SUBMARINE EXTERIOR COMMUNICATIONS SYSTEM (SubECS)

Navy Program (no ACAT)		**Prime Contractor**
Total Number of Systems:	68	Various
Total Program Cost (TY$):	$689M	
Average Unit Cost (TY$):	$12M	
Full-rate production		
Phase I:	4QFY01	
Phase II:	4QFY03	
Phase III:	3QFY05	
Virginia ECS:	4QFY07	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The Submarine Exterior Communications System (SubECS) is an umbrella program, which integrates fifteen smaller acquisition programs and Commercial Off-the-Shelf (COTS) components into a system that supports Network Centric Warfare. The goal of this effort is a communications system that is common across all submarine classes, and which is ***interoperable*** with the planned DoD C^4I infrastructure, and will support the Navy's Copernicus Information System Architecture, the Joint Technical Architecture (JTA), the Global Command and Control System Maritime (GCCS-M), and the Joint Maritime Communications System (JMCOMS).

SubECS supports ***information superiority*** by improving data throughput to and from the submarine using new antennas, advanced processing, new transceivers and waveforms, and new information technology networks. SubECS will also support the steady infusion of new technology and the modernization and replacement of obsolete equipment to allow prompt, sustained and synchronized operations with Joint US and multinational forces, ensuring that the submarine force is a major contributor to ***full spectrum dominance***.

BACKGROUND INFORMATION

SubECS upgrades the communications systems of all existing and planned submarines (SSN 688 Class, Seawolf Class, Trident Class, and Virginia Class) and is being fielded in four major phases. Phase 1 will provide increased interoperability, data rate, and aggregate throughput to the submarine; Phase 2 will provide enhanced message processing and distribution; and Phase 3 will replace remaining legacy transceivers and cryptographic hardware with digital modular radios and programmable cryptographic solutions (PMCS). During these phases, software and hardware upgrades to equipment from previous phases will be implemented as necessary to keep up with commercial technologies. By Phase 3, a functionally common radio room baseline will exist for all in-service submarine classes. The Virginia Class (SSN 774) Exterior Communications System (ECS) is being developed and integrated as part of new construction using the construction shipyard as the integrator. The Virginia ECS will build on SubECS Phase 3, and is Phase 4 of SubECS. The goal for the out-years is that all in-service submarines will be upgraded to the Virginia ECS plus any necessary technology insertions, maintaining a common state-of-the-art radio room on all submarine classes.

The test concept for SubECS involves operational testing for each smaller sub-component, and end-to-end system testing for each major phase. Each sub-component program will continue to be operationally tested before it is introduced into the Fleet. Each SubECS Phase will undergo a land based Operational Assessment (OA) and land based Technical Evaluation (TECHEVAL), which will be used to certify the system for installation on a submarine. Subsequent to on-board installation, each SubECS Phase will then undergo an at-sea TECHEVAL (for those tests not completed in the land based radio room) and an Operational Evaluation (OPEVAL). The Virginia Class ECS land based testing will occur in the Combat Control System Module (CCSM) Off-hull Assembly and Test Site (COATS) during Virginia class submarine construction at the Electric Boat Company in Groton, CT. At-sea operational testing of the Virginia ECS will occur concurrently with the overall Operational Evaluation of the USS Virginia (SSN 774).

In FY99, the Navy consolidated the in-service submarine ECS backfit program with the Virginia ECS new construction program under a single program manager, directly accountable to the Program Executive Officer for Submarines. This arrangement was designed to reduce overall risk across and enable the Navy to more efficiently achieve a programmatic plan that can support a common submarine ECS architecture within the next decade. Driven by the need to reduce costs, this realignment is part of a larger Navy effort to rearrange its submarine acquisition and engineering support functions wherever possible along functional instead of submarine hull-specific lines.

To further reduce Virginia ECS risk, the Navy is evaluating an early build of the Virginia ECS for possible at-sea testing as part of SubECS Phase 2 on SSN 23, utilizing the construction shipyard as the integrator during new construction. The tentative plan would then upgrade SSN 21 and SSN 22 during each ship's Shipyard Restricted Availability (SRA). Final decisions on this milestone change will be dependent on contract negotiations with the construction shipyard, which are in progress. Fielding of a Virginia Class variant on SSN23 could allow for the consolidation of SubECS Phase 2 and 3 with the Virginia Class ECS, yielding a direct path from Phase 1 to the Common Submarine Radio Room. These potential programmatic changes will be finalized by 2Q01 and documented with an update to the SubECS Capstone Test and Evaluation Master Plan (TEMP).

TEST & EVALUATION ACTIVITY

In March 2000, DOT&E approved the Capstone TEMP and tasked the Navy to revise the TEMP by April 2001 due to anticipated changes in the Navy's acquisition strategy. The new strategy is expected to essentially freeze SSN 688 class radio room development at SCSS Phase 1, and move directly to a common submarine radio room among all submarine classes, based on the Virginia Class ECS.

In April 2000, the Navy approved the Submarine High Data Rate (SubHDR) Antenna Operational Requirements Document, which supports Extremely High Frequency (EHF), Low Data Rate and Medium Data Rate (LDR/MDR), Super High Frequency (SHF), and Global Broadcast System (GBS) communications. In August 2000, the Navy approved the SubHDR TEMP.

In June 2000, follow-on Operational Test and Evaluation (FOT&E) was satisfactorily completed in the Trident submarine variant of the Submarine Low Frequency (LF)/ Very Low Frequency (VLF) Versa Module European Bus (VMEbus) Receiver (SLVR), which incorporated the new KOV-17 embedded encryption device, a space-savings improvement. SLVR is now being introduced to fleet Trident submarines and to some Los Angeles submarines. Additional FOT&E is needed for Los Angeles class submarines with automated equipment and antennae alignment switching installed.

In 4Q00, developmental testing was conducted on the SLVR Range Extension Mode (REM). The REM is planned for future installation on both Trident SSBNs and SSN-688 SSNs.

In 3Q00, Land based testing of the Submarine High Data Rate (SubHDR) Antenna was conducted at the Land Based Submarine Radio Room (LBSRR) and the Submarine EHF System Integration Facility (SESIF) in Newport, RI.

In August 2000, the first SubHDR antenna installation was completed in USS Providence (SSN 719). Installation testing is in progress

The first SubECS system level developmental testing (Phase 1) is scheduled for 3Q01 at the LBSRR in Newport, RI. At-sea operational testing is tentatively scheduled for 1Q02 on a Los Angeles class submarine.

TEST & EVALUATION ASSESSMENT

Operational testing occurred on SubECS sub-components in accordance with their individual Navy-controlled TEMPs, but no SubECS integrated phase tests occurred in FY00 due to budget cuts to the SubECS program. Of note, all FY00 operational testing was successful. The first integrated test (Phase 1) should begin in late FY01 or early FY02.

The most significant FY00 event in the SubECS program was the approval of the SubECS Capstone TEMP, which culminated a five year of effort by DOT&E and the Navy to achieve a focused, overall SubECS program test strategy. The introduction of a Capstone TEMP will provide Virginia and all in-service submarines with a framework in which formal communications system requirements can be addressed. However, the Navy's C^4I acquisition practices, with shorter and shorter generation cycles, continue to make test discipline difficult, particularly with the introduction of COTS.

The FY99 Annual Report cited the Virginia ECS as moderate risk with concerns about interoperability, the high rate of change in the Navy's C^4I acquisition practices, short acquisition cycles, and reduced equipment rack space. The Virginia ECS program implemented a phased delivery approach to mitigate risk that delays the selection of a final configuration as long as possible to reduce changes, both anticipated and unanticipated, in the Navy's C^4I acquisition programs. Virginia's limited ECS space, nine racks versus fourteen on SSN 688, also makes it important to delay Virginia's final configuration as long as possible in order to take best advantage of the latest miniaturization developments. DOT&E continues to evaluate the Virginia ECS risk as moderate but acknowledges that the Navy's approach appears sound. Navy initiatives to field an early Virginia ECS build on the Seawolf class, if funded, would further reduce risk, at least to the Virginia class ECS.

Significant delays in the launch of MILSTAR satellites has pushed complete SubHDR antenna operational testing to several years past the fleet introduction date, which has added risk to the SubHDR Program. The Navy has decided to operationally test the Sub HDR antenna in FY01 as much as practicable, and proceed on with fleet introduction (a budget-driven decision), even thought the antenna's higher data rate capability cannot be tested until FY03, when a MILSTAR satellite hopefully will be operational and available. DOT&E agrees that this course of action, although not ideal, is a reasonable approach.

DOT&E continues to monitor and work with the SubECS program office, the sponsors (OPNAV N77 and N61), and both the Seawolf and Virginia programs to keep focus on submarine C^4I systems testing. Although progress continues to be made, funding cuts continue to delay milestones.

Specific examples include:

1. SubECS Phase 1 developmental and operational testing have slipped at least six months because of an OPNAV N77 FY00 budget reduction.
2. An OPNAV N6 FY00 budget reduction resulted in an 18 month delay in availability of the SLVR Extremely Low Frequency (ELF) pre-planned improvement (P3I) for integration, TECHEVAL, and OPEVAL in SubECS.

LESSONS LEARNED

Although the use of COTS products in communications systems has the potential to provide the Fleet with needed capability quickly, its use should not come at the cost of inadequate logistics, poor training, and erroneous documentation. Disciplined land based testing before fleet installation with close attention to training and maintenance documentation has resulted in improved test performance during FY00.

The Capstone Requirements and TEMP process can add value by bringing focus to system-of-systems test planning.