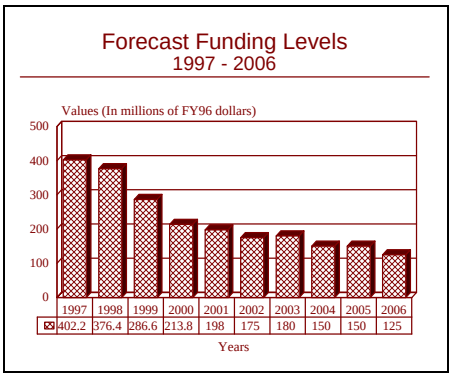
SSD/CEC (Ship Self-Defense/Cooperative Engagement Capability) - Archived 2/98

Outlook

- A technology development program that supports ship self-defense improvement and cooperative engagement capability development
- Concentrates on sensor, command and control, data processing, and weapons improvements against anti-ship missiles
- Ongoing support expected
- More emphasis on contingency operations rather than anti-Soviet deep-water threats determining the program orientation



Orientation

Description. This effort combines PE#0603755N and PE#0604755N, ship self-defense. These program elements fund efforts to develop a self-defense capability against anti-ship missiles. Sensors, command and control, data processing, and weapons improvements are addressed as part of the cooperative engagement capability development. The program became effective when the Navy began consolidating the management of several projects.

Sponsor

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Contractors. Contractors vary with R&D effort changes.

Status. Technology base, engineering, and advanced system development.

Total Produced. This is a technology development program only.

Application. This program element provided funds for the development and upgrade of defensive systems for surface ships.

Price Range. Indeterminate.

Technical Data

PE#0603755N. This program incorporates efforts dedicated to the enhancement of ship self-defense against anti-ship threats. Its primary focus is on the development of technologies, systems, and procedures necessary to defeat the evolving anti-ship cruise missile threat. These projects focus on ship defense improvements through the development of advanced concepts and capabilities which will enhance both defense in depth of ships in a force and self-defense of individual ships in a littoral war fighting environment.

Cooperative Engagement Capability (CEC), Project U2039, is the major effort and is developing concepts for coordinating all battle force sensors into a single, real-time, composite track picture having fire control quality. Project U2133 is a Quick Reaction Combat Capability

(QRCC) development of multi-sensor integration and kill coordination efforts which will improve the performance of current systems. U2184 Force Anti-Air Warfare Coordination Technology (FACT) is also a development of technology improvements for current systems.

PE#0604755N. This program element became effective in FY94 and consolidates efforts related to Ship Self-Defense (SSD). The unified approach has improved planning for and management of these efforts, exploiting the synergistic relationship inherent in each. These projects are directed by a single program manager in Program Executive Office for Theater Air Defense.

Analysis and demonstration have established that surface defense based on single-sensor detection, point- to-point control architecture performs marginally against current and projected Anti-Ship Cruise Missile (ACM) threats. The supersonic sea-skimming ACM reduces the effective battle space to the horizon and the available reaction time-line to less than 30-seconds, from first opportunity to detect until the ACM impacts its target ship.

Against such a threat, multisensor integration is required for effective detection. parallel processing is essential to reduce reaction time to acceptable levels and to provide vital coordination/integration of hardkill and softkill assets, and improvements in terminal gun system effectiveness and in missile kinematics, control and homing accuracy are required for successful hardkill engagement.

These projects address and coordinate the detect, control, and engage functions necessary to meet rigorous self-defense requirements within a development structure dedicated to systems engineering.

Detection: Coordinated sensor performance will increase the probability of detecting low-altitude, observable targets is to be achieved through the synergism gained from the integration of dissimilar sensor sources. Multi-sensor integration is addressed through the efforts of Quick Reaction Combat Capability (QRCC) (U2178), while sensor improvements are addressed through the SPS Improvements (U0166), Infrared Search and Track (U0665), and Shipboard Electronic Warfare Improvements (U0954) projects.

These improvements to both active and passive detection capabilities are complementary to the ship signature reduction technology also being pursued through project U0954.

Control: Multisensor integration, parallel processing and the coordination of hardkill/softkill capabilities in an automated response to the ASCM threat are the cornerstones of the Ship Self-Defense System (SSDS) being developed through Quick Reaction Combat Capability (QRCC) (U2178) efforts. In addition, that project provides for the central system engineering management of SSD developments.

Engagement: Both missile and terminal gun system requirements are being addressed via NATO Sea Sparrow Missile System (NSSMS) (U0173), 5 inch Rolling Airframe Missile (RAM) (U0167), and CIWS (PHALANX) (U0172). Missile improvements are to include improved kinematic performance plus advanced seeker and low elevation fuzing/warhead capabilities. Gun system improvements address system detection, rate- of-fire, number of rounds on target, first round accuracy, and reliability and maintenance.

The Engagement area is further supported by NULKA decoy development (U2190) and the Semi-Active Fuze project (U2256) will improve ESSM lethality. U2176, the SSD Engagement Improvements project is programmed to begin in FY98.

Variants/Upgrades

These programs develop technology that can be used to upgrade existing systems and incorporate them into developing systems.

Program Review

Background. The Navy has ship self-defense as one of its highest priorities. The Ship Self-Defense program will integrate ship, force, and other service sensors in order to achieve 24-hour extended-range coverage and improve early detection and sharing of hostile target information. The self-defense area had been less than optimally coordinated in the past, so by consolidating management and focusing attention on the efforts, the overall effectiveness of the program has been improved significantly.

Details of the planned efforts from the Navy's Program Element Descriptors follow.

PE#0603755N Ship Self-Defense

U2039 Cooperative Engagement Capability (CEC). The Cooperative Engagement Capability program is developing significant improvements in the battle force Anti-Air Warfare (AAW) capability by coordinating all Battle Force AAW sensors into a single, real-time, composite

track picture having fire control quality. CEC distributes sensor data from each ship and air-craft, or cooperating unit (CU), to all other CUs in the battle force through a real-time, line of sight, high data rate sensor and engagement data distribution network.

CEC must be highly resistant to jamming and provide accurate gridlocking between CUs. Each CU independently employs high capacity, parallel processing, and advanced algorithms to combine all distributed sensor data into a fire control quality track picture which is the same for all CUs. CEC data is presented as a superset of the best AAW sensor capabilities from each CU, all of which are integrated into a single input to each CU's combat weapon systems. CEC will significantly improve battle force defense in depth, including both local area and ship defense capabilities against current and future AAW threats.

CEC is designed to enhance the AAW warfighting ability of ships and aircraft and to enable coupling of the force into a single, distributed AAW weapons system and towards more effective use of tactical data and the cooperative use of all the force sensors and weapons. These capabilities will provide the ship defense flexibility needed to meet the threat brought about by increasing numbers of highly sophisticated weapons held by potentially hostile Third World countries.

CEC consists of the Data Distribution System (DDS), the Cooperative Engagement Processor (CEP), and Combat System Modifications. The DDS encodes and distributes ship sensor and engagement data, and is a high-capacity, jam-resistant, directive system providing a precision gridlocking and high throughput of data. The CEP is a high-capacity distributed processor which is able to process force levels of data in a timely manner that allows its output to be considered real-time fire control data. This data is passed to the ship's combat system as fire control quality data with which the ship can cue its onboard sensors or use the data to engage targets without actually tracking them.

The following accomplishments/plans include milestone dates and/or cost estimates (in US$ thousands) for that specific item.

Project 2133 - Quick Reaction Combat Capability There was no activity in FY93.

FY94 accomplishments included developing and demonstrating a cued and remote data missile firing engagement with AEGIS and new threat upgrade class ships (US$91.965 million). Program personnel demonstrated an Airborne Early Warning Aircraft Air Cooperating Unit in a P-3 aircraft and developed and demonstrated cued self-defense missile firing engagements (US$42,625). The Navy completed Composite Identification and Cooperative Engagement Decision data collection (US$21,985). Program managers developed and tested Fleet CEC tactics and operations (US$15,358) and conducted Developmental Test/Operational Testing (DT/OT) (US$5,635) and assessed the potential contribution of airships to airborne components of CEC (US$10.0 million).

The program office initiated engineering design efforts to develop an airborne version of the Common Equipment Set (CES) for integration with the E-2C aircraft (US$11.356 million). Engineers developed self-aligned gate technology to support accelerated processor production for use in CES subsystems (US$1,500).

In FY95, planners completed analysis of the Developmental Testing/Operational Testing (DT/OT) lessons learned to fully support continued developmental efforts in CEC system design and fleet operations and tactics, funding this at US$17.865 million. The Navy spent US$73.848 million to continue developing a shipboard Common Equipment Set (CES) and incorporated results of the DT/OT testing into system design and ship integration. A budgeted US$62.041 million went into the continued development of airborne CES for integration with E-2C aircraft.

The plan for FY96 was to (US$3050) complete the Initial Operational Capability (IOC) certification for shipboard CEC system (US$3.050 million). US$134.257 million was budgeted to continue development of shipboard CES and US$15.568 has been committed to continue developing airborne CES for integration with the E-2C aircraft. The Navy set aside US$7.240 for the continued assessment of system performance and development of tactical applications during active fleet exercises.

US$22.435 million was planned for the develop of an organic infrastructure for CES Integrated Logistics Support (ILS) with US$23.0 million going to initiate engineering studies to integrate CEC with joint service weapon systems. Planners would spend US$46.0 million to modify Naval Research Laboratory (NRL) and fleet owned P-3 aircraft to provide dedicated airborne support for CEC test program. US$5.290 million was reserved for Small Business Innovation Research (SBIR) assessment in accordance with 15 U.S.C. 638.

The FY97 plan is to (US$105247) continue development of shipboard CES, funded at US$105.257 million, and spend US$44.6 million to continue development of airborne CES for integration with E-2C aircraft. US$5.156 million is budgeted to conduct Initial Operational Test and Evaluation (IOT&E) of the shipboard CES and US$9.5 million is programmed to continue development of organic ILS infrastructure for CES.

(QRCC). The QRCC program provides the multisensor integration and hardkill/softkill coordination to improve current system performance with respect to short range anti-air ship self-defense. It is intended to leverage recent critical experiments, the Rapid Anti-Ship Missile Integrated Defense System (RAIDS) program efforts, and the Ship Self Defense System (SSDS) demonstration on USS WHIDBEY ISLAND (LSD 41) conducted in June 1993. This effort would upgrade existing short-range Anti-Air Warfare (AAW) defenses by providing a quick reaction combat capability through flexible embedded doctrine that coordinates the detect-through-engage sequence for in-service equipment. In particular, QRCC applies multisensor integration to existing sensors, upgrades and integrates RAIDS for support of local command and control, integrates and coordinates weapons systems, and provides a first level of hardkill/ softkill integration.

QRCC architecture centers on the distributed processing concept and will be incrementally implemented and demonstrated via an MK 1 SSDS focusing on integration of the Rolling Airframe Missile (RAM), Phalanx Close-In Weapons System (CIWS) and Electronic Countermeasures System (SLQ-32), followed by an MK 1 system which integrates NATO Sea Sparrow, CIWS, RAM, SLQ-32, and the Target Acquisition System (TAS) across a broad ship class spectrum. It integrates existing system elements via a fiber-optic local area network and uses an advanced display system currently under development for system operation, maintaining form, fit and function of the OJ-194 console.

QRCC will pace the threat along a development path which captures emerging technologies to enhance short range AAW capability, transitioning to Engineering and Manufacturing Development (E&MD) programs (RDT&E category 6.4) where appropriate.

The following accomplishments/plans include milestone dates and/or cost estimates (in US$ thousands) for that specific item.

FY93 included completing a successful demonstration of integrated RAM/CIWS self-defense system aboard *USS Whidbey Island* (LSD 41) in June 1993 (US$5.1 million) and a RAIDS Milestone III approval for DD 963. FFG 7 RAIDS production was pending until completion of successful Follow-on Test and Evaluation (FOT&E) (US$3 million). The program office accomplished programmatic risk-reduction efforts, systems analysis, testing preparations, and documentation to support MS III for RAIDS and Milestone IV/II for SSDS MK 1 (US$9.081 million).

FY94 accomplishments were progress towards achievement of Milestone IV/II for the SSDS MK 1 system (US$1.8 million) and continued transitioning to Engineering and Manufacturing Development (E&MD) for SSDS MK 1 version for LSD class ship, including a Preliminary Design Review and Critical Design Review (US$13.785 million). The effort progressed towards RAIDS Follow-on Test and Evaluation (FOT&E) for FFG 7 class ship (US$800,000) and initiated adaptations of the MK 1 system for installation aboard DD 963 and LHD class ships (US$300,000). Engineers conducted analysis of Ship Self Defense System capabilities in support of Investment Strategies and Cost and Operational Effectiveness Analyses (COEAs) (US$3.552 million). They also continued integration of a Central Identification Friend or Foe, Identification Doctrine Processor, and noncooperative target recognition programs with SSDS (US$3.800 million), and conducted development efforts in support of Self Defense Test Ship (SDTS) and Wallops Island Test Sites (US 3.041 million).

In FY95, the Navy spend US$2.143 million to completed transitioning SSDS MK 1 version to E&MD for LSD class ship. This included risk reduction studies. Planners put US$700,000 to conduct advanced engineering studies to support the integration of SSDS with the Advanced Combat Direction System (ACDS) Block 1 Level 3 LHD variant in order to provide the LHD class with an Integrated Ship Defense (ISD) capability.

The budget included US$11.200 million for continued development efforts on the SDTS to include remoting of all combat system signals, data extract capability and completed outfitting for testing. US$4.335 million went into continued analysis efforts focusing on impact of Littoral Warfare environment on SSDS architecture/ elements and required design improvements, to include SSDS MK 1 system adaptation/risk reduction studies for LHD, LHA, and CV/CVN class ships.

Plans for FY96 were to spend US$1.054 million to complete ISD adaptation/risk reduction studies for LHD class ships, including preliminary design. US$2.567 million was programmed to continue analysis efforts focusing on required upgrades to existing elements and identifying new initiatives required to pace the evolving Anti-Ship Cruise Missile (ASCM) threat, including associated upgrades to the operation of the SDTS.

US$412,000 was set aside to begin ISD adaptation/risk reduction studies for LHA and CV/CVN class ships, with US$319,000 slated to start investigations of DoD and non-DOD technology initiatives available to address optimization of hardkill/softkill sensors and weapons. US$31,000 was reserved for Small Business Innovation Research (SBIR) assessment in accordance with 15 U.S.C. 638.

The FY97 plan is to continue ISD adaptation/risk reduction studies for LHA and CVN class ships (US$200,000) and spend US$1.877 million to continue

analysis and requirements efforts to update the impact of Littoral Warfare environment and continued ASCM evolution on Ship Self Defense elements, including associated upgrades to the operation of the SDTS.

Project U2136 - LINK IRON. This is a classified project.

Project U2184 - Force Anti-Air Warfare Coordination Technology (FACT). This is an advanced development effort designed to demonstrate force Anti-Air Warfare (AAW) concepts and capabilities which will significantly improve force defense in depth, including both local area and self-defense capabilities against current and future AAW threats. FACT improvements are designed to enhance the AAW warfighting ability of ships and aircraft and to enable coupling of the force into a single, distributed AAW weapons system and towards more effective use of tactical data and the cooperative use of all the force sensors and weapons. These capabilities will provide the ship defense flexibility needed to meet the threat brought about by increasing numbers of highly sophisticated weapons held by potentially hostile Third World countries.

FACT defines requirements and develops prototype systems or modifications to existing systems to test new concepts for the coordination of force AAW operations. Some examples of prototype systems now in production are SPS-48C Detection Data Converter, SPS-48E Environmental Control Feature, Shipboard Gridlock System Automatic Correlation (SGS/AC), and Dial-a-Track Link-11 Quality Selection.

Other FACT developments nearing production stages are the Automatic Identification System (Auto-ID) and the Multi-frequency Link-11 capability. Short- and long-term objectives will be phased in to produce higher degrees of ship defense and battle coordination and effectiveness.

The following accomplishments/plans include milestone dates and/or cost estimates (in US$ thousands) for that specific item.

In FY93, the Navy supported integration of Remote Data Engage (RDE) capability in shipboard Systems and Link interoperability between joint and allied forces (US$1.516 million) and demonstrated advanced multisensor tracking and force identification in Force Threat Evaluation and Weapon Acquisition (FTEWA) along with Geodetic SGS/AC. Engineers demonstrated the initial development of FTEWA (US$7.0 million). Planners completed a feasibility evaluation of Remote Missile Launch (RML) (US$750,000) and provided further recommendations for improving the Link-11 interoperability among force participants, joint services, and allied network participants. They also provided recommendations for improving Link-16 integration into force, including interoperability with existing Link-11 (US$1.0 million).

In FY94, the Navy supported integration of the Force Threat Evaluation and Weapon Assignment (FTEWA) into major AAW combatants (US$4.5 million). Program personnel provided engineering for improving Link-11 interoperability among Force participants, Joint Services, and Allied network participants. Developed recommendations for improving Link-16 integration into Force, including interoperability with existing Link-11 (US$1.626 million). Engineers continued developing the Remote Data Engage (RDE) and Remote Missile Launch (RML) systems (US$1.0 million).

FY95 accomplishments included US$8.665 million for the continued advanced development of FTEWA in support of Combat Air Patrol (CAP) and Surface-to-Air Missile (SAM) integration. US$1.150 million was programmed for developing and demonstrating Auto-ID with ESM. US$800,000 was put into the continued RDE development. With US$600,000 supporting Remote Missile Launch (RML) and Forward Pass development. US$400,000 was used to conduct experiments to determine the feasibility of integrating non-organic data to identify organic Battle Group air tracks in real time. US$400,000 supported Link interoperability between Joint and Allied forces, including multiple simultaneous links with emphasis on track identification, and command and control in support of FTEWA.

The FY96 plan was to continue advanced development of FTEWA in support of CAP and SAM integration (US$3.7 million). US$1.500 million went to developing and demonstrating Auto-ID with ESM. US$873,000 was budgeted to support RML and Forward Pass, with US$1.0 million to continue RDE development. Supporting Link-11 interoperability between Joint and Allied Forces, including multiple, simultaneous links with emphasis on track ID, command and control in support of FTEWA was budgeted at US$608,000.

US$305,000 was set to continue experiments to determine feasibility of integrating non-organic data to ID organic Battle Group air tracks in real time. US$185,000 was reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C. 638.

Plans for FY97 are to continue advanced development of FTEWA in support of CAP and SAM integration. ($3.5 million). US$1.5 million is budgeted for the development and demonstration of Auto-ID with ESM. US$1.0 million will be spent to continue RDE development, with US$755,000 planned to support RML and Forward Pass. The Navy budgeted US$699,000 to support link interoperability between Joint and Allied Forces, including multiple, simultaneous links with emphasis on track ID, command and control in support of FTEWA. US$341,000 will continue experiments to determine

feasibility of integrating non-organic data to ID organic Battle Group air tracks in real time.

PE#0604755N Ship Self-Defense

Project U0166 - SPS Improvement Program. This program develops and tests performance and reliability upgrades for search radar equipment to meet the evolving threat.

FY93 accomplishments supported continuing analysis/ trade-off studies and implementation of functional and performance allocations among elements comprising integrated Ship Self-Defense System (SSDS), including system interface adaptations and preparation/ conduct of associated tests and demonstrations (US$200,000). Engineers completed testing of an Anti-Ship Missile Defense (ASMD) modification to SPQ-9 Radar and completed risk-reduction design efforts and tests (US$1.2 million). The Navy completed the specifications, a Statement of Work, and Request for Proposal (RFP) for design and development of an ASMD Upgrade to the SPQ-9 Radar. The RFP included Low Rate Initial Production (LRIP) (US$6.273 million). Westinghouse Norden Systems was awarded a US$16 million contract to design and develop the SPQ-9B radar system for the Theater Defense Program Office in October 1994. The program would up-grade the ability to detect and track sea-skimming, low radar cross-section, high-speed missiles. Planners continued SSDS integration studies (US$100,000).

FY94 saw continued support for analysis/trade-off studies and implementing functional and performance allocations among elements of the integrated Ship Self Defense System (SSDS), including system interface adaptations and preparation/conduct of associated tests and demonstrations (US$200,000). Planners evaluated proposals for the SPQ-9B Radar and continued development of an acquisition documentation (Cost & Operational Effectiveness Analysis (COEA), Operational Requirement Document (ORD), Test & Evaluation Master Plan (TEMP), etc.) for the SPQ-9B Radar (US$1.989 million). Engineers continued integrating the radar with the MK 86 Gun Fire Control System. The Navy awarded a development contract for two SPQ-9B Radars in the first quarter of FY95 (US$5.450 million). Contract execution will be accomplished from FY95 through FY97 due to the FY96 mark up of US$5.238 million.

Engineers continued SPQ-9(I) Advanced Development Model (ADM) Radar testing at Naval Research Laboratory's Land Based Test Site (LBTS) and at-sea test/operational assessment with the ADM Radar (US$2.045 million). Engineers continued SSDS integration studies (US$100,000).

In FY95, the Navy continued SSDS integration engineering (US$100,00) and funded the ongoing SPQ-9B Radar development contract at US$4.277 million. The Program Office spent US$1.132 million to manage the SPQ-9B Radar development contract, including conducting a Preliminary Design Review (PDR). Engineers continued radar integration into the MK 86 Gun Fire Control System. Engineers completed at-sea testing of the SPQ-9B ADM Radar at a cost of US$800,000.

The plan for FY96 was to spend US$300,000 to continue radar analysis/trade-off studies and implement functional and performance allocations among the elements that make up the integrated Ship Self Defense System (SSDS). This would include system interface adaptations and the preparation for and conduct of associated tests and demonstrations. Plans also included US$9.402 million to continue the ongoing SPQ-9B Radar development contract. US$3.066 million was allocated to managing the SPQ-9B Radar development contract, including a Critical Design Review (CDR) and a Production Readiness Review (PRR). Engineers would continue the radar integration to the MK 86 Gun Fire Control System.

Planners would spend US$183,000 to analyze and demonstrate a Digital Sidelobe Cancellation product improvement to the SPQ-9B Radar. They allocated US$234,000 of the extramural program for Small Business Innovation Research (SBIR) assessment in accordance with 15 U.S.C. 638.

The FY97 plan is to continue the radar analysis/trade-off studies and implementation of functional and performance allocations among the elements of the integrated Ship Self Defense System (SSDS), including system interface adaptations and preparation/conduct of associated tests and demonstrations. This is funded at US$200,000.

The Navy set aside US$6.887 million for the ongoing SPQ-9B Radar development contract. Engineers will conduct First Article Testing (FAT) on two production proof kits and support integration into the MK 86 system at the Land Based Test Site. US$2.636 million is planned to continue managing the SPQ-9B Radar development contract, including First Article Testing at the contractor site and MK 86 integration testing at the NAVSURF-WARCENDIV, Port Hueneme. Planners set aside US$169,000 to continue the Digital Sidelobe Cancellation development as a product improvement to the SPQ-9B Radar.

U0167 - 5 inch Rolling Airframe Missile. The purpose of this program is to develop a surface-to-air self-defense system utilizing a dual mode, passive Radio Frequency /Infrared 5" Rolling Airframe Missile. It is treated in detail in the Forecast International *Surface-to-Air Missiles* Market Intelligence Report.

Project U0172 - Close-In Weapons System (Phalanx). The Phalanx Close-in Weapons System (CIWS) is an

automatic, fast-reaction, computer-controlled radar and gun system. It functions as the last segment in the Navy's layered ship self-defense concept. Its mission is to detect, engage, and destroy hostile anti-ship missiles that have penetrated the ship's other defense systems.

The program requirements are contained in the CIWS Block I (MK 15 MODS 11-14) TEMP 142-1 (Rev 2). It automatically detects, evaluates, tracks, and engages threats and then returns to search mode for another target. CIWS Block I provides increased search elevation coverage, increased velocity coverage, a larger, and improvements to system operability test and fault isolation test programs.

On October 16, 1992, based on the results of a Cost and Operational Effectiveness Analysis (COEA) and subsequent executive review, the Assistant Secretary of Navy (Research, Development & Acquisition) directed that the Advanced Minor Caliber Gun System (AMC-GS) requirement be fulfilled via an Ordnance Alteration (ORDALT) to the Phalanx CIWS, providing a Phalanx Surface Mode (PSuM) capability.

PSuM will modify Block I systems to counter small surface threats and low, slow-flying air threats. System upgrades will include a non-developmental item (NDI) forward looking infrared sensor and automatic video tracker (AVT), manual acquisition controls, video monitors, and operating program modifications.

FY93 accomplishment included continued development of improved sensor capabilities which could better counter low elevation, low Radar Cross Section (RCS) targets, be more capable in an Electronic Countermeasures (ECM) environment, and provide a detection sensor for Rolling Airframe Missile (RAM) (US$6.954 million). The Navy developed and tested the High Order Language Computer (HOLC) and Advanced Fire Control (AFC) programs which will counter the capabilities which are projected to be fielded in anti-ship missiles in the near future (US$1.940 million). Engineers continued ongoing design and engineering efforts to incorporate all FY 1993 Phalanx improvements into the Ship Self-Defense System, an element of the total ship self-defense concept (US$2.0 million). The Navy initiated development of PSuM ORDALT on July 12, 1993 (US$5.0 million).

In FY94, the Navy continued development of Phalanx Surface Mode (PSuM) to include selection of a Non-Developmental Item (NDI) automatic acquisition video tracker and advanced electro-optic equipment, as well as integration of these equipment capabilities to improve overall system operation in AAW (US$18.855 million). The program office spent US$7.075 million to continue development of Baseline 3, to include design and development of a Low Noise Signal Generator and Digital Signal Processor. Engineers started development of AAW improvements and SSDS integration to include: development of receiver modification to reduce electro-magnetic interference; integration of the electro-optic system into the AAW fire control algorithms; and developed the hardware/software interfaces to allow integration into the SSDS (US$3.758 million).

In the Close-In Weapon System effort, the Navy continued Phalanx EMI mitigation testing to define the interference mechanism and determine software and hardware fixes (US$2.743 million).

In FY95, planners continued developing and testing PSuM to include: development of software, integration of NDI electro-optic hardware, and preliminary contractor testing (US$12.257 million). Engineers continued developing AAW improvements to include: design engineering and documentation of AAW subsystems, component qualification, integration of hardware modifications and EO/RF Fire Control Integration (US$3.767 million). They completed developing the initial SSDS integration with Baseline 2 to include: development magazine, augmented reliability, built-in test equipment of initial DT/OT software delivery and support of preliminary testing at a cost of US$3.375 million. Engineers completed DT/OT on the High Order Language Computer and operational program (US$3.326 million).

In FY96, the Navy planned to complete developing and continue contractor evaluation testing of the PSuM and the AAW improvements to include: finalizing hardware and software development and preparing for Navy testing at a cost of US$5.703 million.

The plan for FY97 is to complete Navy test and evaluation and DT/OT testing on the Surface Mode Upgrade portion of the Phalanx Improvement Program. This is funded at US$6.116 million.

U0173 - NATO Sea Sparrow. This program encompasses efforts to enhance ship self-defense by enhancing the kinematic capability of the Sea Sparrow missile to counter the high speed Anti-Ship Cruise Missile (ASCM) including associated system integration.

It is treated in detail in the Forecast International *Surface-to-Air Missiles* Market Intelligence Report.

Project U0665 - Infrared Track & Search (IRST), Thermal Imaging Sensor System (TISS). The sophistication and diversity of threats facing naval surface combatants is increasing with respect to lower radar cross-section, use of passive anti-radiation missile (ARM), increased speed, and lower altitudes.

This program element provides funding for two infrared sensors - the Infrared Search & Track (IRST) and Thermal Imaging Sensor System (TISS). The IRST will provide passive augmentation to complement radar, electronic

support measures (ESM) and visual surveillance systems for air targets. It will declare those air targets to the ship's combat system. The TISS will provide surface ships with a day/night high resolution surveillance capability for small cross-section targets.

It also supports anti-surface warfare (ASuW), mine warfare (MIW) and anti-submarine warfare (ASW) missions. The system will be a non-developmental item (NDI) procurement.

FY93 accomplishments included a Cost and Operational Effectiveness Analysis (COEA) conducted via funding provided in PE#0603755N, Project U2138 in preparation for FY94 program initiation.

FY94 saw the completion of the Cost and Operational Effectiveness Analysis (COEA) completed. The Navy spent US$2.765 million to develop system specifications for the TISS and IRST system. The program office prepared a RFP (US$1.333 million) and acquisition plans and progressed towards obtaining a Milestone II decision to enter Engineering and Manufacturing Development phase (US 2.834 million). They also progressed towards awarding an E&MD contract for TISS (US$5.454 million). IRST development was delayed one year due to FY94 reprogramming and a delay in requirements formulation. Follow-on Engineering Development would be slipped two years to accommodate a two-phase development approach.

FY95 accomplishments included ($1225) a Milestone II decision and progress towards awarding and IRST contract. This effort was funded at US$1.225 million. Planners ($5398) performed a continuing assessment of risk reduction efforts, spending US$5.398 on this. The Navy awarded a ($5841) Awarded TISS E&MD contract which included integration with the Land Based Test Site (LBTS), funding this effort at US$5.841 million. US$1.675 million was used to conduct a technical evaluation (TECHEVAL) and operational assessment of the TISS. US$600,000 was used to forward-finance FY96.

Planners spent US$1.865 million to achieve a Milestone II decision and began preparations for a Milestone III decision for TISS.

The FY96 plan included US$10.828 million to continue IRST EDM design development (performance, safety, reliability, environmental suitability, human factors, and combat system integration). US$1.535 million was set aside for IRST logistics support development and preparing for test and evaluation. Planners allocated US$937,000 to prepare for the IRST Preliminary Design Review. US$221,000 of the extramural program was reserved for Small Business Innovation Research assessment in accordance with 15 U.S.C. 638.

There was a congressional appropriation increase of US$9.5 million.

The FY97 is to complete construction of EDM-1 and deliver it to the land based test site (US$2.130 million). Planners targeted US$1.450 million to begin preparations for IRST installation at the LBTS. US$300,000 is to conduct the IRST PDR.

IRST development was delayed one year due to FY94 reprogramming and a delay in requirements formulation. Follow-on Engineering Development slipped two years to accommodate a two-phase development approach.

Project U0954 - Shipboard EW Improvements. The Shipboard EW Improvements Program major efforts are:

- Advanced Capability (ADCAP): Improves Active Countermeasure capability.
- SLQ-32(V) Phase E: Improves threat detection capability.
- DECM/Decoy Integration (DDI): Integration of MK 36 Decoy Launching System with SLQ-32(V) Shipboard Electronic Countermeasures System.
- Rapid ASM Integrated Defense System (RAIDS): phased Rapid Development initiative to improve the ability of surface combatants to perform Anti Ship Missile Defense (ASMD).
- The Advanced Torch Decoys program: develops Ship Launched Decoys capable of seduction and distraction of IR homing Anti-Ship Missiles.
- The MK186 MOD 2 Torch: provides improved flame characteristics.
- OUTLAW BANDIT Ship Signature management: includes development of Radar Cross Section (RCS) reduction treatments for FFG-7, DD-963, DDG-993, CG-47 class ships and also covers RCS and Infrared (IR) measurement and control techniques.
- Advanced Integrated Electronic Warfare System (AIEWS): provides development of an advanced EW System to operate as an integral component of ships combat system and provides increased ECM capability to support ship defense and introduces the next generation of EW technology.
- Offboard Active Countermeasure (OACM): an active Decoy compatible with existing MK 36 DLS.

In FY93, the Navy completed the Phase E Full Scale Engineering Development (FSED) Program Decision Review (PDR) (US$6.285 million). The ADCAP effort concluded FSED and engineers conducted field testing (US$.686 million). Program personnel continued developmental testing of Torch/Flying IR Torch (FLIRT)

(US$1.400 million), continued the Signature Management program, conducted OPEVAL on FFG-7 (OT IIC 22-25 FEB 93), and conducted DT on the CG-47 class and Production Acceptance Test and Evaluation (PAT-&E) for the DD-963 class. The program office also initiated Radar Cross Section Control (RCSC) design for DDG-993 class ships and an IV&V effort along with conducting modeling and simulation for FFG-7, DD-963, CG-47 and DDG-993 class EW effectiveness (US$ 3.416 million). They achieved Milestone III for OUTLAW BANDIT (US$ 4.800 million), conducted DDI DT-IIIE/OT-IIIB At-Sea Tests (US$ 2.772 million), and completed RAIDS DT-IIA/ OT-IIA - ARB on July 19, 1993 (US$ 2.098 million). The Navy also made a Milestone III decision for RAIDS (US$ 2.438 million) and approved the AIEWS Mission Needs Statement (MNS) and COEA proposal. COEA was completed in January 1994 (US$ 2.412 million). It fully funded the final increment of the AEWS contract (US$ 1.715 million).

In FY94, the Navy performed the Phase E Critical Design Review (CDR) and factory tests (US$ 8.474 million) and conducted ADCAP/DDI testing as well as final Developmental Testing/Operational Testing (DT/OT) (US$ 3.181 million). The program office continued the Signature Management Program, completed a radar cross-section control (RCSC) design package for CG-47 and DD-963, completed SPG antenna reflectivity improvements, and conducted COMOPTEVFOR V&V efforts on EW effectiveness modeling and simulation as part of Follow-on Test and Evaluation (FOT&E) preparations (US$ 5.378 million). The Navy also restructured Phase I of AIEWS to include SLQ-32 Phase E (US$ 2.500 million). Engineers conducted AIEWS multiple concept Exploration and Definition Studies (US$ 1.800 million). US$ 4.705 million was allocated to the NULKA program. The AIEWS program office prepared restructured program logistics, and AIEWS technical and program documentation (US$ 1.900 million). Completion of TORCH developmental/operational testing cost US$ 450,000 and US$ 500,000 went into a Special project systems test. The AIEWS program was re-structured to include back- fitting to SLQ-32-equipped ships.

In FY95, engineers completed ADCAP and achieved Milestone III in the second quarter (US$ 1.779 million). Programmers initiated AIEWS Phase I Development, including Phase E, funded at US$16.335 million. Engineers conducted Signature Measurement DT-III on DD 963 class ships. The OT-III element of DT/OT was canceled in favor of OPTEVFOR DT III observation, Fleet applications, and additional threat-representative systems. There was a DT-III of the R&D installation on the USS WADSWORTH (FFG 9). The program office conducted hardkill/softkill integration effectiveness modeling and simulation (US$5.800 million). US$2.4 million was used to forward-finance FY96

Plans for FY96 were to continue AIEWS Phase I Development and initiate an AIEWS Phase II/III Broad Agency Announcement, programmed at US$6.613 million. Planners would spend US$3.746 million to complete the RCS reduction design package for DD-993 class ships. They would also conduct DT III on CG 47 class, the RAM improvement program (including maintenance), and reduced installation cost initiatives. Engineers would continue measurement testing along with Hardkill/Softkill integration effectiveness modeling and simulation. US$2.4 million was used to forward-finance FY97.

In FY97, planners would continue AIEWS Phase I and Phase II, budgeting US$4.713 million for this. OUTLAW BANDIT, including the RAM improvement program will continue (US$4.381 million). This will include hardkill/softkill integration effectiveness modeling and simulation.

U2176 - SSD Engagement Improvements. Efforts are funded in FY98 and beyond.

Project U2187 - Quick Reaction Combat Capability Improvements (QRCC). The QRCC program provides the multisensor integration and hardkill/softkill coordination to improve current system performance with respect to short range anti-air ship self-defense. It is intended to leverage recent critical experiments and RAIDS program efforts to upgrade existing short range anti-air warfare defenses by providing a quick reaction capability through flexible embedded doctrine that coordinates the detect-through-engage sequence for in-service equipment. In particular, QRCC applies multisensor integration to existing sensors, upgrades and integrates RAIDS for support of local command and control, integrates and coordinates weapon systems, and provides a first level of hardkill/softkill integration.

QRCC architecture centers on the distributed processing concept and will be incrementally implemented via a MK 1 Ship Self-Defense System (SSDS) focusing on integration of RAM, CIWS and the SLQ-32 electronic countermeasures system, followed by a Mark 1 system which integrates NSSMS, CIWS, RAM, SLQ-32 and the MK 23 TAS across a broad ship class spectrum. It integrates existing system elements via a fiber optic local area network and uses an advanced display system currently under development for system operation, maintaining form, fit and function of the OJ-194 console. This project provides for full scale EMD of SSDS leading to production and installation.

There was no activity in FY93.

FY94 activity continued risk-reduction engineering efforts of SSDS MK 1 for the LSD-41 (Dock Landing Ship) class (US$3.091 million). The program office conducted a system requirements review and system design review and completed the system specifications (US$1.0 million). Managers initiated the design and engineering of modifications to the MK 1 system for installation aboard LHD, LHA amphibious assault ships), and aircraft carriers (US$100,000). The program office initiated Integrated Logistic Support and other programmatic efforts to prepare for fleet support requirements (US$100,000).

In FY95, the Navy spent US$ 9.1 million to continue risk reduction efforts for the MK 1 Ship Self Defense system for LSD 41 class ships. The Program Office ($10500) conducted a Milestone II review and began Engineering and Manufacturing Development of the MK 1 SSD (US$10.5 million). US$10.0 million was used to initiate Land Based Test Site development and US$5.206) went into the continued design and engineering efforts for the MK 1 system onboard follow-on class ships. US$4.0 million initiated NATO Sea Sparrow Missile System re-architecture for follow-on class ships.

The FY96 plan was to continue E&MD development of the MK 1 (US$17.0 million). The Navy allocated US$ 10.550 million to begin Developmental Testing on LSD 41 class ships. US$1.0 million was planned to complete the programmatic documentation that would support a Milestone III deployment decision. Planners completed the logistics requirements that would support DT/OT and MS III (US$4.362 million. The programmed US$4.450 million to complete Milestone III and transition to the production of SSDS MK 1 for LSD 41 class ships. US$2.021 was allotted to continue engineering development of SSDS MK 1 for the follow-on classes of ships.

The Navy programmed US$3.614 million to develop a multi-sensor data fusion capability for Centralized Identification Friend or Foe (CIFF)and Non-Cooperative Target Recognition Capability for Self Defense (NCTRC-SD) to ensure proper identification. The Program Office set aside US$2.205 million to continue development and testing of a Ship Self Defense System for future Non-Aegis ships as well as integration of new technologies. US$6.962 would provide modifications to the Self Defense Test Ship for testing of remote operations, reduced radar cross section targets and infrared signature reductions. US$760,000 of the extramural program was reserved for the Small Business Innovation Research assessment in accordance with 15 U.S.C. 638.

FY96 funding was increased US$14.5 million by Congress and saw a decrease of US$1.938 due to undistributed general and inflation reductions; and revised DOD inflation rates and other minor pricing adjustments.

In the FY97 plan US$ 13.572 million was allocated to continue E&MD development and commence DT of SSDS MK 1 for LHD class ships. The Navy budgeted US$ 3.9 million to continue E&MD of SSDS MK 1 for follow-on class ships. US$750,000 would support programmatic documentation changes and US$ 3.758 million was budgeted to support logistics requirements made necessary by ship class adaptations. Planners budgeted US$7.5 million to complete DT and conduct OT on the SSDS for LSD 41 class ships.

U2190 - NULKA Decoy. The Offboard Active Decoy (NULKA) is a joint cooperative program between the United States and Australia to develop an active offboard decoy which utilizes a broadband radio frequency repeater mounted atop a hovering rocket. The Decoy is designed to counter a wide variety of present and future radar guided Anti-Ship Missile (ASM) threats by radiating a large radar cross-section signal while flying a ship-like trajectory. The United States developed the Electronic Payload and Fire Control System.

Currently the United States is modifying the payload to incorporate cost savings improvements and improve reliability. The Fire Control System components are being consolidated and modified. The MK 36 Decoy Launching System (DLS) is being modified to support NULKA Launches. Australia developed the hovering rocket, launcher, and launcher interface unit.

In FY90, Engineering Development Models 1 and 2 and a launcher were delivered. Developmental Test IIA was started. In FY91, the Navy completed DT-IIA and conducted a captive-carry of a NULKA payload in Australia. EMI testing was completed.

FY92 plans called for Developmental Testing IIB/E in Australia as well as DT-IIC/D in the US. Captive-carry testing continued in Australia and a Critical Design Review of the NULKA vehicle and launching system was accomplished.

By mid-1993, three at-sea test phases had been concluded. Reports indicated that significant consolidation of the electronics components could be possible.

In 1994, a Payload Improvement Program and cost reduction were accomplished at a cost of US$ 8.1 million. A limited production decision was made. The Royal Australian Navy contracted AWA Defense Industries to produce the NULKA system for the RAN Fleet. The US$16.9 million contract was awarded for Phase I of the Australian effort. AWADI would install the system on a selected Australian frigate, develop and build a fire control system, and assist with the acceptance trials.

FY95 saw the continued development of NULKA development and start of launch system integration testing, continued rocket motor qualification program, and the

initial fabrication and delivery of test rounds. This was funded at US$12.729 million.

The plan for FY96 was to complete NULKA development and conduct land based testing US$7.576 million as well as completing the integration of a stand-alone NULKA system with the SLQ-32. Engineers would begin research and development of payload improvements that will be required to counter the next generation threat and to improve EMC capability. They would also begin integration of NULKA with SSDS. US$175.000 was reserved for Small Business Innovative Research assessment in accordance with 15 USC 638.

FY96 funding was increased US$8.0 million in the Congressional appropriation and because of undistributed general and inflation reductions. A revised DOD inflation rate and other minor pricing adjustments generated a reduction of US$249,000.

In FY97, planners hope to conduct the DT/OT testing required to achieve a milestone III decision for the stand-alone NULKA system. (US$4.377 million) and continue research and development of payload improvements required to counter the next generation threat and to improve EMC capability. Engineers will continue integration of NULKA with SSDS.

U2256 - Semi-Active Fuze Improvement. This funds development efforts for technologies that have become available for transition into an engineering and manufacturing development program. These emergent technologies can provide improved capabilities for one or more Ship Self Defense programs. Development of the Evolved Sea Sparrow Missile (ESSM) under project U0173 will provide enhanced ship survivability against the current and emerging threat, but additional capability is required to pace the evolving threat. Maneuverable, low radar cross-section anti-ship missiles can be countered by near-term fuzing system improvements and mid-term improvements, including dual mode seekers and even greater kinematic performance.

This is a "NEW START PROGRAM" that will develop near-term fuze improvements to improve data processing to accurately discriminate targets in high clutter/ECM environments and provide increased capability in high angle of attack/high closing rate engagements. The fuze design is based on an upgrade of existing AIM/RIM-7 DSU-34B Fuze; accordingly, the improved fuze will be form and function compatible with ESSM and existing AIM/RIM-7P missiles.

There were no accomplishments in FY94 or plans for FY95.

In FY96, US$101,000 was reserved for Small Business Innovation Research (SBIR) assessment in accordance with 15 U.S.C. 638. US$4.332 million was budgeted for beginning the development of a fuze modification for the ESSM Missile to Counter the Advanced Low Altitude highly maneuverable threats.

Plans for FY97 are to spend US$ 5.446 million to continue the effort associated with the fuze modification for the ESSM.

FY95 Congressional Action. The FY95 National Defense Authorization Act (H Rpt 103-701 to S 2182) increased funding for both Program Elements by a total of US$ 24.2 million. Specific additions were:

Accelerating improvements to the self-defense test ship, US$ 11.2 million.

Evaluating an insensitive munition, dual-thrust motor upgrade to RAM, US$ 5.0 million.

Procuring NULKA decoys, US$ 8.0 million.

The FY95 Defense Appropriations Act (H Rpt 103-747 to H 4650) added US$11.2 million to PE 0603755N for the self-defense test ship. The House/Senate conferees added US$47 million to PE 0604755N. Specific additions were:

Advanced Display System, US$25.0 million.
Land Based Site, US$10.0 million.
Sea Sparrow Integration, US$4.0 million.
NULKA, US$8.0 million.

The appropriations legislation made additions and included the following comments on Ship Self-Defense:

"The conferees agree with the House-recommended bill language with respect to incorporating its own ship-self-defense capability - including cooperative engagement capability - on the new LPD-17 amphibious ship. In approving this requirement, the conferees do not believe that the Navy will find it necessary to install on the ship the SPY-1 radar system and associated Standard missile launch capabilities to provide the required self-defense.

The conferees goal in providing this statutory provision is to address the requirement for the LPD-17 to defend against sea-skimming cruise missiles in the final phases of flight, not to address the need for area defenses against theater ballistic missiles and other air threats.

The conferees direct the Navy to report to the Committees on Appropriations no later than May 5, 1995, on its plans and activities related to developing infrared search and track systems for ship self-defense.

The conferees also agree to provide additional funding of US$25,000,000 to be made available to the Naval Sea Systems Command, for use by the UYQ-70 Advanced Display System (ADS) program office only for adaptation of the ADS for shipboard deployment

in support of cooperative engagement capability, future AEGIS baseline, advanced combat direction system Block I, and ship self-defense system Mk 2, as well as for the demonstration of emerging COTS/NDI technology for future deployment."

FY96 Congressional Action. The FY96 Defense Appropriations Conference (H Rpt 104-261 to HR 2126) noted that the Department of Defense and Congress had reached agreement on the direction of ship self-defense programs. The text of the report that accompanied the legislation re-affirmed Congress's support for achieving robust self-defense capabilities on Navy ships, especially the LPD 17 class, as soon as possible.

After resolving the differences between the House and Senate versions of the two bills, the conferees added US$87.0 million to PR 0603755N and US$41.3 million to the Navy's request for PE 0604755N. The additions (US$ in millions) were:

PE 0603755N	+87,000	
	NLR P-3	+26.5
	Fleet P-3	+11.5
	E-2C CEC	+5.5
	Patriot/Thaad/Corps SAM CEC	+5.0
	Hawk CEC	+3.0
	AWACS CEC	+11.0
	National Sensors CEC	+4.0
	FACT high definition systems	+4.5
	UYQ-70	+16.0
PE 0604755N	+41.3	
	Test ship	+7.9
	QRCC	+2.5
	ESM	+4.5
	IRST	+9.5
	SPQ-9	+4.8
	Multisensor integration	+4.1
	NULKA	+8.0

The FY96 Defense Authorization focused heavily on CEC. The budget request included US$180.0 million in PE 0603755N for development of the Cooperative Engagement Capability The House bill would have authorized the requested amount, but direct that no more than US$102.0 million be obligated until the secretary of defense notifies the congressional defense committees that the test and evaluation master plan for the CEC program had been approved by the director, operational test and evaluation. The Senate would have added US$22.5 million to continue the accelerated development of the airborne component of CEC and an additional US$20.0 million to accelerate joint Army-Navy and Air Force-Navy exploitation of CEC for cruise missile defense and theater missile defense.

In the end, the conferees agreed to an additional US$42.5 million for CEC for the purposes described in Senate amendment and the House receded from its funding limitation. The conferees noted House concerns regarding developmental testing and independent operational testing required to insure that the CEC is operationally effective and suitable when deployed to the fleet. They directed the Secretary of the Navy to submit to the congressional defense committees, by March 31, 1996, a report on the status of plans for developmental and independent operational testing of the CEC.

FY97 Congressional Action. Congress continued its interest in and adjustment of the Ship Self Defense and Cooperative Engagement Capability programs. In the FY97 Authorization, the Navy requested US$164.5 million for Cooperative Engagement Capability (U2039) in PE 0603755N and US$9.9 million in PE 0204152N for continued development of the CEC. In its report to accompany the legislation, Congress noted that funding provided by the budget request would focus on the development of shipboard and airborne Cooperative Engagement Systems (CES), initial operational test and evaluation of shipboard CES, and development of organic integrated logistic support for the CES.

Because the Navy reported that a challenging cruise missile defense exercise, *Mountain Top*, that relied heavily on CEC position information, had been held earlier in Hawaii and involved over-the-horizon detection, tracking, and engagement of a variety of

difficult targets. As a result, the Navy projected that initial operational capability of the system will be achieved by September 1996.

During testimony at FY97 defense posture hearings, the Secretary of Defense singled out CEC as a program of high priority that he chose to accelerate because of its great potential for linking units from more than one service together and greatly increasing their warfighting ability.

The report further noted that despite relatively robust funding for CEC in the budget request, it contains no funding to pursue joint service integration efforts that were begun in FY96 Congress felt that successful consummation of these efforts, in consonance with the Navy's baseline program, could greatly leverage the capability of the services to conduct joint operations and provide ballistic missile defense. Another area not addressed by the budget request, an issue raised in Armed Services and National Security Committee hearings as the reported interference between CEC and other data links currently in use in the fleet.

The House bill would authorize an increase of $27.0 million in PE 63755N for the CEC program and urge the continued acceleration and expansion of joint service integration efforts, including application to the Airborne Warning and Control Systems (AWACS) aircraft, Patriot and Theater High Altitude Area Defense (THAAD) missile systems, Marine Corps TPS-59 radar and the HAWK missile system. The Senate amendment would have authorized an increase of $63.0 million above the budget request for CEC in PE 63755N to permit continued pursuit of a number of promising efforts, including CEC integration with AWACS and national sensors, to accelerate development of an airborne capability for the system, and to address the issue of CEC interference with other fleet data links, particularly the link installed on the SH-60B.

The conferees agree to an increase of $35.0 million in PE 53755N for the CEC program and urge the continued acceleration and expansion of joint service integration efforts, including application to AWACS aircraft, Patriot and THAAD missile systems, Marine Corps TPS-59 radar and the HAWK missile system. The conferees also directed the secretary of the Navy to prepare a detailed report, for submission no later than March 15, 1997, on progress made in resolving the issue of spectrum interference as a result of the reallocation under title VI of the Omnibus Reconciliation Act of 1993 of the spectrum in which CEC operates; and steps that the Secretary had taken to address and resolve harmful interference between CEC and other fleet weapons systems and data links.

Funding

US FUNDING

	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USN)								
PE#0603755N								
Ship Self-Defense								
U0172 CIWS	-	3.0	-	3.4	-	0.0	-	0.0

	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
U2039 Cooperative Engagement	-	200.4	-	153.8	-	256.8	-	164.5
U2133 QRCC	-	27.1	-	18.4	-	4.4	-	2.1
U2136 LINK IRON	-	49.6	-	39.6	-	47.1	-	42.1
U2184 FACT	-	7.1	-	12.0	-	8.2	-	7.8
U2236 SCGT	-	2.5	-	0.0	-	0.0	-	0.0
RDT&E Total	-	289.7	-	227.2	-	316.5	-	251.5*

*NOTE: The FY97 Defense Authorization increased this funding by US$35.0 million from the original request of US$216.5 million.

RDT&E	FY98		FY99		FY00		FY01	
(USN estimate)	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
U2039	-	151.1	-	88.7	-	46.6	-	49.3
U2133	-	4.3	-	4.6	-	4.6	-	4.7
U2136	-	39.5	-	45.8	-	45.9	-	47.1
U2184	-	7.7	-	8.0	-	8.0	-	8.2
RDT&E Total	-	202.6	-	139.1	-	105.1	-	109.9

	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USN)								
PE#06004755N								
Ship Self-Defense								
U0166 SPS Improvement Program	-	9.8	-	6.3	-	13.2	-	9.9
U0167 Rolling Airframe Missile	-	9.0	-	17.9	-	25.1	-	20.0
U0172 Close-In Weapons Sys (Phalanx)		32.4	-	24.0	-	5.5	-	5.0
U0173 NATO Sea Sparrow	-	18.3	-	45.3	-	63.2	-	47.5
U0665 IRS&T	-	12.4	-	16.0	-	13.5	-	3.9
U0954 Shipboard EW Improvements	-	28.9	-	23.8	-	14.6	-	9.1
U2176 SSD Engage Improvements		0.0	-	0.0	-	0.0	-	0.0
U2178 QRCC	-	4.3	-	38.8	-	52.9	-	29.5

	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
U2190 NULKA Decoy		8.1	-	12.7	-	7.8	-	4.4
U2256 SAF	-	0.0	-	0.0	-	4.4	-	5.5
U2258 Adv Displ	-	0.0	-	24.2	-	0.0	-	0.0
RDT&E Total	-	123.2	-	209.0	-	200.2	-	150.7**

**NOTE: The FY97 Defense Authorization increased this funding by US$16.0 million from the original request of US$134.7 million.

	FY98		FY99		FY00		FY01	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USN estimate)								
U0166	-	6.2	-	2.7	-	1.8	-	1.8
U0167	-	18.2	-	8.7	-	8.5	-	8.7
U0172	-	14.6	-	10.9	-	6.1	-	5.5
U0173	-	49.3	-	14.3	-	5.9	-	4.1
U0665	-	14.6	-	30.7	-	29.2	-	10.2
U0954	-	18.6	-	29.9	-	30.1	-	32.7
U2176	-	5.0	-	9.0	-	9.1	-	9.5
U2178	-	30.1	-	28.5	-	13.6	-	13.7
U2190	-	12.7	-	7.8	-	4.4	-	1.9
U2256	-	4.5	-	1.0	-	0.0	-	0.0
RDT&E Total	-	173.8	-	143.5	-	108.7	-	88.1

All US$ are in millions.

Recent Contracts

No recent contracts identified.

Timetable

PE#0603755N

CEC

1Q	FY94	DT/OT
2Q	FY94	PDR/CDR, P-3 demonstration
2Q	FY94	Milestone I/II PDM
1Q	FY95	CDR E-2C
2Q	FY95	P-3 Dem Val
3Q	FY95	PDR E-2C
1Q	FY96	PDR/CDR
4Q	FY96	IOC
3Q	FY97	IOT&E
1Q	FY98	Milestone IIA, LRIP award
2Q	FY98	E-2C Demo
3Q	FY98	DT-IIC/OT-IIB
1Q	FY99	Milestone III, FRP award
3Q	FY99	DT-II (E-2C)
4Q	FY99	OT-II (E-2C)
4Q	FY00	FOC/MSD/NSD

QRCC

Jun	1993	SSDS Mk 1 Demonstration
Aug	1993	RAIDS Milestone III
2Q	FY95	Mk 1 Milestone II, EMD
2Q	FY96	Mk 1 Procurement
Jan	1996	Mk 1 Milestone III
1Q	FY97	LSD-41 DT
2Q	FY97	LSD-41 OT II, Mk 1 procurement
2Q	FY98	CVN-76 FOT&E
4Q	FY98	LHD FOT&E
2Q	FY99	LHA FOT&E
4Q	FY99	CVN-68 FOT&E
2Q	FY01	LPD-17 OT&E

PE 0604755N

SPS Improvements

1Q	FY95	SPQ-9 Milestone IV/II, contract award for 2 PPKs
1/2Q	FY95	SPQ-9(I) ADM At-Sea Test
3Q	FY95	SPQ-9B PDR
	FY96	SPQ-9B CDR
4Q	FY96	SPQ-9B PRR
3Q	FY97	SPQ-9B FAT
2Q	FY97	Two SPQ-9B LRIP option
1Q	FY98	SPQ-9B integration at LBTS
2Q	FY98	Four LRIP, one Production award
2Q	FY99	SPQ-9B MS III
2Q	FY99	SPQ-9B last delivery

CIWS Improvement

2Q	FY95	PIP PDR
4Q	FY95	PIP CDR
4Q	FY95	HOLC DT/OT
3Q	FY97	Milestone III
3Q	FY00	Contract award
1Q	FY01	Milestone III

IRST/TISS

3Q	FY95	TISS MS II
4Q	FY95	IRST MS II
3Q	FY95	TISS EMD
4Q	FY95	Award IRST EMD Phase 1
1Q	FY96	Milestone II
4Q	FY96	IRST PDR
	FY98	Award IRST Phase 2 EMD
2Q	FY98	IRST PDR
3Q	FY98	Start build
	FY01	TISS MS III

Shipboard EW Improvements

	FY94	Phase E CDR
4Q	FY94	ADCAP/DDI DT/OT II
2Q	FY95	ADCAP MS III
	FY95	AIEWS Phase I development
3/4Q	FY95	OUTLAW BANDIT DT III/FOT&E
3Q	FY95	AIEWS Phase 1 award

4Q	FY96	AIEWS DT/OT IIA
4Q	FY99	AIEWS DT/OT IIB Phase I
QRCC		
2Q	FY95	Mk 1 MS II
2Q	FY95	Mk 1 EMD
2Q	FY97	Mk 1 MS III
1Q	FY97	LSD 41 DT II/OT II
2Q	FY98	CVN-76 FOT&E
4Q	FY98	LHD FOT&E
2Q	FY99	CVN-68 FOT&E
2Q	FY01	LPD-17 OT&E
	TBD1	CVN-76 FOT&E
NULKA Decoy		
1Q	FY96	Qualification test
2Q	FY96	MS IIA
3Q	FY96	LRIP award
1Q	FY97	MS III (Decoy), DT
2Q	FY97	MS III (System)
2Q	FY97	OT

Worldwide Distribution

These are **US** only programs, except for the Rolling Airframe and NATO Sea Sparrow missile projects.

Forecast Rationale

Ship self-defense is a major focus of the US Navy. Equipping the fleet with effective protection will be a major RDT&E and procurement effort through the remainder of the decade. This is a multi-faceted program that concentrates on weapons upgrades, sensor enhancements, and data communications/processing innovations.

A key to the program's success is more centralized management and increased priority. The *USS Stark* incident in the Persian Gulf was Capitol Hill's trigger and remains its benchmark. Congressional prompting and their measurement of progress is relative to preventing another *Stark* incident.

A major change in emphasis on and thrust of these programs developed out of the Navy's strategic and tactical switch from deep sea/blue-water operations to operations in the littoral area close to shore. In the littoral, ships face far more deadly threats from surface-skimming missiles which can be launched without warning from shore sites or ships that cannot be readily detected because of interference from shore line and small boat clutter. Reaction time will be limited and early detection/rapid reaction critical.

The Cooperative Engagement Capability effort has become the largest effort through the forecast period. It is crucial that ships detect missiles at the longest possible range. Tying the sensors of multiple platforms together into a command and control system takes advantage of outlying sensors feeding a powerful central hub which can make decisions based on fused data from multiple sources. CEC not only improves the number of inputs available to decision makers, but compensates for loss of one or more individual sensors. It makes it possible to use weapons on ships that may not have a good track on a particular target.

Because the development of effective self-defense for the fleet has become a high-interest item in Congress, funding should remain robust until systems have been developed. Capitol Hill favors wants to see emphasized. For the next several years, this will probably be the trend, the Navy will get most of or more than what they ask for, as long as congressional confidence in the program remains.

One criticism has been that the US ship defense philosophy and tactics were conceived with a Soviet deep water threat in mind. As "friendly" export weapons become more commonplace in the Third World, and as the likelihood of combat in the Third World increases, enhanced protection becomes even more important. Another concern grows out of the philosophical difference between US and European, specifically British, naval EW.

The Royal Navy incorporates its shipboard electronic warfare systems more as an integral part of the vessel's overall combat capability than the US does. A major thrust of the Ship Self-Defense programs will be to better integrate the systems on a ship as well as integrate the data from multiple ships in a battle group. This is the thrust of the near-term Navy program and congressional emphasis.

In the near term, funding will be favorably received on Capitol Hill, with portions of the effort smiled on by the legislators, and funding added selectively until requests come up to the level Congress wants it to be. The push may cause some of the out-year requests to be less than originally planned because some work will be stepped up and the programs finished earlier than currently projected. Others will move out of these program elements and into separate development or production efforts.

The forecast combines funding for both program elements. Following the forecast is a chart reflecting the Navy's latest CEC fielding schedule. The CEC reflected is not a single system or specific piece of equipment, but rather the installation of the appropriate capability in the ships and aircraft listed. It does not convert directly to a particular system forecast as do other outlooks. This chart is included for information, since it provides a general roadmap of the Navy's approach to the Cooperative Engagement Capability.

Ten-Year Outlook

FORECAST FUNDING LEVELS
(FY96 US $ Millions)

			High Confidence Level				Good Confidence Level			Speculative			
Designation	Application	thru 96	97	98	99	00	01	02	03	04	05	06	Total 97-06
SHIP SELF DEFENSE	SURFACE SHIPS (USN)	1383.72	402.2	376.4	286.6	213.8	198.0	175.0	180.0	150.0	150.0	125.0	2257.0

CEC Fielding Schedule

Ship Class	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	Total
CG-47 Aegis	2		3	3	3	4	3	2	2	2		22
DDG-51 Aegis					1	4	8	12	12	13	7	57
DDG-993 NTU				2	2							4
CV/CVN	1		4	2	1	2	2	2		1		14
LPD-17				1		2	2	2	2	2	1	12
LHD/LHA	1		2	1	1	2	1	2	2			11
LSD-41								2	3	3	4	12
DD-963								3	3	3	3	12
E-2C	2				1	3	1	11	12	11	8	47
LETS/Training Site	4		3	2	1		3					9
Total	**10**		**12**	**11**	**10**	**17**	**20**	**36**	**36**	**35**	**23**	**200**