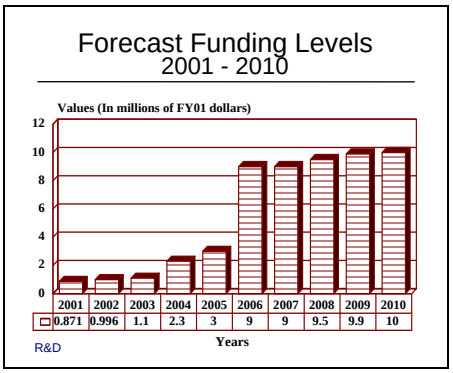
Submarine Acoustic Warfare Development – Archived 12/2002

Outlook

- R&D efforts decrease as WLY-1 program expands
- R&D Funding expected to increase in outer years with production of Virginia class submarines
- This report will be archived in 2002, in favor of the WLY-1 report



Orientation

Description. This technology development effort, Program Element #0101226N Submarine Acoustic Warfare Development, develops countermeasure devices such as the WKY-1 for use as defensive warfare systems by submarines.

Sponsor

US Navy
US Naval Sea Systems Command
Naval Undersea Warfare Center
New London, Connecticut (CT) USA

Contractors

Anteon Corp
Analysis & Technology Inc
RR 2 Box 220
North Stonington, Connecticut (CT) 06359
USA
Tel: +1 203 599 3910
Fax: +1 203 599 2171
Web site: http://www.aati.com
(System architecture software)

BAE Systems
Advanced Systems Division
(formerly Hazeltine Corp)
One Hazeltine Way
Greenlawn, New York (NY) 11740-1600
USA
Tel: +1 613 261 7000
Fax: +1 613 262 8002
Web site: http://www.hazeltine.com
http://www.baesystems.com
(Acoustic device countermeasures)

Lockheed Martin Corp
Naval Electronics & Surveillance Systems (NESS) - Undersea Systems
9500 Godwin Drive
Manassas, Virginia (VA) 22110
USA
Tel: +1 703 367 2121
Fax: +1 703 367 6091
Web site: http://www.lockheedmartin.com/manassas
(ECP 1000 upgrades)

Northrop Grumman Corp
(Formerly Westinghouse Norden Systems Inc)
75 Maxess Road
Melville, New York (NY) 11747
USA
Tel: +1 516 694 0900
Fax: +1 516 694 0938
Web site: http://www.northgrum.com
(Advanced development WLY-1)

Science Applications International Corp (SAIC)
10260 Campus Point Drive
San Diego, California (CA) 92121-1522
USA
Tel: +1 619 546 6000
Fax: +1 619 546 6777
Web site: http://www.saic.com
(Technical support)

University of Texas
Applied Research Laboratory
PO Box 8029
10000 Burnet Road
Austin, Texas (TX) 78713-8029
USA
Tel: +1 512 835 3200
Fax: +1 512 835 3259
Web site: http://www.arlut.utexas.edu
(Technical support)

Secondary Contractors

AlliedSignal Inc
Bendix Oceanics
Sylmar, California (CA) USA
(ADC Mk 3 Mod 0)

EML Research
Hudson, Massachusetts (MA) USA
(Technical support)

ESCO Electronics Corp
Emerson Electric Inc
Orlando, Florida (FL) USA
(ADC Mk 2 Mod 1)

Orincon Corp
San Diego, California (CA) USA
(Engineering support)

Piqua Engineering Inc
Piqua, Ohio (OH) USA
(ADC Mk 3 Mod 2)

Status. Advanced development, with limited low-rate EMD production on various prototype models, including the WLY-1 Acoustic Threat Intercept System which is a submarine defensive warfare system.

Total Produced. Various prototypes. Approximately 1,312 Mk 3 Mod 2 acoustic jammer beacons, 367 ADC Mk 3 Mod 0 decoys, 1,382 ADC Mk 2 Mod 0 units, 1,250 ADCs of unknown variant, and three WLY-1s (one EDM prototype produced and two low-rate initial production units in final stages of construction).

Application. Defensive warfare for use on US Navy attack submarines.

Price Range. Indeterminate, as this is a research and development program.

Technical Data

Design Features. This program develops a Submarine Defensive Warfare System (SDWS) to improve the effectiveness and survivability of all classes of US submarines. Efforts in this area consist of countermeasures devices, launchers, threat detection systems, and command and control systems.

Specific devices in development are Acoustic Device, Countermeasure (ADC) Mk 4 (an advanced sonar countermeasure device), a Mobile Multifunction Countermeasure Device (known originally as MMD and later as ADC EX-11), and an advanced Submarine Torpedo Defense (SMTD) device capable of interception of future torpedo threats.

Among launcher development efforts, external countermeasure launchers are being specifically configured to each submarine class for ready stowage and rapid launching of devices. In addition, the launchers are being made quieter to meet advanced submarine noise requirements.

Threat detection and C^2 efforts consist of the development of a new sonar intercept system designated WLY-1, which will have torpedo recognition capability for early threat acquisition, classification, and tracking, and a consolidated C^2 subsystem.

Variants/Upgrades

The following are known variants of Acoustic Device Countermeasures:

ADC Mk 1 Mod 0. This unit is a 5 inch expendable ADC originally produced by the Conax Corp. Procure-

ment order for the years 1990 to 1994 was reported to exceed 2,000 units.

ADC Mk 1 Mod 1. This unit is a 6 inch variation of the ADC Mk 1 Mod 0.

ADC Mk 2 Mod (V). This is a 3 inch ADC produced by the Hazeltine Corp. Original production was by Emerson Electric Co (now ESCO Electronics Corp), which is reported to have manufactured over 7,000 ADC Mk 2 Mod 1 units since 1978.

ADC Mk 3 Mod (V). This is a 6 inch submarine-launched ADC manufactured by Bendix Oceanics (AlliedSignal).

ADC Mk 4 Mod (V). This is a Hazeltine version of a submarine-launched ADC.

CSA Mk 2 Mod 0/1. This is a 6 inch launching ADC system.

Mobile Multifunction Device (MMD or ADC EX-11). A 6 inch, expendable, submarine-launched advanced ADC currently in development. Some 20 developmental models are said to be in production by Bendix Oceanics.

Note: Additional information on other systems, such as the SLQ-25 NIXIE, can be found in the report titled "Surface Anti-Submarine Warfare" located in the ANTI-SUBMARINE WARFARE binder.

Program Review

Background. Originally, the Sub Acoustic Warfare Development concept was initiated and funded under PE#0101221N Fleet Ballistic Missile Systems, Project S1265 Submarine Countermeasure Development. During FY89, work progressed as follows:

CSA Mk 2: Milestone (MS) III approved for low-rate production, production contract awarded, SSN-688 launcher system design commenced, and SSN-688 engineering development model (EDM) system and components acquired.

ADC Mk 3: MS III approved for low-rate production and production contract awarded.

ADC Mk 4: Preliminary Design Review completed and Critical Design Review commenced.

New Sonar Intercept system (NSIS): Operational requirement completed, program startup requirements prepared, and Advanced Development Model specifications prepared.

The project was restructured, retitled, and transferred to PE#0101226N Sub Acoustic Warfare Development in FY90, where it was separately identified under Project S1265 Submarine Countermeasure Development. The following also occurred in FY90:

CSA Mk 2: SSN-688 launcher system design completed and EDM systems and components acquired.

ADC Mk 4: Critical Design Review completed, EDM design commenced, and EDM fabrication initiated.

NSIS: Ordnance Requirement issued and specifications completed, along with an ADM contract procurement package.

NLQ-1 Device: program startup documentation and requirements completed, and design of the ADMs begun.

MMD (later known as ADC EX-11): program startup requirements completed.

CMC^2: program startup completed, feasibility testing with advanced prototype model conducted, and specifications for ADM prepared.

During this period, the schedule slipped in the NLQ-1, MMD, and CMC^2 projects because of a FY90 funding loss of US$3.2 million. The lost funding was earmarked for a higher priority program.

Under the CSA Mk 2/Quiet Launch effort, SSN-688 system testing continued during FY91, and a production contract was awarded. The electromagnetic launch technology (EML) project was transitioned from Advanced Research Projects Agency (ARPA) concept development.

Regarding the ADC Mk 4, fabrication and testing of the EDM unit were completed, and fabrication of low-rate initial production (LRIP) units commenced. Also, competitive prototype system contracts were solicited for NSIS and a countermeasure device C^2 subsystem was integrated into the design. Regarding the NLQ-1 device, design, fabrication, and testing of breadboard models was completed, and prototype model specification was begun. The MMD continued with design, fabrication, and testing of prototype model components. The SMTD device transitioned to the Demonstration and Validation Phase, and modifications were made to the subsystem test vehicles.

During FY92, Submarine Acoustic Warfare Development concentrated on the following: completing ADC Mk 4 fabrication of LRIP units, dynamic launch DTIIA testing of LRIP units and DTIIB Technical Evaluation testing, completing launcher quieting prototype model fabrication and conducting acoustic and design verification DTI testing, awarding a WLY-1

prototype system contract and completing prototype Preliminary Design Review and Critical Design Review, completing the NLQ-1 device prototype model fabrication and conducting final in-water DTI testing, completing MMD prototype model fabrication and conducting processor and integrated vehicle open ocean testing, and completing the SMTD in-water propulsion and self-noise subsystem TECHEVAL testing.

The DTIIB for the ADC Mk 4 device was completed in FY93. Additional accomplishments consisted of the following: continuing the prototype system fabrication and factory acceptance testing for the WLY-1 system, actual submarine installation of the WLY-1 system prototype, completing prototype integrated vehicle range and Torpedo DTI testing for the ADC EX-11 device, continued prototype fabrication, and conducting integrated vehicle acoustic, propulsion, and guidance DTI testing on the SMTD device. In addition, the EMD design effort was completed.

Technology updates to the ADC EX-11 were undertaken in FY94 (an effort that continued for several years), and an at-sea test was conducted for the WLY-1. In addition, Milestone III approval was obtained and OPEVAL II for the ADC Mk 4 was completed.

Prototype testing and analysis for the WLY-1 system continued during FY95. Also, there was a planned delay in the SMTD programs during this time frame to provide for technology updates. The Acoustic Device Countermeasure (ADC) EX-11 development was canceled.

A contract option to design and fabricate two EDM units of the WLY-1 was exercised in December 1995, with Northrop Grumman (formerly Westinghouse Norden Systems) being awarded a US$10.8 million contract.

A Critical Design Review (CDR), as well as fabrication and developmental testing for the WLY-1, was conducted in FY97.

In FY98, fabrication and development efforts advanced for the WLY-1, and at-sea testing continued. Sensor and software development for the WLY-1 was completed during FY99, and a Phase II Design Review was scheduled to be conducted and EMD fabrication started. Once the review was completed, the WLY-1 would enter TECHEVAL in the second quarter of FY00; OPEVAL was slated for the third quarter of FY00. Efforts in FY01 concluded with a "threat weapon vulnerability and countermeasure effectiveness" analysis.

In early 1999, Northrop Grumman (which acquired Westinghouse Norden) was awarded a $5.7 million contract from the US Naval Sea Systems Command for the LRIP of two WLY-1 units that are scheduled to be completed by February 2002. The WLY-1 is slated to replace the WLR-9/12/17 series electronic warfare systems aboard the SSB-688 (Los Angeles), SSN-21 (Seawolf), and SSN-774 (Virginia, formerly known as NSSN-New Attack) class submarines.

Note: For full program details on the WLY-1 system, please see the report titled "WLY-1."

Funding

US FUNDING

	FY00		FY01		FY02		FY03	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (US Navy) PE#0101226N Sub Acoustic Warfare Development	-	3.857	-	0.871	-	0.996	-	N/A

Source: US Department of the Navy FY02 RDT&E Descriptive Summary

N/A = not available

All $ are in millions.

Note: The WLY-1 project is one of several efforts under development and funded by the US Navy's Submarine Acoustic Warfare Development Program. Funding for this program has not been broken out by specific system such as the WLY-1. The WLY-1 program is composed of three phases: Active Emissions System, Passive Emission System, and Command and Control Subsystem. Due to funding reductions in FY98 and FY99, the Passive Emission System has been cut back within the WLY-1 program.

Recent Contracts

Contracts identified specifically for this program have been difficult to pinpoint. The contracts listed below are likely to be involved, or at least cover similar technology development.

Contractor	Award ($ millions)	Date/Description
Lockheed Martin	13.0	Mar 1999 – A not-to-exceed modification to previously awarded contract to manufacture 19 Phase II acoustic rapid, commercial off-the-shelf insertion kits and associated spares. This Phase II effort is a Fast Attack Submarine sonar upgrade that provides significant improvement in towed array data processing and display. The upgrade will be installed on Los Angeles (SSN- 688) and Improved Los Angeles (SSN-688I) class submarines. Contract completed by August 2000. (N00024-98-C-6201)
Lockheed Martin	16.2	Sep 1999 – A not-to-exceed modification to previously awarded contract N00024-98-C-6201 to provide labor and materials necessary to convert two acoustic rapid, commercial off-the-shelf insertion kits from Phase II to Phase III and two Phase III kits to Phase IV. This procurement includes spare parts provisions for both conversions. A-RCI is a fast attack submarine sonar upgrade that provides significant improvement in towed array data processing and display. These kits will be installed on SSN-688 and SSN-688I class submarines. Contract completed November 2000. (N00024-98-C-6201)
Lockheed Martin	63.5	Jan 2000 – A modification to previously awarded contract N00024-98-C-6201 to manufacture five acoustic rapid, commercial off-the-shelf insertion (A-RCI) Phase II kits; provide labor and material necessary to upgrade four A-RCI Phase II kits to Phase III, three Phase III kits to Phase IV, and six Phase II kits to Phase IV; procure associated spares; and provide engineering services. A-RCI is a fast attack submarine sonar upgrade that provides significant improvement in towed array data processing and display. Contract completed October 2001. (N00024-98-C-6201)
Lockheed Martin	15.3	May 2000 – A modification to previously awarded contract N00024-95-C-6535 to provide the hardware and software necessary to upgrade the common trainer engineering production models with current acoustic rapid, commercial off-the-shelf insertion functionality, to procure two submarine multimission team trainer upgrade kits, and for training. Contract completed November 2001. (N00024-95-C-6535)

Timetable

Month	Year	Major Development
Jul	1993	ADC Mk 4 TECHEVAL
Nov	1993	ADC Mk 4 OPEVAL
Mar	1994	Milestone III for ADC Mk 4
1Q	1996	WLY-1 EMD; ADC EX-11 canceled
Mar	1996	Milestone II for WLY-1
2Q	1998	ADC EX-11 EMD
Aug	1998	Milestone II for SMTD

Month	Year	Major Development
2Q	1998	WLY-1 at-sea test
1Q	1999	SMTD EMD
	1999	Phase II WLY-1 Design Review
2Q	1999	WLY-1 EMD fabrication. Low-rate initial production contract for two units awarded
2Q	2000	WLY-1 TECHEVAL
3Q	2000	WLY-1 OPEVAL
	2001	WLY-1 multiyear contract for backfit market to be awarded
3Q	2002	SMTD TECHEVAL
4Q	2002	SMTD OPEVAL; two low-rate initial production units to be completed. Full-scale production and installation to begin

Worldwide Distribution

This a **US Navy** project only. However, it is likely that advanced technology will eventually be shared with the navies of selected allied nations.

Forecast Rationale

While there are several efforts in development under the US Navy's Submarine Acoustic Warfare Development program, the main subproject continues to be developing the WLY-1, a new acoustic threat intercept system that has threat platform sonar and torpedo recognition capability for early detection, classification, and tracking of threats. The system includes a control subsystem for launch management of all onboard countermeasure devices and launchers.

During the next few years, research and development funding for this program is expected to drop sharply as one of the advanced development systems projects (the WLY-1) transitions to production. Toward the second half of the forecast period, funding is predicted to once again increase significantly as research and development efforts concentrate on the next-generation acoustic countermeasure devices for the latest US attack submarines, the Virginia class.

Note: This report will be archived next year, 2002, in favor of the WLY-1 report.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING ($ in millions)

			High Confidence Level			Good Confidence Level				Speculative			
Designation	Application	Thru 00	01	02	03	04	05	06	07	08	09	10	Total 01-10
SUB ACOUSTIC WARARE DEV	ACOUSTIC COUNTERMEASURES (US NAVY)	187.057	0.871	0.996	1.100	2.300	3.000	9.000	9.000	9.500	9.900	10.000	55.667