29001 | Various | CON T | CONT | CONT |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal T&E | | | 97122 | 11900 | | 26546 | | 29001 | | CON T | CONT | CONT |
| Remarks | | | | | | | | | | | | |
| Program Management | Various | Various | 21618 | 2478 | Various | 5973 | Various | 7073 | Various | CON T | CONT | CONT |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Subtotal Management | | | 21618 | 2478 | | 5973 | | 7073 | | CON T | CONT | CONT |

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Remarks

| | | | | | | | | | | | | |
|------------|--|--|--------|-------|--|-------|--|-------|--|----------|------|------|
| Total Cost | | | 118740 | 14378 | | 32519 | | 36074 | | CON T | CONT | CONT |
|------------|--|--|--------|-------|--|-------|--|-------|--|----------|------|------|

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PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| Project Number & Title | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate |
|---------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 0798 Over the Horizon TARGETING | 1,566 | 1,692 | 1,620 | 2,007 | 2,095 | 2,148 | 2,209 | 2,267 |

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Over the Horizon Targeting (OTH-T)/Allied Interoperability program provides a virtual, global systems integration and test facility for C4ISR technology that supports the collection, transmission, correlation, and display of track data into Common Operational and Tactical Pictures (COTP) in support of warfighting requirements. The common view of the battle space applies across the spectrum of warfare missions. However, the technology and doctrine has changed radically. The first objective of the OTH-T/Allied Interoperability program is to transition the Joint/Navy architectures and systems to state-of-the-art COTS and GOTS products that support Network Centric Warfare. The second objective is to support development, integration, and joint interoperability of all National Security System (NSS), IT, and C4I systems into warfighting capabilities. This support includes providing technical expertise afloat and ashore via a cadre of highly trained Fleet Systems Engineers in order to integrate, validate, and evaluate new OTH-T/Allied Interoperability capabilities during major Fleet exercises and demonstrations. The OTH-T/Allied Interoperability program integration and testing in support of warfighting capabilities includes joint interoperability testing for C4ISR equipment. Allied and joint interoperability is an important issue for future Naval operations, especially with the Navy initiative to expand Internet Protocol (IP) networking throughout the Fleet (IT-21 and Naval Intranet). Currently, specific solutions do not exist to solve the IP connectivity issue with Allies. Funding will allow for development of solutions for emerging Allied and joint interoperability requirements. Data throughput will need to be increased for the exchange of large size files within the limitations of high frequency (HF) medium in support of, for example, Collaboration at Sea (CAS). Funding will allow for further development of potential solutions for merging improved transmission control protocol/internet protocol (TCP/IP) capability with advance digital network systems (ADNS) and existing international standards (e.g. STANAG 5066). Funding will also allow for development of subnet relay protocols and automatic link establishment standards, which will provide for a significant improvement within, and between, battlegroups.

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B. ACCOMPLISHMENTS/PLANNED PROGRAM:

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---------|---------|---------|---------|
| ADVANCED RELAY/WIRELESS/ANTENNA TECHNOLOGIES | 0 | 206 | 398 | 736 |

FY 2004 Accomplishments:

Not applicable.

FY 2005 Plans:

Secure 802.11 and related wireless networking technologies will be evaluated in FY 05 for operational use in the maritime environment. Advanced directional and phased-array antennas, including beam orientation, steering and control, will also be evaluated.

FY 2006 Plans:

Engineering development models will be evaluated in Trident Warrior 06 and 07 and in other venues of opportunity.

FY 2007 Plans:

Engineering development models will be evaluated in Trident Warrior 06 and 07 and in other venues of opportunity.

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PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---------------------|---------|---------|---------|---------|
| SUBNET RELAY | 664 | 517 | 358 | 195 |

FY 2004 Accomplishments:

Exploited and coordinated subnet relay protocols and multi frequency band channels to provide greater data throughput in the HF and UHF Line-of-Sight RF mediums. Exploited HF Beyond-Line-of-Sight and Extended-Line-of-Sight ground – and sky – waveforms to improve long-range tactical communications. Adapted IP Quality of Service (QOS), Voice over IP (VoIP), STANAG 5066 Edition 2 (HFIP) and IP VTC (H.323) protocols to subnet relay communications. This effort included Information Assurance (IA).

FY 2005 Plans:

Engineering development models of subnet relay communications will be evaluated during Trident Warrior 05 for FORCEnet integration.

FY 2006 Plans:

Advanced engineering development models of subnet relay that incorporate STANAG 5066 Edition 2 will be evaluated in Trident Warrior 06.

FY 2007 Plans:

Venues of opportunity will be exploited to validate and evaluate developed portions of subnet relay configurations through testing, trials, and demonstrations.

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PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---------|---------|---------|---------|
| SYSTEMS INTEGRATION & INTEROPERABILITY TESTING | 420 | 453 | 405 | 496 |

FY 2004 Accomplishments:

Conducted/participated in six overall Joint/Navy systems integration and interoperability tests events including Distributed Engineering Plan (DEP) and Joint Distribution Engineering Plan (JDEP) Tests; facilitated two planning reviews for Joint Raptor Architecture Experiments (JRAE) and Trident Warrior 04; participated in Joint Users Interoperability Communications Exercise (JUICE) and other joint test events. Served as technical expert in researching the fleet's technical questions and providing information, two trouble calls per month. Provided input and risk mitigation assessment for the feasibility of C4ISR (GCCS-M 3.x & 4.x) systems interoperability in joint multi-battle group architectures to DEP and JDEP.

FY 2005 Plans:

Conduct/participate in four overall Joint/Navy integration and interoperability tests; facilitate two planning reviews for Joint Test and Evaluations; participation in Joint Users Interoperability Communications Exercise (JUICE).

FY 2006 Plans:

Conduct/participate in three overall Joint/Navy integration and interoperability tests; facilitate one planning review for Joint Test and Evaluations; participation in JUICE.

FY 2007 Plans:

Conduct/participate in six overall Joint/Navy integration and interoperability tests; facilitate two planning reviews for Joint Test and Evaluations; participation in JUICE and other joint test events.

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PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|------------------------------------|---------|---------|---------|---------|
| INTEROPERABILITY VALIDATION | 144 | 154 | 138 | 172 |

FY 2004 Accomplishments:

Validated and verified the interoperability of architectures for new capabilities and supporting systems to the fleet for ten Net Ready-Key Performance Parameters (NR-KPP) Migration Plan Development Support events and one interoperability C4ISR certification.

FY 2005 Plans:

Using The Reconfigurable Land Based Test Sites (RLBTS) and Over the Horizon Targeting (OTH-T) resources to validate IT-21 and Global Information Grid (GIG) technologies prior to shipboard installation, support eight NR-KPP Migration Plan Developments and two joint interoperability C4ISR certifications to ensure interoperability requirements between sensors, weapon systems and information systems are met.

FY 2006 Plans:

Using The RLBTS and OTH-T resources to validate IT-21 and GIG technologies prior to shipboard installation, support eight NR-KPP Migration Plan Developments and two joint interoperability C4ISR certifications to ensure interoperability requirements between sensors, weapon systems and information systems are met.

FY 2007 Plans:

Using The Reconfigurable Land Based Test Sites (RLBTS) and OTH-T resources to validate IT-21 and Global Information Grid (GIG) technologies prior to shipboard installation, support ten NR-KPP Migration Plan Developments and four joint interoperability C4ISR certifications to ensure interoperability requirements between sensors, weapon systems and information systems are met.

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PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|------------------------------|---------|---------|---------|---------|
| TESTING OTH-T SYSTEMS | 338 | 362 | 321 | 408 |

FY 2004 Accomplishments:

Conducted six developmental, integration, and certification tests, in accordance with OPNAVINST 9410.5, of Over-The-Horizon Targeting and Combat systems. Provided five final evaluations/certifications (IATO/ATO recommendations) letters for systems including Advanced Tomahawk Weapons Control System, Tactical Tomahawk Weapons Control System, Global Command & Control Systems-Maritime (ATWCS, TTWCS, GCCS-M 3.x, GCCS-M 4.x, and OASIS). Conducted three integration test events for GCCS-M4x/COE/COE-M and CAS (Collaboration at Sea).

FY 2005 Plans:

Conduct five developmental, integration, and certification tests, in accordance with OPNAVINST 9410.5, of Over-The-Horizon Targeting and Combat systems. Conduct three developmental and integration test events for GCCS-M4x/COE/COE-M/CAS/ATWCS/TTWCS. Testing will also address issues of Fleet essential capabilities and emerging mission essential needs both for new, legacy, and technology refreshed systems.

FY 2006 Plans:

Conduct five developmental, integration, and certification tests, in accordance with OPNAVINST 9410.5, of Over-The-Horizon Targeting and Combat systems with tactical data exchanged over Common Operational Picture (COP) Synchronization Tools (CST) networks and other networks; two integration test events for Joint Command and Control and Collaboration at Sea systems within the GIG. Testing will also address issues of Fleet essential capabilities and emerging mission essential needs both for new, legacy, and technology refreshed systems.

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FY 2007 Plans:

Conduct five developmental, integration, and certification tests, in accordance with OPNAVINST 9410.5, of Over-The-Horizon Targeting and combat systems with tactical data exchanged over Common Operational Picture (COP) Synchronization Tools (CST) networks and other networks; three integration test events for Joint Command and Control, Combat Decision Systems, and Collaboration at Sea systems within the GIG. Testing to also address issues of Fleet essential capabilities and emerging mission essential needs both for new, legacy, and technology refreshed systems.

C. OTHER PROGRAM FUNDING SUMMARY:

RELATED RDT&E:

SEW Architecture/Engineering Support program element is related to all Naval C4I related efforts.

D. ACQUISITION STRATEGY:

Not applicable.

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PROJECT NUMBER: 0798 PROJECT TITLE: OTH TARGETING

| Exhibit R-3 Cost Analysis | | | | | | | Date: February 2005 | | | | | |
|---|------------------------|--------------------------------|----------------|------------|------------------|------------|--|------------|------------------|------------|------------|--------------------------|
| APPROPRIATION/BUDGET ACTIVITY RDT&E,N/BA 04 | | | | | | | PROJECT NAME AND NUMBER OTH Targeting 0798 | | | | | |
| Cost Categories | Contract Method & Type | Performing Activity & Location | Total PYs Cost | FY-05 Cost | FY-05 Award Date | FY-06 Cost | FY-06 Award Date | FY-07 Cost | FY-07 Award Date | CostToComp | Total Cost | Target Value of Contract |
| System Test and Evaluation | Various | Various | 3648 | 206 | Various | 398 | Various | 736 | Various | CONT | CONT | |
| Interoperability Requirements | Various | Various | 3266 | | | | | | | | 3266 | |
| T & E Tools Development | Various | Various | 429 | | | | | | | | 429 | |
| Systems Int. & Interop. Testing | Various | Various | 1724 | 453 | Various | 405 | Various | 496 | Various | CONT | CONT | |
| Interoperability Validation | Various | Various | 2004 | 154 | Various | 138 | Various | 172 | Various | CONT | CONT | |
| Joint Interoperability | Various | Various | 1174 | | | | | | | | 1174 | |
| Testing OTH-T Sys | Various | Various | 1340 | 362 | Various | 321 | Various | 408 | Various | CONT | CONT | |
| Subtotal T&E | | | 13585 | 1175 | | 1262 | | 1812 | | 0 | CONT | |
| Remarks | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | 0 | |
| Government Engineering Support | Various | Various | 3443 | 517 | Various | 358 | Various | 195 | Various | CONT | CONT | |
| Program Management Support | Various | Various | 1468 | | | | | | | | 1468 | |
| Travel | | | | | | | | | | | 0 | |
| Transportation | | | | | | | | | | | 0 | |
| Subtotal Management | | | 4911 | 517 | | 358 | | 195 | | 0 | 5581 | |
| Remarks | | | | | | | | | | | | |
| Total Cost | | | 18496 | 1692 | | 1620 | | 2007 | | 0 | CONT | |

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PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

| Project Number & Title | FY 2004 Actual | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | FY 2010 Estimate | FY 2011 Estimate |
|------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2144 SEW ENGINEERING | 9,496 | 9,532 | 10,330 | 11,331 | 11,702 | 11,968 | 12,268 | 12,550 |

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: OPNAVINST 3050.23 defines the policy to fuse validated/approved C4ISR architectures and interoperability requirements with Joint requirements, milestones and program decisions. C4ISR integrated architectures/requirements are the underpinnings for all C4ISR mission areas and capabilities and, as such, requirements and acquisition processes have been reengineered to use these Integrated Architecture for decisional purposes and strategic planning. Furthermore, Office of the Secretary of Defense (OSD) has defined key programs/efforts (GIG Baseline Extension (BE)), Transformational Satellite (TSAT), JTRS, Network Centric Enterprise Services (NCES), and IA that will drive and change the Navy's C4ISR integrated architectures and associated business processes for requirements, budgets and acquisition. To that end, the SEW provides two main functions: 1) Development of C4ISR Integrated Architecture Products and 2) Supporting C4ISR Systems Engineering processes. The integrated architecture products are used to support the Navy's C4ISR budget process by providing the critical core architecture and enabling capabilities to the Warfighter. The C4ISR systems engineering processes provide the construct for assessments to identify capability shortfalls/gaps and for systems engineering to compare/test alternatives in a joint end-to-end environment while identifying associated Navy wide C4ISR implications. This includes Human Systems Integration (HSI) that provides a mission-centered orientation to ensure effective operational employment of fielded capability. As joint concepts and OSD driving efforts/programs are matured/defined the Navy's C4ISR integrated architectures are refined and the supporting C4ISR Systems Engineering processes work to engineer and enact C4ISR implementations Navy wide across all C4ISR mission areas.

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PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

Products provided:

1) C4ISR Integrated Architectures

-Integrated Architectures and Standards - Architecture Views (Operational Views, Technical Views, System Views etc.)

-Migration Roadmaps to the "To Be" Architectures

-Architecture technical studies and white papers

2) Supporting C4ISR Systems Engineering processes

-C4ISR Requirements Assessments – Gaps Analysis, Overlap Analysis, System Priority Lists, C4ISR Metrics and Models, Analysis of Alternatives, Requirements Database, Assessment Repository, Resource Implications Studies, Baseline Performance Models, Mission Task Analysis, Human Systems Integration (HSI) assessments

-End-to-End Systems Engineering and Integrated Design – Operational feasibility studies, technical feasibility studies, technical roadmap engineering validations, Architectures and Assessment traceability matrices

-Joint and Coalition interoperability trials – Joint end-to-end prototyping trials, and Joint/Coalition interoperability demonstrations, Interoperability assessments and metrics, Interoperability studies via the Joint Warrior Interoperability Demonstration (JWID) and the Joint Rapid Architecture Experimentation (JRAE) Process.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---------|---------|---------|---------|
| Joint Warrior Interoperability Demonstration (JWID)/ Coalition Warrior Interoperability Demonstration (CWID) | 1,660 | 1,937 | 2,384 | 2,910 |

FY 2004 Accomplishments:

US Northern Command (NORTHCOM) was the host commander for Joint Warrior Interoperability Demonstration (JWID) 2004 and chartered JWID to address Homeland Security/Defense (HLS/D) and Defense Service to Civil Authorities (DSCA) issues by including Federal Emergency Management Agency (FEMA), United States Coast Guard (USCG) and National Guard participants. SPAWAR's JWID 2004 Site hosted 26 different technology trials in two major trial groups (US and Coalition) and demonstrated them to over 150 VIPs and visitors from technology and military backgrounds. SPAWAR's JWID 2004 Site produced two technologies that were submitted for Assistant SECNAV (RD&A) consideration for rapid transition program (results pending). Additionally, Commander THIRD Fleet (COMTHIRDFLT) purchased a number of JWID items for their prototype command center,

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Exhibit R-2a

DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

CORTEX. OPNAV realigned JWID as a FORCEnet Coalition venue to solve near term allied interoperability issues. JWID 2004 has enabled SPAWAR's Coalition group to graduate their technologies to TRIDENT WARRIOR 2005, a FORCEnet leave-behind C4I exercise.

FY 2005 Plans:

JWID has been renamed CWID, changing "Joint" to "Coalition." Commander, Joint Forces Command (JFCOM) has assumed management oversight of CWID. NORTHCOM continues as host COCOM and desires to increase the DSCA and HLS/D emphasis. As the sole San Diego site, SPAWAR would assume responsibility for running critical port/border protection scenarios and trial series. Plans are in work to include COMTHIRDFLT participation in CWID 05, and currently, SPAWAR has chosen approximately 21 technologies for its site. Funds in excess of the \$1.7 million passed to the Joint Management Office (JMO), will pay for all site expenses, including coalition interoperability trials and US and national domestic agency interoperability trials. All trials are based on published Federal Business Opportunity issues, delineated in the JMO letter Ser. No. CWID2005 dated 05 MAY 04.

FY 2006 Plans:

Commander, European Command (EUCOM) has been selected as the host COCOM for CWID 06. The emphasis is expected to be on advanced Coalition interoperability, but JFCOM has indicated that CWID will continue to focus on DSCA and HLD/HLS as well. \$1.7 million exercise "buy-in" is funded for CWID participation. \$548K will support the US Navy site in San Diego, which will continue to fund coalition and US trials based on annual published Federal Business Opportunity letter. JWID trials provide the Fleet with three separate evaluations: 1) evaluation provided by NSA for proper security procedures; 2) evaluation provided by Joint Integrated Test Command (JITC) for technical issues; and 3) evaluation provided by warfighter to verify usability. These evaluations are then used to determine whether these projects become program of records.

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DATE: Feb 2005

BUDGET ACTIVITY: 04

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PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

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FY 2007 Plans:

Commander, European Command (EUCOM) will continue as the host COCOM for CWID 06. \$1.7 million exercise "buy-in" is funded for CWID participation. \$565K supports the US Navy site in San Diego, which will continue to fund coalition and US trials based on the CWID Federal Business Opportunity letter that will be published in 2006. Remaining funding will allow for additional US trials. JWID trials provide the Fleet with three separate evaluations: 1) evaluation provided by NSA for proper security procedures; 2) evaluation provided by JITC for technical issues; and 3) evaluation provided by warfighter to verify usability. These evaluations are then used to determine whether these projects become program of records.

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|------------------------------------|---------|---------|---------|---------|
| JRAE (FORMERLY TITLED EC5G) | 3,704 | 4,125 | 3,648 | 4,316 |

FY 2004 Accomplishments:

Implemented Navy's participation in JRAE process via the associated Joint events known as Joint RAPTORS. These joint efforts built on prior year knowledge gained in C4ISR architecture issues but with specific focus on joint interoperability at the tactical level, including impact on the Warfighter. Completed Navy participation in three Joint Rapid Architecture Prototyping Test & Operational Research (RAPTOR) events with the Army, Air Force and Marine Corps in coordination with JFCOM's Joint Battle Management Command and Control (JBMC2): Joint RAPTOR 04-1 - Joint Enterprise Services Interoperability Experiment (Mar 04); Joint RAPTOR 04-2 - FORCENet/FCS Interoperability Experiment (May/June 04); Joint RAPTOR 04-4 - Navy/Army/Air Force GIG Transformation Experiment (Sept 04). Completed Joint RAPTOR 04-1,2,3,4,and 5 experiment plans, data collection and analysis, and final reports. The results of these joint interoperability events were metrics and measurable outcomes that fed back into Navy Programs of Record and Joint Architecture Products and Assessments (i.e. JFCOM JBMC2) and resulted in specific Army/Navy interoperability enhancements (e.g. interoperable publish and subscription of Army/Navy Blue Force Tracks).

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BUDGET ACTIVITY: 04

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PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

FY 2005 Plans:

The Joint RAPTOR efforts are driven by JFCOM interoperability risk areas at the horizontal (tactical) level as identified by the Joint Architecture efforts under the JFCOM JBMC2 effort. The JRAE process (via the Joint RAPTOR events) will be used to prototype the "to be" joint integrated architectures and integrate and collaboratively test with the Army and the Air Force to promote joint interoperability between the services next generation tactical C4ISR architectures.

- Two Major Joint RAPTOR interoperability events examining interoperable Service Oriented Architectures and Service transition to the Global Information Grid (GIG) environment.
- Joint RAPTOR Interoperability Trial Plans
- Joint RAPTOR Interoperability Data Collection and Analysis
- Joint RAPTOR Interoperability Metrics
- Joint RAPTOR Final Reports

FY 2006 Plans:

Continue the Joint RAPTOR efforts which will be driven by JFCOM interoperability risk areas at the horizontal (tactical) level as identified by the Joint Architecture efforts under the JFCOM JBMC2 effort. The JRAE process (via the Joint RAPTOR events) will be used to prototype the "to be" joint integrated architectures and integrate and collaboratively test with the Army and the Air Force to promote joint interoperability between the services next generation tactical C4ISR architectures.

- Continue conducting 2 to 3 Major Joint RAPTOR interoperability events
- Joint RAPTOR Interoperability Trial Plans
- Joint RAPTOR Interoperability Data Collection and Analysis
- Joint RAPTOR Interoperability Metrics
- Joint RAPTOR Final Reports

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DATE: Feb 2005

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FY 2007 Plans:

Continue the Joint RAPTOR efforts, which will be driven by JFCOM interoperability risk areas at the horizontal (tactical) level as identified by the Joint Architecture efforts under the JFCOM JBMC2 effort. The JRAE process (via the Joint RAPTOR events) will be used to prototype the "to be" joint integrated architectures and integrate and collaboratively test with the Army and the Air Force to promote joint interoperability between the services next generation tactical C4ISR architectures.

- Continue conducting 2 to 3 Major Joint RAPTOR interoperability events
- Joint RAPTOR Interoperability Trial Plans
- Joint RAPTOR Interoperability Data Collection and Analysis
- Joint RAPTOR Interoperability Metrics
- Joint RAPTOR Final Reports

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---------------------------------------|---------|---------|---------|---------|
| C4ISR REQUIREMENTS ASSESSMENTS | 867 | 937 | 1,289 | 1,232 |

FY 2004 Accomplishments:

Continued to use Modeling and Simulation tools to support the Naval Capabilities Development Process (NCDP) and completed performing requirements analysis of ISR Mission Capability Packages (MCPs) as well as Joint Blue Force Situational Awareness (JBFSAs) MCPs. Participated in SYSCOM MCP assessments led by other SYSCOMs for Strike, Shield, and Basing SP-21 pillars. Completed the development of the ISR and JBFSAs network related Measures of Effectiveness (MOEs) and Measures of Performance (MOPs) that can be used to assess combat effects, Warfighter impacts, and funding impacts of changes to FORCEnet architecture. Established baseline performance models. Expanded analysis to other systems that identify dependencies of the C4I Architecture, with follow up evaluations in FY 2005.

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FY 2005 Plans:

Continued using Modeling and Simulation tools to support the Naval Capabilities Development Process (NCDP) by performing requirements analysis, collecting and developing model architectures for the Campaign Analysis Modeling and Simulation effort, and conducting assessments of capabilities; and associated systems, associated with analytical issues identified by OPNAV, NETWARCOM, and SPAWAR.

2014-2020 Model C4ISR architectures for 3 Major Combat Operations and specific assessments for 5 POM08 analytic issues in support of the Integrated Strategic Capabilities Plan (ISCP). Additionally this work will be aligned/integrated with the FORCENet Implementation Process (FIP) to support the Sponsor Program Proposal (SPP).

FY 2006 Plans:

2014-2020 Model C4ISR architectures for 4 Major Combat Operations and specific assessments for 5 Navy analytic issues.

FY 2007 Plans:

2016-2022 Model C4ISR architectures for 3 Major Combat Operations and specific assessments for 5 Navy analytic issues.

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| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|---|---------|---------|---------|---------|
| C4ISR ARCHITECTURE AND STANDARDS | 2,272 | 1,701 | 2,106 | 2,011 |

FY 2004 Accomplishments:

Provided the groundwork for developing the overarching FORCEnet architecture as outlined in Sea Power-21 for Sea Strike, Sea Shield, Sea Basing, including FORCEnet standards. Provided FORCEnet Design Studies and support systems that will integrate unique C2 of a BF that will allow warfighters to effectively utilize data from diverse sources over the C4I information grid. Reviewed Joint & Cross service requirements, which will be incorporated in the FORCEnet Architecture in FY 2005.

- FORCEnet Architecture & Standards Ver 1.4 (30 Apr 04)
- FORCEnet Architecture AV-1 (Draft)
- FORCEnet White papers delivered:
 - FORCEnet Beyond line of Sight
 - Composed and Orchestrated Mission Engagement Packages Through Business Process Execution Language (BPEL)
 - Defense Message Service Consolidation
 - Air-borne ADNS Via E2C
 - Alternative use of the Cooperative Engagement Capability (CEC) Data Distribution System (DDS)
 - Recommended for Future Cost-Effective, Supportable and Interoperable US Navy Tactical Voice Systems
 - Fleet Network Operation Center Services (FNOCS)and Restoral capability

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PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

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FY 2005 Plans:

Architecture efforts will begin to develop a target architecture that will support a migration strategy to move Navy PORs from their current platform/stovepipe domain to a future joint network-centric domain. This will be accomplished by aligning fleet and joint requirements and establishing common engineering standards that facilitate common operational mission threads, and architecture that creates interoperational C4ISR and enterprise business systems across the US services. This includes collaboration efforts among Navy FORCEnet, Air Force C2 Constellation, Coast Guard Deepwater and Army Enterprise Architecture. These products will provide for the net-centric C4ISR transformation of the next generation of warfare platforms and systems.

- FORCEnet Architecture & Standards Volume 2.0 updated semi-annually
- Naval Enterprise DoD Architecture Framework (OV, SV,TV, etc.) products
- Various white papers and studies as needed to develop architecture products

FY 2006 Plans:

The FY06 efforts will build upon the FY05 efforts and extend the scope of the work to include the tactical domain. Architecture efforts will continue to expand a target architecture that will support a migration strategy to move Navy PORs from their current platform/stovepipe domain to a future joint network-centric domain. This will be accomplished by aligning fleet and joint requirements and establishing common engineering standards that facilitate common operational mission threads, and architecture that creates interoperational C4ISR and enterprise business systems across the US services. This includes the collaboration efforts of Navy FORCEnet, Air Force C2 Constellation, Coast Guard Deepwater and the Army Enterprise Architecture. These products will provide for the C4ISR transformation of the next generation of warfare platforms and systems. .

- FORCEnet Architecture & Standards Volume 2.0 updated semi-annually
- C4ISR DoD Architecture Framework 1.0 products OV, SV and TV products
- Various white papers and studies as needed to develop architecture products

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DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

FY 2007 Plans:

The FY07 efforts will build upon the FY06 efforts and extend the scope of the work to include the warfighting support. Architecture efforts will continue to expand a target architecture that will support a migration strategy to move Navy PORs from their current platform/stovepipe domain to a future joint network-centric domain. This will be accomplished by aligning fleet and joint requirements and establishing common engineering standards that facilitate common operational mission threads, and architecture that creates interoperational C4ISR and enterprise business systems across the US services. This includes the collaboration efforts of Navy FORCEnet, Air Force C2 Constellation, Coast Guard Deepwater and the Army Enterprise Architecture. These products will provide for the C4ISR transformation of the next generation of warfare platforms and systems.

- FORCEnet Architecture & Standards Volume 2.0 updated semi-annually
- C4ISR DoD Architecture Framework 1.0 products OV, SV and TV products
- Various white papers and studies as needed to develop architecture products

| | FY 2004 | FY 2005 | FY 2006 | FY 2007 |
|--|---------|---------|---------|---------|
| END-TO-END SYSTEM ENGINEERING AND INTEGRATED DESIGN | 993 | 832 | 903 | 862 |

FY 2004 Accomplishments:

Decomposed validated Joint operational requirements and performed engineering analysis to determine the appropriate technical solutions. Provided end-to-end engineering assessment of proposed FORCEnet and C4ISR architectural products to ensure operational and technical feasibility. Provided system engineering support to ensure respective Land Based Test Facilities (LBTF) were configured to provide full Net-Centric environment for programs and initiatives. Provided system engineering to PEO Programs in developing integrated roadmaps.

FY 2005 Plans:

Provide systems engineering support for Program Executive Officer (PEOs) to produce near-term integrated roadmaps in various warfare areas.

FY 2006 Plans:

Continue providing systems engineering support for PEOs to integrate architecture and roadmap capabilities across warfare areas.

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PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

FY 2007 Plans:

Provide systems engineering support to apply end-to-end integrated architectures across the Naval Enterprise.

C. OTHER PROGRAM FUNDING SUMMARY:

Not applicable.

D. ACQUISITION STRATEGY:

Not applicable.

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Exhibit R-3

DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

| Exhibit R-3 Cost Analysis | | | | | | | | | | Date: February 2005 | | |
|---|------------------------|--------------------------------|----------------|--------------------------|------------------|------------|------------------|------------|------------------|---|------------|--------------------------|
| APPROPRIATION/BUDGET ACTIVITY RDT&E,N | | | | PROGRAM ELEMENT 0604707N | | | | | | PROJECT NAME AND NUMBER: SEW ENGINEERING 2144 | | |
| Cost Categories | Contract Method & Type | Performing Activity & Location | Total PYs Cost | FY-05 Cost | FY-05 Award Date | FY-06 Cost | FY-06 Award Date | FY-07 Cost | FY-07 Award Date | Cost To Comp. | Total Cost | Target Value of Contract |
| Primary Hardware Development | | | | | | | | | | | 0 | |
| Ancillary Hardware Development | | | | | | | | | | | 0 | |
| Systems Engineering | | | | | | | | | | | 0 | |
| Licenses | | | | | | | | | | | 0 | |
| Tooling | | | | | | | | | | | 0 | |
| GFE | | | | | | | | | | | 0 | |
| Award Fees | | | | | | | | | | | 0 | |
| Subtotal Product Development | | | 0 | 0 | | 0 | | 0 | | 0 | 0 | |
| Remarks | | | | | | | | | | | | |
| Development Support | Various | Various | 4554 | | | | | | | | 4554 | |
| SEW/C4I Technology Integration | Various | Various | 12985 | | | | | | | | 12985 | |
| Systems A&E and Validation | Various | Various | 13188 | | | | | | | | 13188 | |
| C4ISR Requirements Assessments | Various | Various | 6823 | 937 | Various | 1289 | Various | 1232 | Various | CONT | CONT | |
| C4ISR Architecture and Standards | Various | Various | 5229 | 1701 | Various | 2106 | Various | 2011 | Various | CONT | CONT | |
| End-to-End System Engineering and Integrated Design | Various | Various | 6610 | 832 | Various | 903 | Various | 862 | Various | CONT | CONT | |

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DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

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PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

| | | | | | | | | | | | | |
|-------------------------------------|---------|---------|-------|------|--|------|--|------|--|--|------|--|
| Info. Repository/Naval Architecture | Various | Various | 4000 | | | | | | | | 4000 | |
| Navy Collaborative | Various | Various | | | | | | | | | | |
| Subtotal Support | | | 53389 | 3470 | | 4298 | | 4105 | | | CONT | |
| Remarks | | | | | | | | | | | | |

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DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: 2144 PROJECT TITLE: SEW ENGINEERING

| Exhibit R-3 Cost Analysis (page 2) | | | | | | | | | | Date: February 2005 | | |
|---------------------------------------|------------------------|--------------------------------|----------------|--------------------------|------------------|------------|------------------|------------|------------------|---|------------|--------------------------|
| APPROPRIATION/BUDGET ACTIVITY RDT&E,N | | | | PROGRAM ELEMENT 0604707N | | | | | | PROJECT NAME AND NUMBER: SEW ENGINEERING 2144 | | |
| Cost Categories | Contract Method & Type | Performing Activity & Location | Total PYs Cost | FY-05 Cost | FY-05 Award Date | FY-06 Cost | FY-06 Award Date | FY-07 Cost | FY-07 Award Date | Cost To Comp. | Total Cost | Target Value of Contract |
| SEW Eng/JWID | Various | Various | 17280 | 1937 | Various | 2384 | Various | 2910 | Various | CONT | CONT | CONT |
| SEW Eng/JRAE | Various | Various | 8416 | 4125 | Various | 3648 | Various | 4316 | Various | CONT | CONT | CONT |
| Subtotal T&E | | | 25696 | 6062 | | 6032 | | 7226 | | | | CONT |
| Remarks | | | | | | | | | | | | |
| Contractor Engineering Support | | | | | | | | | | | 0 | |
| Government Engineering Support | | | | | | | | | | | 0 | |
| Program Management Support | | | | | | | | | | | 0 | |
| Travel | | | | | | | | | | | 0 | |
| Transportation | | | | | | | | | | | 0 | |
| Subtotal Management | | | 0 | 0 | | 0 | | 0 | | 0 | 0 | |
| Remarks | | | | | | | | | | | | |
| Total Cost | | | 79085 | 9532 | | 10330 | | 11331 | | 0 | CONT | |

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DATE: Feb 2005

BUDGET ACTIVITY: 04

PROGRAM ELEMENT: 0604707N

PROGRAM ELEMENT TITLE: SPACE & ELECTRONIC WARFARE (SEW) ARCHITECTURE/ENGINEERING SUPPORT

PROJECT NUMBER: Various PROJECT TITLE: Congressional Plus-Ups

CONGRESSIONAL PLUS-UPS:

| 9364 | FY 2004 | FY 2005 |
|------------------------------|---------|---------|
| ADVANCED WIRELESS TECHNOLOGY | 3,363 | 0 |

Advanced Wireless Network was used to design and develop a flexible, reconfigurable wireless communications network that combines advanced antennas, a software radio, mobile networking protocols and real-time resource management. It will have the ability to provide an adaptive, reconfigurable, mobile wireless network for Navy ships and Marine Corps forces ashore. The benefits will be enhanced Navy battle group and Marine Corps mobile network operations and extended over-the-horizon communications connectivity.

| 9365 | FY 2004 | FY 2005 |
|--|---------|---------|
| COALITION WARFARE PROGRAM (CWP) OPERATIONAL ASSESSMENT | 2,752 | 0 |

The Coalition Warfare Project integrates, federates and secures IT systems of multiple operating systems and security domains to improve information sharing and collaboration between services, coalitions, and other organizations and agencies. The system combines network-centric server clusters, Ultra Thin Clients (UTCs) or traditional PCs, and a robust security solution of EAL4 certified trusted operating systems and hardware VPNs. It is an open-system architecture (OSA) so that any operating system and application can be quickly integrated into the system allowing for rapid scalability and flexibility. The security solution provides an avant-garde ability to rapidly reconfigure networks of various security domains and communities of interest (COI) in near-real time globally. On a single display, multiple applications and multiple security domains can be viewed. The system also reduces space, weight, heat, and total ownership costs. This project will establish interoperability across domains, applications, and operating system platforms.