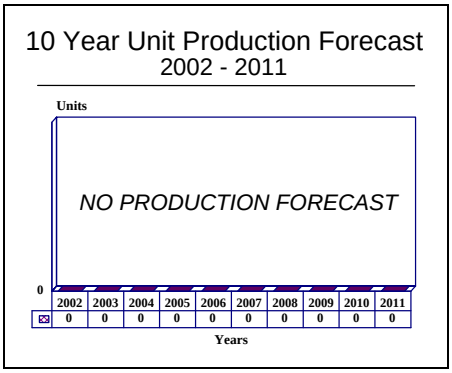
SLY-2(V) (AIEWS) – Archive 02/2003

Outlook

- Was to be part of Integrated Ship Defense System
- Design was to capitalize on newest technology
- Program terminated April 2002 due to cost and schedule problems



Orientation

Description. SLY-2(V), the Navy's next-generation shipboard Electronic Warfare (EW) system, was planned for use with the Ship Self-Defense System (SSDS) and the AEGIS Combat System (ACS). This effort was developed as part of PE#0604755N, Ship Self-Defense. It was to replace the ALQ-32(V) and SSQ-82(V).

Sponsor

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(ES subsystem support)

Status. In EMD; approximately six test articles were being built.

Total Produced. EMD and prototype EA systems only.

Application. AIEWS was planned to become part of the ship's combat system (AEGIS and SSDS). Forward fit was planned for DDG-91 and above, LPD-22 and above, CVN-77 and above, and DD-21. Backfit was considered for CG-52 through -73, DDG-51 through -90, LPD-17 through LPD-21, LHD-1 through LHD-7, and CVNs.

Price Range. Initial estimates put the unit cost at US$6.8 million. Adapting the system to individual ship classes would have caused the unit cost to vary from ship to ship.

Price is estimated based on an analysis of contracting data and other available cost information, and a comparison with equivalent items. It represents the best-guess price of a typical system. Individual acquisitions may vary, depending on program factors.

Technical Data

Design Features. The next-generation Electronic Warfare (EW) system, the Advanced Integrated Electronic Warfare System (AIEWS), would have been an integral part of a ship's combat system (AEGIS and Ship Self-Defense System [SSDS]). AIEWS was to be developed in two sequential increments. *Increment 1* would have introduced advanced electronic support (ES), consisting of precision electronic support measures (ESM), Specific Emitter Identification (SEI) a special receiver, increased processing throughput, an open architecture, a standard combat system workstation with a new Human Machine Interface (HMI), decoy integration, and electro-magnetic interference (EMI) improvements. *Increment 2* would have introduced both radio frequency (RF) and infrared (IR) advanced Electronic Attack (EA) capabilities. This development would have supported both backfit and forward fit. The prime contract called for the development of engineering development models (EDMs) to be used for multiple purposes: factory qualification tests, Land-based Testing (LBT) and Operational Assessment (OA), and SSDS combat development testing, Combat System Engineering Development System (CSEDS) testing, and TECHEVAL/OPEVAL.

The prime contractor was designing the ES subsystem from proven commercial off-the-shelf (COTS) and non-developmental item (NDI) components. High sensitivity would have made early detection of all threats more likely. An Intelligent Blanking technique would have improved the interoperability of the SLY-2(V) by reducing the amount of interference with other systems. High throughput would have ensured rapid response times, even in a dense jamming environment.

The Control & Processing Subsystem was featuring a COTS, open architecture design approach with modular, isolated interfaces that would have improved cross-platform compatibility and minimized the amount of change needed to develop interfaces with other systems. Software would have been independent from the infrastructure; risk-reduction software and Open System Standard Interfaces would have been used.

The Electronic Attack Subsystem would have reduced development risk by using mature ATC designs that provide multi-channel, multiple simultaneous engagements. Monolithic Microwave Integrated Circuit (MMIC) technology would have reduced EMI, improved reliability, and provided an instant "on" capability. Threats would have been more accurately classified because of the system's high IR spectral resolution. RF and IR countermeasures would have been coordinated to defeat multi-spectral threats.

PE#0604755N was initiated in FY94 and consolidated several efforts related to Ship Self-Defense (SSD) for purposes of more efficient planning.

Operational Characteristics. AIEWS was to be a total replacement for the SLQ-32(V) system. Increment 1 of AIEWS was to be capable of detecting and identifying radio frequency emissions, providing precise angle-of-arrival information that would cue hard-kill fire-control system sensors, and launch self-protection

decoy devices. Increment 2 would have added additional capabilities, especially advanced onboard radio frequency and infrared countermeasures.

The AIEWS effort supported the Joint Vision 2010 concept of full-dimensional protection by providing a final layer of self-protection against air threat "leakers" for individual ships and by assisting other self-protection engagement systems.

The system would have provided precision azimuth/ elevation information on threats in all environments. It was also being designed to take advantage of proven multi-path recognition and rejection, as well as multi-sensor situational assessment techniques. Reduced EMI and improved electro-magnetic capability (EMC) were to eliminate some of the problems experienced with EW systems already in service. Hardkill/softkill decisions were to be integrated with the ship's anti-air warfare system, and intelligent and adaptive blanking would have reduced interference with other systems on the ship or in the battle group.

The system would have been designed for future growth in order to adapt quickly to changes in the threat environment. Flexibility would have been supported by the use of common interfaces, modular architecture, a scaleable network, and external gateways. The system would have had low life-cycle costs and been adaptable to different platforms, an important budgetary consideration.

SLY-2(V) prototype antenna

Source: DoD DOT&E

Variants/Upgrades

The RDT&E program focused on developing technology that could be used to upgrade existing systems and be incorporated into developing systems.

Program Review

Background. The replacement for the Navy's SLQ-32(V) surface ship electronic warfare suite, AIEWS, was being developed under PE#0604755N, Project K2309.

On May 21, 1997, the Naval Sea Systems Command (NAVSEA) and the Program Executive Office for Theater Air Defense announced a proposal to acquire the SLY-2(V) AIEWS. The acquisition was to include five engineering development models for Increment 1,

with options for up to 12 low-rate initial production (LRIP) units. A requirement for up to 12 Increment 1 production units was possible in FY02. Other production plans included up to 16 Increment 1 production units for FY03 and up to 14 Increment 1 production units for FY04. Up to five Increment 2 EDMs were anticipated and up to 10 LRIPs for Increment 2, along with options for engineering services and software support activity.

The SLY-2(V) was to feature open architecture and to be developed as an integral part of a ship's command and control system to facilitate technology insertion upgrades. COTS and NDI items were preferred. The contract was competitively procured with proposals solicited; two offers were received by the Navy.

A prototype of the first version of the system was to be installed on the AEGIS cruiser USS *Yorktown* in FY99.

In FY98, the Navy awarded an AIEWS Increment 1 EMD prime contract (US$15.27 million) to include the provision of a receiver, precision ESM, SEI, logistics, and integration efforts for both AEGIS and SSDS Combat Systems. In December 1997, the Naval Sea Systems Command awarded Lockheed Martin a US$66,599,433 (excluding award fee) cost-plus-award-fee contract for EMD of the SLY-2(V) AIEWS. The award excluded contract options and was to be completed by July 2002.

Risk reduction efforts and advanced technology demonstrations were begun in 1998. A US$7.5 million Control and Processing (CAP) software development contract was awarded. AEGIS forward fit integration development for AIEWS was funded at US$1.14 million. US$768,000 was budgeted to begin the development of Increment 1 logistics efforts, including the provision of electronic technical documentation, an embedded training foundation, and manpower personnel and training analysis.

In late 1998, Northrop Grumman demonstrated an Electronic Countermeasure Transmitter developed for the SLY-2(V). The Electronic Warfare Systems Group and the Naval Research Laboratory completed a three-year Advanced Technology Demonstration (ATD), conducting a final program review and demonstration at the Northrop Grumman Ridge Road antenna range near Baltimore.

The antenna featured a broadband, multi-beam, electronically steered array, interfaced with a photonics-based, true-time delay beam-former, a multi-channel techniques generator, and a Windows™-based controller. The controller was developed and built by NRL. The broadband array technology was developed in support of the Navy's Advanced Multi-Function RF System effort to reduce the number of antennas on a ship.

In FY99, as part of PE#0604577N, the Navy spent US$31.289 million on the AIEWS Increment 1 EMD, including receiver, SEI, precision ESM, and logistics. A Preliminary Design Review (PDR) was conducted and an incremental Critical Design Review (CDR) begun. US$9.132 million was budgeted for continued Control and Processing (CAPS) software development, with US$791,000 going to the development of Increment 1 logistics. US$600,000 was used to initiate an EW Roadmap study to optimize and ensure the compatibility of onboard RF/IR countermeasures with offboard RF/IR countermeasures for Increment 2.

The FY00 plan budgeted US$42.271 million for an Increment 1 EMD prime contract. US$9.680 million was allocated to continue CAPS software development, US$645,000 for the Increment 1 logistics efforts, and US$900,000 for the EW Roadmap Study. US$550,000 was budgeted to begin test and evaluation efforts in support of engineering, development and operational testing – an effort that would be funded at US$1.746 million in 2001 and US$4.785 million in 2002. US$250,000 was earmarked for planning combat systems integration efforts, including SSDS/GCCS(M) and LAMPS/SH-60R.

In FY01, US$33.875 million was budgeted for AIEWS Increment 1 EMD. US$8.173 million was budgeted for CAPS, and US$615,000 for the Increment 1 logistics efforts.

In FY02, efforts were transferred to PE#0604757N, Project K2309. Plans budgeted US$2.081 million for SBIR Phase III follow-on efforts, and US$27.987 million for Increment 1 EMD. US$4.75 million was budgeted for continuing the CAPS effort, with US$965,000 set aside for Increment 1 logistics.

The FY03 budget plan would have continued EMD of Increment 1, completed CAPS, and supported hardware and software testing. A High Gain/High Sensitivity (HG/HS) effort would have been initiated and Increment 2 EMD begun.

Acquisition Strategy: The AIEWS program awarded its Increment 1 EMD cost-plus-award-fee (CPAF) contract following a full and open competition. Included in the contract were phased price options for Increment 1 LRIP and production. Other options included Increment 2 EMD and LRIP for RF and IR countermeasures. Finally, it included options for full contractor support, including Direct Vendor Delivery (DVD), Software Support Activity (SSA) and engineering services. A special HG/HS receiver

capability was to have been separately developed and funded beginning in FY03.

Navy Terminates AIEWS Program. On April, 15, 2002, the Navy canceled the SLY-2(V) AIEWS program because of continuing cost growth and schedule slips. The 1997 estimate for the development was put at US$164 million; by 2002, the estimate had more than doubled to US$375 million. The initial 2002 IOC date has slipped to FY05. Officials believed the program had become "too risky," but there was no indication of what the replacement would be.

The FY03 budget request was for US$168.8 million for AIEWS, US$25.9 million for RDT&E, US$15 million for "other procurement" to buy one system for installation on an active ship, and US$127.2 million in shipbuilding accounts to buy and install eight systems in new-construction ships.

The Senate version of the FY03 Defense Authorization bill said that the Navy would focus on upgrading the SLQ-32(V) instead of buying the new SLY-2(V) system, and had requested transferring US$25.9 million from AIEWS development to the SLQ-32(V) program. No plans were announced regarding how the excess "other procurement" money would be allocated.

In its version of the authorization, the House recommended cutting US$25.9 million from AIEWS and adding US$27.5 million to SLQ-32(V), along with cutting "other procurement" by US$15.8 million. The Senate also directed the Secretary of the Navy to ensure that any new-construction ships scheduled to receive AIEWS be provided with a replacement EW system equal in capability to that installed on other ships of the same class. This would, in most cases, be the SLQ-32(V).

At the time of writing, the defense appropriations bills were still in process.

DOT&E FY2001 Annual Report

The SLY-2(V) Advanced Integrated Electronic Warfare System (AIEWS) is the Navy's next generation shipboard electronic warfare system planned for use with the Aegis Combat System and Ship Self Defense System Mark 2. It is a total replacement for the SLQ-32(V) system. Increment 1 of AIEWS will include the capability to detect and identify radio frequency (RF) emissions, provide precision angle of arrival information to cue hard-kill fire control system sensors, and launch self-protection decoy devices. Shown in the photograph is a demonstration antenna used during at-sea engineering tests. Integration of Increment 1 with the ship command and decision system will support other sensor cueing and combat identification. Increment 2 will include additional capability.

BACKGROUND INFORMATION. The Navy approved the ORD in April 1997. The initial TEMP (Test & Evaluation Master Plan) was received by OSD in March 1998 and was returned without approval because of the fundamental disconnect between the program structure (as agreed to by the PEO in November 1997) and the program structure reflected in the language of the Milestone II ADM. This was somewhat redressed in FY01 when the OPEVAL was delayed so it could be conducted in an Aegis destroyer with AIEWS more integrated with the combat system.

AIEWS development is behind schedule and the initial installation will still not be fully integrated with the host combat system. For initial installations, AIEWS will use the same interfaces as the system it will replace, the SLQ-32(V) electronic warfare system. As a result of this limited integration, some of the improved capability required of AIEWS cannot be fully used to benefit the combat system. For example, the improved precision angle-of-arrival information will not be available to cue hard-kill fire control system sensors. The program was rebaselined in FY01 as a result of cost and schedule breaches.

TEST & EVALUATION ACTIVITY. This Naval Air Warfare Center, Weapons Division, Point Mugu, CA, integrated and tested an anti-ship cruise missile (ASCM) seeker with an existing target drone to provide a test asset that would partially address inadequacies of proposed ASCM simulators. In December 2000, two BQM-34S drones, configured with ASCM seekers, were flown to demonstrate operation of the seekers at ASCM-representative speeds and altitudes; collection of seeker data as it detected, acquired, and tracked a surface target; and safe recovery of the seekers. The only objective that was not completely achieved was that the low altitude required was never achieved. Post-flight analysis has indicated the likely cause, and it is projected that this will not be a problem in the future. This demonstration project was conducted under the Target Management Initiative program under the auspices of DOT&E.

TEST & EVALUATION ASSESSMENT. There are no test results of sufficient scope on which a performance assessment can be based. The Increment 1 T&E program will examine critical operational effectiveness issues, including situation awareness (the effective and accurate detection, track, and identification of radio frequency emitters); engagement support (effective employment of decoys against anti-ship cruise missiles); tactics; and survivability. In addition, the T&E program will address the full spectrum of critical operational suitability issues: reliability, maintainability, availability, logistic supportability, training, and safety.

As noted below, as of this writing, the following significant issues with the overall T&E program remain:

ORD Deficiency. The ORD is deficient in the following regard: (1) Although the ORD asserts that it will "support the evolutionary development of capabilities to meet the operational requirements," it is ambiguous with regard to

what initial functionality is required, and the schedule for delivering additional capabilities; (2) The currently proposed AIEWS/Aegis interface for OPEVAL significantly deprives the combat system of the improvements brought by AIEWS. It is noted that such a limited level of integration with the existing electronic warfare system, intended to be replaced by AIEWS, is described in the ORD as the major contributor to "shortcomings of existing system;" and (3) Going to OPEVAL with the proposed level of integration will require additional measures of effectiveness, with thresholds.

Realistic Simulation of Anti-Ship Cruise Missiles. Increment 1 OT requires a platform, with appropriate radar cross section, that can carry anti-ship cruise missile active radar seekers or acceptable seeker simulators at threat-representative speeds and altitudes. The legacy platform, identified up front by the OT community as not meeting the requirement, uses a large, slow aircraft that cannot descend to threat-representative altitudes. The use of an existing target drone, integrated with an anti-ship cruise missile active radar seeker, appears to be an acceptable solution, but now adequate numbers of these drones will have to be funded for OT. For Increment 2, threat ASCMs or acceptable surrogates will be required.

Realistic Background Emitter Density. As of this writing, the test range for the OT&E of AIEWS Increment 1 has not been identified. Whichever sea range is selected, the RF emitter resources for that range will have to be funded to ensure that a realistic background density of RF emitters exists for the testing.

Self Defense Test Ship (SDTS) for AIEWS Increment 2. It is expected that anti-ship cruise missiles or very high fidelity surrogates will be required for OT&E. This will necessitate a follow-on SDTS in order to simulate threat-representative anti-ship cruise missile profiles and conduct safe testing.

Funding

US FUNDING

	FY01		FY02		FY03(Req)		FY04(Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USN)								
PE#0604755N								
K2309 AIEWS	-	44.4	-	2.1*	-	-	-	-
PE#0604757N								
K2309 AIEWS	-	0.0	-	38.5	-	25.9**	-	33.9**
Other Funding								
OPN 231300 AIEWS	-	0.0	-	0.0	-	15.8	-	16.1

	FY05(Req)		FY06(Req)		FY07(Req)		FY08(Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
K2309	-	33.5**	-	32.2**	-	32.8**	-	-
OPN 231300	-	19.2**	-	33.1**	-	33.3**	-	-

* Should have been in PE#0604575N

** AIEWS program terminated April 15, 2002. Some funds may be transferred to the SLQ-32(V) program.

All $ are in millions.

Recent Contracts

(Contracts over US$ 5 million.)

Contractor	Award ($ millions)	Date/Description
Digital Systems Resources	17.6	Oct 1997 – Cost-plus-award-fee contract with cost-plus-fixed-fee provisions for the design, development, integration, test and evaluation of the Control and Processing (CAP) subsystem for the AIEWS. With options, contract valued at US$20,678,070. Completed September 2000. (N00024-98-C-5411)

Contractor	Award ($ millions)	Date/Description
Lockheed Martin	66.6	Dec 1997 – Cost-plus-award-fee (excluding fee) contract for engineering and manufacturing development of the SLY-2(V) Advanced Integrated Electronic Warfare System (AIEWS). Completed July 2002. (N00024-98-C-4522)

Timetable

Shipboard EW Improvements

Month	Year	Major Development
	FY94	Phase E CDR
4Q	FY94	ADCAP/DDI DT/OT II
2Q	FY95	ADCAP MS III
	FY95	AIEWS Phase I development
3Q	FY95	AIEWS Phase 1 award
	1996	Concept exploration and definition studies
Dec	1997	SLY-2(V) EMD contract award Increment 1
3Q	FY98	Increment 1 SRR
2Q	FY99	Increment 1 PDR
3Q	FY99	Increment 1 CDR
	FY00	Program rebaselined
2Q	FY00	Complete Increment 1 CDR
	FY01	Increment 1 EDM deliveries
3Q	FY01	Increment 1 OT IIA (At Sea OA)
1Q	FY02	LRIP Option
Apr	2002	AIEWS program terminated

Worldwide Distribution

This is currently a **US** only program.

Forecast Rationale

The Ship Self-Defense effort concentrates on weapons upgrades, sensor enhancements, and data communications/processing innovations in support of the development and upgrade of an integrated, layered defense system. The AIEWS electronic support subsystem would have been the input portion of the suite and interface with the rest of the ship's sensors to ensure effective situational awareness. It would have been designed to integrate with a ship's combat control system and interface with the network-centric concept of naval operations.

The SLY-2(V) would have needed to perform particularly well in the complex littoral environment, an area where the SLQ-32(V) has demonstrated operational problems. It would have been the backbone protection suite for up to 173 primary surface combatants, the AEGIS ships, and newer frontline ships, with the first system to go to sea aboard DDG-91, the *Pinckney*.

The SLY-2(V) emphasized open architecture and COTS/NDI. The system design would have been software- rather than hardware-intensive.

AIEWS seemed to be on track, but then Navy acquisition chief Lee Buchanan threatened to cancel the program immediately after a successful Preliminary Design Review and Critical Design Review. Buchanan claimed the system was behind schedule (less than 25 percent complete and six months behind schedule, according to industry sources) and over cost.

CDR 2 was completed in December 1999, with Navy officers exclaiming, "We want it now!" After a briefing from Lockheed Martin in December, Buchanan gave permission to proceed. The System Design

Certification was planned for October 2001, with an LRIP decision set for June 2002, DT/OT in August 2002, and the first LRIP delivery in August 2003. The first system would be delivered for DDG-91 PDA in October 2003.

In spite of the earlier confidence-building statements, cost and schedule could no longer be ignored. When IOC slipped to an unacceptable FY05, planners decided to put the program out of its misery. The Navy needs improved protection quickly, and the escalating cost added another unacceptable dimension to the AIEWS program. By enhancing and rehabilitating SLQ-32(V)s, the ships can be provided with protection that may not be everything the Navy wants, but will at least be as much protection as can be achieved right now.

Another factor that may have influenced the decision was the awarding of the DD(X) next-generation surface combatant development contract. This family of ships will feature a newly developed sensor, communications, and protective suite, as well as significant stealth characteristics. This changes the EW concept, since most of the ships' radar and EW systems will be based on multipurpose, active-aperture arrays designed as an integral system from the start. This makes the cost-effectiveness of a new system less than originally planned. Retrofits to current ships would have been included in AIEWS' plans, but cost made that a less-than-attractive idea.

Ten-Year Outlook

The AIEWS program has been terminated.

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