

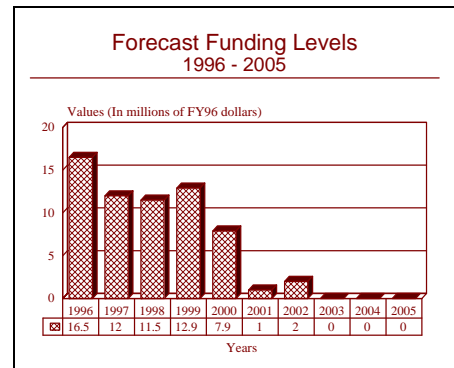
# ARCHIVED REPORT

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## Submarine Support Equipment - Archived 11/97

### Outlook

- This is a technology development program
- Part of a multi-project program element
- Program changes expected and normal
- Recent cuts compensated for in outyears



### Orientation

Description. PE0604503N, Submarine System Equipment Development, combines several programs, including the Submarine Support Equipment Program (Project F0775).

#### Sponsor

US Navy

Naval Sea Systems Command (NAVSEA)  
2531 Jefferson Davis Highway  
Arlington, Virginia (VA) 22202  
USA

Tel: +1 703 602 3381

Naval Underwater Systems Center

Code 0223 Building 102  
Newport, Rhode Island (RI) 02481-5047  
USA  
Tel: +1 401 841 3611

Contractors. Currently identified contractors. List will vary as projects change.

#### Raytheon Co

6380 Hollister Ave  
Goleta, California (CA) 93117  
USA

Tel: +1 805 967 5511  
Fax: +1 805 964 0470  
(IEM ADSU EMD)

#### ST Research Inc

8419 Terminal Rd  
Newington, Virginia (VA) 22122  
USA

Tel: +1 703 550 7000  
Fax: +1 703 550 7470  
(IEM HPI Interface)

#### Lockheed Martin Corp

6801 Rockledge Drive  
Bethesda, Maryland (MD) 20817  
USA

Tel: +1 301 897 6711  
Fax: +1 301 897 6800  
(IEM BDE)

Status. Advanced/engineering development.

Total Produced. Development program only.

Price Range. Indeterminate.

Application. The systems and equipment are primarily used on submarines.

## Technical Data

PE0604503N The Submarine Support Equipment Program (SSEP) develops and improves submarine Electronic Warfare Support Measures (ESM) techniques and components, equipment, and systems that will increase submarine operational effectiveness in the increasingly dense and sophisticated electromagnetic environment caused by the proliferation of complex radar, communications and navigation equipment of potential adversaries. Improvements are necessary for submarine ESM to be effective in conducting the following mission areas: Littoral Warfare, Joint Surveillance, Space and Electronic Warfare, Intelligence Gathering, Maritime Protection, and Joint Strike.

The major efforts in this area are engineering and manufacturing development of the Integrated ESM Mast (IEM) and the Advanced Submarine Tactical ESM Combat System (ASTECS) for the New Attack Submarine and for potential backfit on the SSN 21 and SSN 688 Class.

The Submarine Integrated Antenna Systems (SIAS) project develops the antennas needed to communicate in networks such as:

- Ultra High Frequency (UHF) Satellite Communications,
- Extremely Low Frequency (ELF)
- Extremely High Frequency (EHF)

- Global Positioning System.

Hardware developments include: mast-mounted systems, buoyant cable systems, and expendable buoys.

The Submarine Tactical Communications Systems project provides attack submarines with an exterior communications system which minimize the time required at communications depth; enhances operability, reducing errors and manpower requirements; and provides flexibility for low impact growth and change throughout the life of the submarine. Design efforts will provide increased antenna signal distribution and interconnection subsystems to accommodate ELF, EHF and Mini-Demand Assigned Multiple Access and a message storage and processing subsystem.

The 0604503N program continues efforts formerly managed under PE0604515N and PE0603522N.

The Submarine Sonar Improvement Program delivers block updates to sonar systems installed on SSN 688, 688I and TRIDENT class submarines. The goal is to maintain clear acoustic, tactical and operational superiority over submarine and surface combatants in all scenarios through detection, classification, localization and contact following. Current developments are focused on supporting littoral warfare, regional sea denial, battle group support, diesel submarine detection, surveillance, and peacetime engagement.

## Variants/Upgrades

This program will contribute to developing technology for upgrading existing ESM equipment.

## Program Review

**Background.** The effort originally consisted of two program elements, PE63522N and PE64515N. PE63522N consisted of two projects: X0770 Advanced Submarine Support Equipment Program, and S1739 Submarine Arctic Warfare Development.

The program developed advanced sensor systems and techniques for attack submarines. PE 64515N consisted of project X0775, Submarine Support Equipment Program, which developed and improved ESM sensors.

The project developed and provided ESM equipment to exploit signals in direct support of over-the-horizon targeting, providing nuclear attack submarines with the capability of employing the Harpoon and Tomahawk missile weapons systems with a minimal of exterior support.

In FY82, the Navy completed development of the WLR-8 and improvements to periscope electronic systems, including antenna coverage and sensitivity.

In FY83, design and development of the Submarine Advanced Combat System Electronic Support Measures System began under PE63522N. Under PE64515N, operation evaluation tests for the Dark Eyes thermal imaging system were completed; upgrade of the WLR-8 continued; a BRD-7 service test model was procured; and BLD-1 system improvements continued.

FY84 saw the start of two new efforts under PE64515N: Submarine Advanced Combat System Electronic Support Measures Subsystem, and an upgrade to the WLQ-4E suite. The navy conducted a technical evaluation of the WLR-8 upgrade.

During FY85, PE63522N continued to develop new diverse sensor/support systems to keep abreast of new threat systems. PE64515N continued to develop and provide capabilities including over-the-horizon targeting.

FY86 plans under P 64515N included beginning a full concept definition for the WLQ-4 ESM system, leading to a competitive contract for full-scale engineering development of the system in FY87; procuring government-furnished equipment as long-lead items; designing the WLQ-4 engineering development model in production and configuration; and continuing with the development of upgrades to the threat capabilities of the existing WLQ-4 SSN-637 class ESM system.

In FY87, the Navy program focused on repackaging and quieting SEA NYMPH for SSN-21 class submarines [the WLQ-4(V)1], and upgrading the data processing/storage system.

FY88 saw the completion of the data processing/storage upgrades and the evaluation of new varieties of Radar Cross Section Reduction (RCSR) material. The Navy also provided a minimal sustaining level of engineering support for the WLR-8 and WLR-1H IFM and frequency extension developments.

In FY89, the Navy continued the SEA NYMPH repackaging program for the SSN-21 and evaluating new radar cross section reduction materials. Work also continued on upgrading data processing equipment subsystems (DPES).

In FY90, SEA NYMPH repackaging for the SSN-21 was completed, as was the DPES effort. Full-scale development of an Integrated ESM (IEM) Mast and improved radar cross section radome for the BRD-7 direction finder began.

In FY91, the Navy completed demonstration and validation of the Integrated ESM (IEM) mast antenna system. Acquisition documentation was generated in preparation for a Milestone II decision and Engineering

and Manufacturing Development (EMD) contract. Development of the Improved Early Warning Receiver (IEWR) began.

In FY92, the Navy obtained Milestone II approval to begin EMD of the IEM.

FY93 called for awarding the IEW Phase I contract. Other efforts continued, and the Milestone I approval of the ASTECS led to beginning the demonstration and validation phase.

F0770 Advanced Submarine Support Equipment Program (ASSEP). Part of PE0603522N, this effort included the Advanced Submarine Tactical ESM Combat System (ASTECS), a new start approved in October 1991.

ASTECS concept exploration and development began in FY92. Efforts included development of an interface with the Improved ESM Mast plus advanced development of components and sensors for detecting, classifying, and locating electro-optic signals and low-probability-of-intercept radar and communications signals. The work also included awarding a contract for a Monopulse DF Feasibility Development Model.

It transitioned to PE 0603522N in FY93.

F0775 Submarine Support Equipment Program (SSEP). This Project became part of PE0604503N beginning in FY94. It develops and improves Electronic Warfare Support Measures (ESM) techniques and components, equipment, and systems to increase submarine operational effectiveness in the increasingly dense and sophisticated electromagnetic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Improvements are necessary for submarine ESM to be effective in conducting the following mission areas: littoral warfare, joint surveillance, space and electronic warfare, intelligence gathering, maritime protection, and joint strike.

Specific efforts include development of the: (1) IEM that replaces the BRD-7 and BLD-1 DF Systems on SSN 688 class submarines, SSN 21 class submarines and is required for the new attack submarine; and (2) the Periscope Monopulse DF System for the Type 18 Periscope. The Advanced Submarine Tactical ESM Combat System (ASTECS), previously funded here, is now supported under PE 0604558N

FY93 accomplishments included continued the IEM Engineering and Manufacturing Development (EMD) Phase and awarded the IEM EMD Phase I contract (US\$16.5 million) along with generating the documentation required for ASTECS Milestone I/II approval. A cost and operational effectiveness analysis

and concept exploration and definition study was performed to support eliminating the Demonstration/Validation phase and proceeding directly to EMD (US\$1.2 million). Engineers completed development of the Improved Electronic Warfare Receiver (US\$472,000) and the Navy awarded a contract for procurement of the Scenario Simulator/Stimulator (US\$ 3.0 million).

In FY94 planners completed an IEM System Design Review and Software Specification Review (US\$3.177 million). They also completed IEM requirements analysis and system trade-off studies (US\$3.372 million) and initiated the IEM/High Probability of Intercept (HPI) interface design (US\$1.480 million).

FY95 accomplishments included the completion of the IEM Preliminary Design Review at a cost of US\$3.623 million. Program personnel spent US\$2.500 to procure non-developmental and long lead items for the IEM radar signals subsystem. Engineers completed IEM and High Probability of Intercept (HPI) interface Software Specification Reviews. (US\$227,000) and procured HPI modification long lead items. (US\$100,000). An additional US\$635,000 was spent to completed the HPI interface System Requirements Design Review.

In FY96, planners were to complete a Critical Design Review of the IEM System and HPI modification kit, and begin fabrication of IEM Engineering Development Models (EDM), programming US\$6.584 million for the task. The Navy planned to spend US\$800,000 to complete underwater explosion shock tests on a mechanical model of the IEM. US\$7.848 million was programmed to manufacture and test printed circuit modules and enclosures, as well as assemble field change kits/HPI modification kits. An additional US\$800,000 was to initiate system level testing of IEM with US\$100,000 programmed to initiate fabrication of HPI Interface modifications. US\$336,000 of the extramural program was reserved for Small Business In-

novation Research (SBIR) assessment in accordance with 15 U.S.C. 638.

The FY96 decrease of US\$616,000 was the result of DBOF, FFRDC, inflation and other adjustments.

Plans for FY97 are to (US\$2500) design and manufacture environmental test fixtures and perform environmental tests on the IEM (US\$2.5 million). US\$2.873 million has been programmed to continue fabrication of IEM EDMs and conduct system performance tests. Other projects planned include performing software module tests (US\$1.0 million); completing system integration of IEM EDM 1 (\$2.881 million); and US\$2.852 million to integrate the IEM with a host ESM system as well as to complete the technical documentation and performing reliability/maintainability tests and correcting discovered design deficiencies.

The FY97 decrease of US\$5.162 million is a result of the restructuring of the IEM and Periscope MDF programs during PR97 (US\$4.616 million) and DBOF, inflation and other adjustments (US\$546,000).

The reduction associated with the IEM and Periscope MDF program restructuring will be restored in the outyears.

Schedule changes include a delay of approximately four months in completing the fabrication and testing of the IEM EDM-2, initially allowing only one EDM for IEM/ESM software and hardware integration (i.e., both software and hardware integration will have to be performed on a single EDM). Initiation of Periscope MDF EMD, originally budgeted in FY97, has been moved to FY98, thus delaying its IOC one year.

Since the IEM will be government furnished equipment to the Advanced Submarine Tactical ESM Combat System (ASTECS) Program, this will add some technical risk to both the IEM and ASTECS programs.

## Funding

<b>US FUNDING</b>									
	<u>FY94</u>		<u>FY95</u>		<u>FY96</u>		<u>FY97(Req)</u>		
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	
<u>RDT&amp;E (USN)</u>									
PE0604503N									
Submarine System Equipment Development									
F0775 Submarine Support Equipment									
Program (SSEP)	-	8.0	-	7.1	-	16.5	-	12.1	
<u>RDT&amp;E</u>									
(USN estimate)	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	
F0775	-	11.5	-	12.9	-	7.9	-	1.0	

Projected funding by company:

	Prior	FY95	FY96	FY97	to compl.
IEM ADSU EMD, Raytheon	20.5	3.8	9.0	7.0	Continued
IEM Technical Support, Raytheon	0.0	0.2	0.2	0.9	Continued
IEM/HPI Interface, ST Research	1.5	0.3	1.3	1.1	Continued
IEM BDE, Lockheed Martin	0.0	0.0	3.0	1.0	Continued

NOTE: Other efforts included under the PE include:

- S0219 - Submarine Sonar Improvement Engineering
- X0742 - Submarine Integrated Antenna Systems
- X1411 - Submarine Tactical Communications System

All US\$ are in millions.

## Recent Contracts

Contracts not identified.

## Timetable

	1988	IEM Dem Val begins
	1991	IEW Dem Val completed
Oct	FY91	ASTECS Operational Requirements Document
Apr	FY92	IEM Milestone II decision
Jul	1992	ASTECS Concept Exploration & Definition Contract award
Sep	1992	Milestone II
Mar	1993	IEM EMD contract award
Oct	FY93	ASTECS Acquisition Strategy Report
Nov	1993	ASTECS Milestone I decision
Dec	1993	ASTECS PDR, IEM PDR
4Q	FY94	IEM-SDR
2Q	FY96	IEM-PDR
1Q	FY98	IEM-CDR

## Worldwide Distribution

This is a US Navy program only.

## Forecast Rationale

As a result of the changing tactical environment, submarines are becoming important operatives in the littoral environment, supporting a variety of contingency and intelligence-gathering operations. Submarine equipment is experiencing a new focus in new equipment development projects. This program element is one part of the changing focus.

There is an increased interest in signals intelligence, especially for treaty verification and strategic planning — this is driving much of the effort. Operation Desert Shield/Desert Storm proved the viability of using submarines in intelligence gathering for conventional and contingency operations.

In the future, submarines, capitalizing on their stealth and independence, will be more actively involved as one of the intelligence gathering assets for theater commanders. This will make ESM equipment important in widespread operations rather than in a limited strategic nuclear deterrence and Soviet anti-submarine role.

The Navy is tailoring the next-generation submarine ESM equipment based on these new missions, state-of-the-art technology, and updated requirements to help

ensure that the equipment meets tactical requirements when it is introduced. By combining several efforts under one program, better interface and coordination between projects is likely.

This program is a continuing effort. Systems continually need development and upgrades, especially as new technology becomes available. By changing the mission of the submarine from strategic nuclear to contingency operation support, the Navy provided a baseline requirement for continuing ESM developments. This will help protect the effort from some budget cutting.

This R&D effort is considered ongoing by the Navy. Annual funding will continue to support added hardware enhancements and software upgrades until a new generation of submarine ESM equipment is absorbed into the inventory.

The forecast is for F0775, Submarine Support Equipment, not the entire program element. It assumes continued funding of the program as planned, and no major changes in program content.

## Ten-Year Outlook

### FORECAST FUNDING LEVELS

(FY96 US \$ Millions)

<u>Designation</u>	<u>Application</u>	<u>thru 95</u>	<u>96</u>	<u>High Confidence Level</u>		<u>Good Confidence Level</u>			<u>Speculative</u>			<u>Total 96-07</u>	
				<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>		<u>05</u>
SUBMARINE	IMPROVED ESM												
SUPPORT EQUIP	(USN)	-	16.5	12.0	11.5	12.9	7.9	1.0	2.0	0.0	0.0	0.0	63.8