ANTI-SUBMARINE WARFARE

FORECAST

SAMPLE

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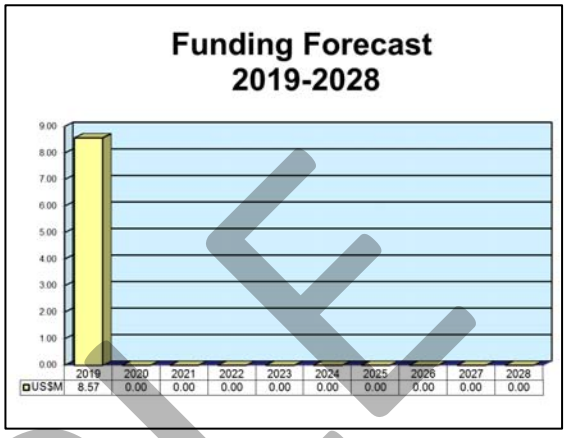


Orientation

Description. The Surface Ship Torpedo Defense (SSTD) program develops soft- and hard-kill anti-torpedo weapons and countermeasures systems. This program was originally a joint effort of the U.S. Navy and U.K. Royal Navy.

The U.K. eventually developed its own SSTD using the technology base of previous systems.

Sponsor

U.S. Navy
Naval Command, Control, and Ocean Surveillance Center
RDT&E Division
San Diego, CA
USA
(Lead laboratory)

U.K. Ministry of Defence
Navy Department
Whitehall, London
England, U.K.
(U.K. RDT&E)

U.K. Defence Research Agency (DRA)
Farnborough, Hampshire
England, U.K.
(RDT&E)

Status. SSTD system in operation with U.K. Royal Navy. The U.S. continues to develop an integrated SSTD comprising various torpedo defense-related systems.

Total Produced. The U.K. Royal Navy has an estimated 65 ships that can use the system, and was believed to have acquired at least 16 systems that will be stored in a pool to be used and installed on ships as needed.

The U.S. Navy has produced engineering development models (EDMs) to install and test on CVN (aircraft carrier) and CLF (supply ship) class ships. The U.S. SSTD program has fielded five Anti-Torpedo Torpedo Defense System (ATTDS) EDM systems on CVNs. Each EDM system consists of one Torpedo Warning System (TWS) with a loadout of a maximum of eight Countermeasure Anti-Torpedoes (CATs). Production of the systems was accelerated due to the lack of hard-kill torpedo defense on high-value units (HVUs). The systems provide a hard-kill torpedo defense capability.

The program installed one hybrid prototype system in FY13 on USS *George H.W. Bush* (CVN 77). The next prototype was delivered in FY14; this system was delivered in a roll-on/roll-off (RORO) configuration and installed on USS *Theodore Roosevelt* (CVN 71). The next two installs occurred in FY15: one additional RORO on USS *Eisenhower* (CVN 69) and one EDM on USS *Harry S. Truman* (CVN 75). The fifth system was purchased in FY16 and has been installed on the USS *Nimitz* (CVN 68). The CVNs with EDM systems were equipped with ROROs by the end of FY18.

Platform. Various surface ships.

Surface Ship Torpedo Defense

Application. Detection, deception, and/or destruction of anti-surface ship torpedoes.

Price Range. The rough estimate for the first 16 units for the U.K. Royal Navy was $1.131 million per unit, based on cost averaging of the August 2002 contract awarded to Ultra Electronics. Adjustment for inflation puts the estimated per-unit price at $1.58 million in 2018 dollars.

The price of the U.S. Navy's SLQ-25A variant was estimated at $0.936 million per unit, based on cost averaging of a 2004 contract. Adjustment for inflation puts the estimated per-unit price at $1.31 million in 2018 dollars.

Contractors

Prime

Argon ST, (A Boeing Company)	http://www.argonst.com, 12701 Fair Lakes Circle, Ste 800, Fairfax, VA 22033 United States, Tel: + 1 (703) 322-0881, Fax: + 1 (703) 322-0885, Prime
Booz Allen Hamilton	http://www.bah.com, 8283 Greensboro Dr, McLean, VA 22102 United States, Tel: + 1 (703) 902-5000, Consortium Member

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

The U.S. Navy's PE#0603506N Surface Ship Torpedo Defense was initially composed of two projects: Project V0225 SSTD and Project V2045 Joint U.S./U.K. SSTD. The two projects were merged into a single effort in 1995.

Project V0225 Surface Ship Torpedo Defense. The U.S. National SSTD program initially provided defense for aircraft carriers (CV/CVN) and amphibious assault ships (LHD/LHA class ships) against torpedo attack. Phase I of the national program took the form of an improved SLQ-25 NIXIE, the standard U.S. towed torpedo countermeasures device or noisemaker. The improved device, designated SLQ-25A, incorporated a soft-kill countermeasures capability. Phase I was expanded to include all NIXIE-equipped ships. Phase II added torpedo detection and an expendable countermeasures subsystem in the form of the SLR-24 detection and classification subsystem. The Lockheed Martin SLR-24 consists of a towed array and a shipboard signal-processing suite. The expendable countermeasures system uses a modified Mk 46 torpedo, turning it into an anti-torpedo torpedo (ATT) that engages incoming weapons, especially wake-homing torpedoes developed and exported by Russia. A third system, the SLQ-36, is a towed system designed to divert torpedoes before they strike a ship.

Project V2045 Joint U.S./U.K. SSTD. This joint project sought to design, develop, and produce a 360-degree anti-torpedo self-defense capability for U.S. Navy and U.K. Royal Navy combatant, amphibious, and auxiliary surface ships. It expanded upon the U.S. National SSTD program and provided advanced detection, classification, localization, and countermeasures capabilities. It was a layered defense system composed of soft- and hard-kill countermeasures to provide defense in depth. The U.S./U.K. SSTD system maximized the use of existing ship equipment and was modular in design to readily fit various ship classes.

Variants/Upgrades

Sea Sentor (Sonar 2170). A commercial off-the-shelf-based open-architecture torpedo defense system made by Ultra Electronics and used by the U.K. Royal Navy. It includes highly sensitive acoustic sensors that are towed some distance behind a ship, where they can identify and pinpoint the location of an incoming torpedo. The Sonar 2170 is the U.K. domestic model, while the Sea Sentor is the name of the export version.

SLQ-25A. A digitally controlled, modular design, electro-acoustic softkill countermeasure decoy system. It employs an underwater towed-body acoustic projector, which is deployed astern by a fiber-optic tow

called the Littoral Fiber-Optic Tow Cable. The SLQ-25A features dual tow capability and enhanced torpedo countermeasures. The system defends ships against wake homing, acoustic homing, and wire-guided torpedoes.

SLQ-25B. Upgraded variant.

SLQ-25C. Upgraded variant.

SLQ-25X. Upgraded variant previously identified as SLQ-25D.

Program Review

Background. The purpose of the U.S. Navy's Surface Ship Torpedo Defense program is to reduce the susceptibility of all surface ships to detection and targeting by acoustic means, reduce ship detection by active sonar devices, and improve the overall sonar performance of ships. SSTD started as a U.S. Navy research and procurement program under which various anti-torpedo countermeasures were developed and systems such as the SLQ-25 NIXIE towed torpedo countermeasures system were procured. (The NIXIE, a successor to the Fanfare system, is towed behind a ship. It simulates propeller noises to lure an acoustic torpedo away from a ship's propellers.)

In October 1988, a Memorandum of Understanding (MoU) was signed between the U.S. and the U.K. establishing a joint program to develop torpedo countermeasures.

The original program consisted of three principal phases. The first two phases were purely U.S. efforts, while the third phase was the joint U.S./U.K. program. The SSTD program looked into both soft- and hard-kill measures; the former involved decoying a torpedo away from a surface ship, while the latter entailed the actual destruction of the torpedo. Among the soft-kill measures were upgrades to the SLQ-25 NIXIE towed countermeasures device. Hard-kill measures included the use of an ATT, which was the subject of both U.S. and U.S./U.K. investigations.

The U.S. Navy first satisfactorily tested various systems against a stationary torpedo testbed during FY85. Through FY88, the Navy continued to evaluate alternative design concepts and test certain launch platforms. Installation of SSTD Phase I systems was then initiated, and the Navy exercised a full-scale development option for certain subsystems.

Joint Program. In October 1988, the U.S. and U.K. signed an MoU for the joint development of SSTD systems. Several companies in each nation formed consortia: one consisted of GE, Alliant TechSystems Inc, and Marconi Underwater Systems Ltd; the other included Westinghouse, AT&T, Dowty Maritime, and Ferranti Naval Systems. In addition, the U.S. Navy and U.K. Royal Navy each formed a project office to coordinate efforts.

U.S. and Britain Team Up to Protect Ships

During the late 1980s, the U.S. Navy commenced development of the SLR-24 and SLQ-36. The SLR-24 is a towed passive sonar that detects and identifies enemy torpedoes. The SLQ-36 is used to divert a torpedo from a ship. Prior to this development, all systems were being designed to lure a torpedo away from a ship. The SLR-24 was tested aboard the USS *John F. Kennedy* (CV 67) and USS *Nimitz* (CVN 68).

By the end of 1990, the test and evaluation master plan had been completed and approved. The Joint SSTD system performance specifications were completed as well. The U.S. Navy then released the Request for Proposals (RFP) to the consortia.

Project V0225 Surface Ship Torpedo Defense. SSTD engineering development models were delivered during FY91, and launch systems were installed aboard TECHEVAL ships. Also, environmental, safety, and acceptance testing of an ordnance alteration kit was conducted, and ORDALT was integrated into the EDMs. The development of support equipment was then completed. Finally, the functional configuration audit of the SSTD detection, torpedo, and launch systems was conducted, as was the production readiness review (PRR) of the detection system.

SSTD TECHEVAL began in FY92. Also, preliminary physical configuration audits of the SSTD detection system and Mk 46 ORDALT were conducted, the PRR was completed, and the maintenance demonstration and logistic review audit of the SSTD system were conducted. In FY93, SSTD TECHEVAL and certification for OPEVAL were completed.

Project V2045 U.S./U.K. SSTD. Initial work under this joint venture program progressed rapidly. In FY91, the concept evaluation phase was completed. In FY92, risk mitigation (RM) study contracts were awarded to two consortia. The first team was headed by Lockheed Martin and the second by then-Westinghouse Electric. Among new efforts, detection, classification, and localization trials and analyses were conducted, and studies of the feasibility of expendable acoustic decoys were launched, as was a cost and operational effectiveness analysis (COEA). In FY93, RM

Surface Ship Torpedo Defense

countermeasures studies were conducted and the COEA was completed. Demonstration and validation (D&V) contract options were exercised in FY94.

Projects Consolidated. In 1995, the National SSTD and Joint SSTD projects were consolidated. The merged program was said to combine the best aspects of the two projects. In December 1994, Westinghouse was awarded a $29.2 million D&V options contract, which was hotly contested by Lockheed Martin, causing delays in the program. Problems also arose with development of the Mk 46 anti-torpedo torpedo and were resolved by dropping it from the effort. However, development of the Mk 46 had not been totally abandoned by the U.S. Navy, which transferred the effort to its Advanced Technology Demonstration Project in FY97.

The D&V phase subsystem development and analysis test was conducted during FY96, as was the test and evaluation of the Torpedo Alertment Processor. Development and integration of the Torpedo Alertment Processor was completed by the end of that fiscal year. By the end of FY97, the Torpedo Alertment Processor had been integrated.

The U.S. Navy's FY98 budget request contained no funding for the SSTD program. However, in FY99, an additional $5 million was allocated for the joint U.S./U.K. effort to address some of the issues uncovered during the D&V phase. No further direct U.S. funding appears to have been allocated beyond this effort.

During FY99, the SLQ-25A winch and tow were upgraded to improve performance in littoral and shallow water operations. In FY00, additional funding in the amount of $640,000 was allocated for the SLQ-25A winch and tow upgrade.

The lack of further funding for the SSTD program inhibited the ability of the Navy to capitalize on the achievements of the joint U.S./U.K. D&V program. Instead, the U.S. focused its attention on production of the SLQ-25A, for which a procurement contract was issued in October 2000 for both the U.S. and Canadian navies. To confirm its commitment to the SLQ-25A, the U.S. Navy awarded a contract modification to SenSyTech in August 2004 for the production, test, and delivery of 11 additional SLQ-25A units.

Currently, this program uses an evolutionary acquisition strategy of providing incremental SSTD capability by implementing it first on cruisers and destroyers (CRUDES) already equipped with sonar systems, fire control systems, and launchers. A draft specification for a CRUDES torpedo detection, classification, and localization system was drawn up in FY09. This followed at-sea demonstrations of TDCL systems, conducted from FY06-FY09.

At-sea testing of the EDM-1 design of the ATT variant of the Common Very Lightweight Torpedo (CVLWT) was conducted from FY07-FY09. Design of the EDM-2 (second test unit) was completed in FY10. The ATT was to be shipped and launched from an all-up-round canister known as the Countermeasure Anti-Torpedo (CAT).

Also in FY10, an EDM of the CRUDES ship system was developed. The system included a command and control system with a user interface, a modified Surface Vessel Torpedo Tube launcher, and a canistered ATT. The TDCL system utilized a sensor set that was added to the SLQ-25 NIXIE system, as well as the hull-mounted sonar already employed on these ships. The development of the ATT was the first derivative of the CVLWT as an acquisition program. CAT and TDCL development was closely linked with Office of Naval Research (ONR) Sea Shield Future Naval Capability (FNC) programs. These programs provided advanced technology inserts at key transition points.

Argon ST Contracted to Complete EDM

In June 2009, Argon ST received a $6.2 million award for engineering development in support of the U.S. Navy's SSTD program. The award, a modification to an existing contract, was received from the Naval Sea Systems Command to complete the EDM design, through Critical Design Review, for the SSTD program's SLQ-25D system.

Since 2006, Argon has served as the lead contractor in designing, developing, and fielding the SLQ-25 Torpedo Countermeasures Transmitting Set, commonly referred to as NIXIE. Argon was initially contracted to design and field the SLQ-25C, a passive, electro-acoustic decoy system used to provide deceptive countermeasures against acoustic-homing torpedoes. The company has been developing the upgrade for this system.

Contract work is primarily being done at Argon's Lemont Furnace, Pennsylvania, facility, with support from the corporate headquarters in Fairfax, Virginia, and the Smithfield, Pennsylvania, production facility.

Shift in Focus of U.S. Program

The president's FY11 budget request indicated that the U.S. SSTD program had been changed. The previous program developed the Anti-Torpedo Torpedo Defense System (ATTDS) for cruisers and destroyers. For this program, IOC was planned for 2015. The FY11 request shifted the focus to first providing torpedo defense capability to HVUs.

Through two new development programs, the project uses technologies developed under the previous ATTDS program to provide a detect-to-engage hard-kill torpedo defense capability. The CAT program develops a canisterized ATT as part of the ACAT II program. The Torpedo Warning System program develops the required ship systems as part of the ACAT III program. Like the ATTDS, the new TWS will require fielding of the SLQ-25D (known as NIXIE) as a tow point for the TWS towed sensors.

The first increment of the TWS will be installed on one CVN and one CLF ship (both HVUs); IOC was scheduled for 2017. The first increment of the CAT will be installed on HVUs in 2021. Additionally, the program will develop two SSTD prototype systems (TWS/CAT) and field them on two CVNs. The U.S. Defense Department had intended to request "prior approval reprogramming" funding of approximately $38 million in FY11 to accomplish this effort. The effort was to be completed 33 months after the funds were received.

At-sea demonstrations of the TDCL systems conducted from FY06 through FY09 led to a CRUDES TDCL draft system specification in FY09, which is being modified to accommodate installation of a system for HVUs. Additionally, in FY10, prototype TDCL systems were tested at sea to collect data for use in characterizing the ability of towed active and passive sonar arrays to detect and track threat targets both actively and passively in adverse conditions. The target date for delivery was FY17.

At-sea testing of the EDM-1 design of the ATT capability was conducted from FY06 through FY09, facilitating completion of the EDM-2 design in FY11. The ONR's development work and testing provided the technology readiness required for the CAT program to achieve Milestone B.

The program was redirected a bit in FY13 and FY14, with development of the SLQ-25X canceled when a more cost-effective technical solution to interfacing the TWS to the NIXIE system was found.

The program is currently developing six SSTD prototype (TWS/CAT) EDM systems and fielding them on CVNs. Each prototype consists of one TWS and eight CATs. The six systems were accelerated due to the lack of torpedo defense on HVUs, a problem that has been exacerbated by recent real-world events and evolving threats. The systems provide a hard-kill torpedo defense capability in advance of the IOC as part of the program of record.

To accomplish this effort, the U.S. Department of Defense reprogrammed $9.9 million of FY10 funds, $6.1 million of FY11 funds, and $6.4 million of FY12 funds. Furthermore, the department received prior approval for the reprogramming of an additional $7.9 million of FY10 funds.

The program delivered one hybrid prototype system in FY13 on the USS *George H.W. Bush* (CVN 77). The next prototype was delivered in FY14; this system was delivered in a roll-on/roll-off configuration and installed on the USS *Roosevelt* (CVN 71). One additional RORO system and one EDM were delivered in FY15. Two additional EDMs were delivered in FY16.

In FY17, the ATTDS program allegedly awarded a contract (unconfirmed) to validate the CAT technical data package, which will lead to production of the proof of manufacturing (POM) units before the end of FY18. The program will also perform first article testing on the TWS.

Plans for FY18 called for continuing land-based reliability testing on returning deployed ATTs; continuing engineering changes on CAT materials and CAT software upgrades; performing safety certifications prior to two FY18 CVN deployments; delivering "ready for issue" CATs for two FY18 CVN deployments; supporting software maintenance through Program Trouble Reports (PTRs); conducting a quick reaction assessment of SALVO software; and conducting a Contractor Test (CT-5). Much of this work will continue through FY19, and a full-rate production contract might be issued in FY20.

No program of record acquisition milestones will be pursued through FY22. Software upgrades, material engineering changes, and safety certifications will remain the program's top priorities to ensure the highest operational availability and performance of the deployed CVN systems.

Compact Rapid Attack Weapon. The U.S. Navy is evaluating the feasibility of using a Compact Rapid Attack Weapon (CRAW) as a surface ship defense weapon. At about one-third the weight of the current lightweight ASW weapon, the CRAW is projected to cost less while performing at least as well. The successful performance testing of the CRAW against submarine targets will validate the weapon and increase its potential as a candidate for weaponizing multiple platforms.

U.K. SSTD. In 1999, Northrop Grumman was awarded a subcontract from Alenia Marconi Systems to develop part of a submarine acoustic warfare control system for the U.K.'s torpedo defense system. The subsystem was delivered by the end of 2001. In August 2002, Ultra Electronics was awarded a $78.1 million contract to begin the second phase of

development, along with the production of 16 SSTD systems.

Originally, all major U.K. Royal Navy surface warships were to be outfitted with the SSTD system; however, it appears that the 16 SSTD units are being placed in inventory and only being installed on designated ships when considered necessary. Remaining ships will be outfitted for quick SSTD transfer and installation if or when needed. In February 2005, the Type 23 frigate HMS *Westminster* became the first Royal Navy vessel to be equipped with the SSTD system.

More Countries to Try Their Hand at Ship Defense

International SSTD. Six NATO countries (France, Germany, Italy, the Netherlands, Norway, and Spain) participated in NATO Project Group 37 to develop an SSTD system after having been denied access to the U.S./U.K. SSTD feasibility study completed in summer 1997. In more recent activity, STN Atlas Elektronik is said to be working on a German version of the SSTD system known as Torpedoabwehr Überwasserschiffe (TAÜ). It is believed to be an offshoot of the U.S./U.K. and NATO SSTD efforts, and is run by the NATO Naval Armaments Group that ran initial feasibility studies completed in 1998. Since then, several countries have pursued national or joint development programs. Italy and France were reportedly collaborating on the Systeme de Lutte Anti-Torpille (SALT), while Germany went at it alone with the TAÜ.

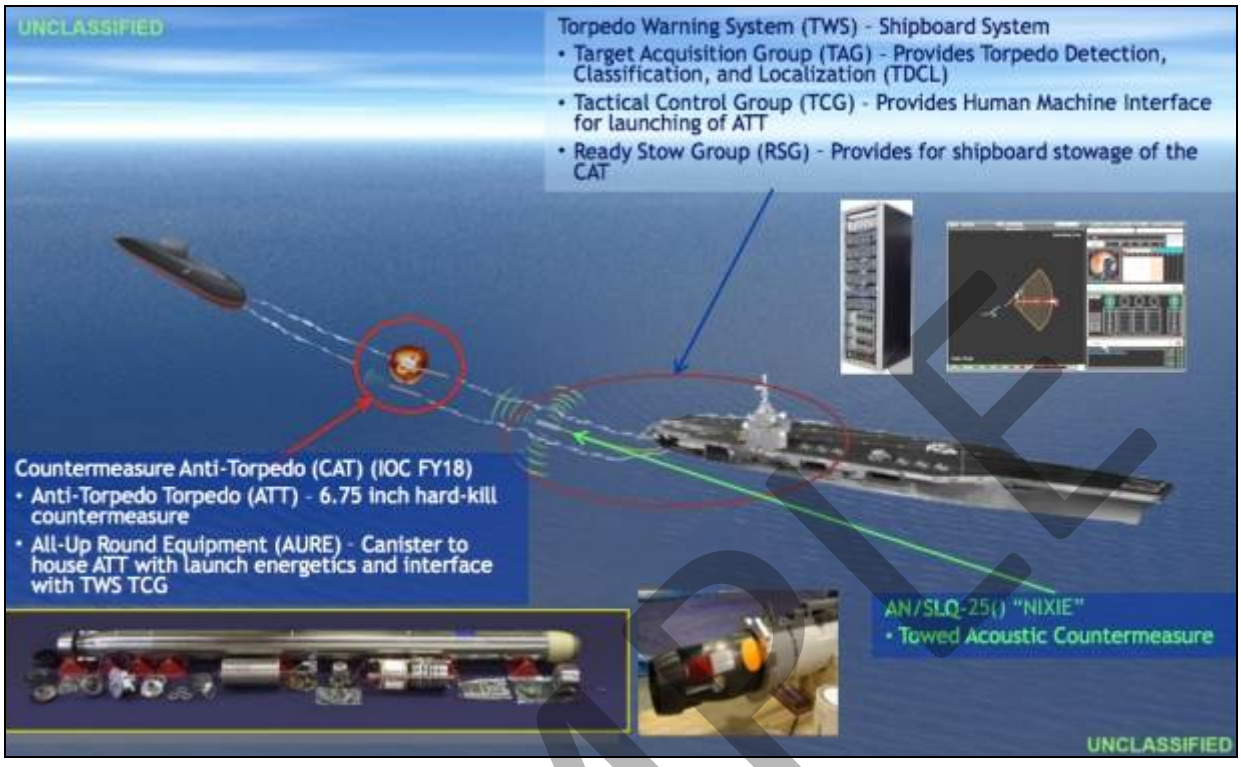
General Dynamics Canada Completes Torpedo-Defense Demonstration

In November 2011, General Dynamics Canada and Defence Research and Development Canada Atlantic demonstrated a torpedo-defense enhancement that would increase the level of protection for Canadian Navy ships. The Multisensor Torpedo Detection, Classification, and Localization Technology Demonstration Program (TDP) was initiated in 2006 by DRDC Atlantic to develop and demonstrate advanced concepts in multisensor automated torpedo warning for application on Halifax-class patrol frigates. The potential lethality of even a single torpedo hit underpins the need for this type of detection capability. As the prime contractor, General Dynamics Canada supported DRDC Atlantic by providing analysis, design, development, installation, and support services, culminating in the development of a prototype underwater warfare system called Pleiades.

Over the course of the five-year TDP, the Pleiades system was used in realistic operational trials on several Halifax-class patrol frigates to respond to more than 100 live, unscripted torpedo firings.

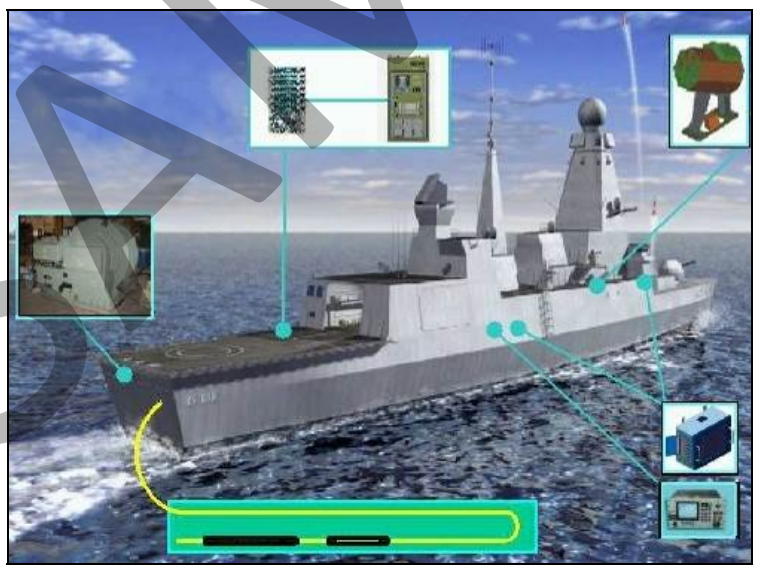
General Dynamics Canada was the original manufacturer of the anti-submarine sonar systems currently in use on the patrol frigates and was selected through a competitive process for the recent project.

The technology developed during the demonstration uses an open-hardware and -software architecture and a modular and flexible system design. Moving this technology from a demonstration prototype to an operational adjunct system would enable future enhancements and a quicker transition of technology from the research lab to the fleet. DRDC Atlantic plans to do further research into the development of new techniques for reliable auto-detection of torpedoes.



U.S. Surface Ship Torpedo Defense (SSTD) System

Source: U.S. Navy



U.K. Royal Navy SSTD System

Source: U.K. Ministry of Defence

Surface Ship Torpedo Defense

Sea Sentor SSTD System

Source: Ultra Electronics

Controls for Ultra Electronics' SSTD System

Source: Ultra Electronics

SLQ-25A Torpedo Defense System

Source: U.S. DoD

Funding

The U.S. is no longer directly funding or developing a totally independent/new SSTD system; instead, the U.S. Navy is working on integrating the SLQ-25(V) and other existing systems into one overall SSTD system. The British SSTD effort has been funded by the U.K. Royal Navy and the U.K. Defence Procurement Agency (DPA).

U.S. FUNDING

	FY17 QTY	FY17 AMT	FY18 QTY	FY18 AMT	FY19 QTY	FY19 AMT	FY20 QTY	FY20 AMT
PE#0603506N (U.S. Navy)								
Surface Ship Torpedo Defense	-	69.8	-	14.9	-	8.5	-	0

	FY21 QTY	FY21 AMT	FY22 QTY	FY22 AMT	FY23 QTY	FY23 AMT	FY24 QTY	FY24 AMT
PE#0603506N (U.S. Navy)								
Surface Ship Torpedo Defense	-	0	-	0	-	0	-	N/A

All $ are in millions.

N/A = Not Available

Source: U.S. Department of Defense FY19 RDT&E Budget Item Justification (R-2)

During FY17, the CAT program was to reach Milestone B and commence the EMD phase. The TWS program was to perform first article testing prior to the start of LRIP in FY18.

Contracts/Orders & Options

Contractor	Award ($ millions)	Date/Description
Argon ST	6.2	Jun 2009 – A modification to an existing contract to complete the EDM design, through Critical Design Review, for the SSTD program's SLQ-25D systems. (Contract number not available)
Argon ST	8.2	Dec 2009 – A modification to a previously awarded contract for production of the SLQ-25A and SLQ-25(C) torpedo countermeasures transmitting sets. This contract modification combined purchases for the U.S. Navy (62.67 percent) and, under the Foreign Military Sales (FMS) program, the governments of Australia (32.67 percent), New Zealand (3.10 percent), and Spain (1.56 percent). Work was performed in Smithfield, PA (99 percent) and Fairfax, VA (1 percent). Work was completed by Dec 2010. The Naval Sea Systems Command was the contracting activity. (N00024-07-C-6201)
3Phoenix	20.4	Sep 2011 – A cost-plus-fixed-fee contract for the design and development of four TWS engineering development models. This effort was for Phase III of Small Business Innovative Research topic N07-070, Distributed Sensor System Innovations. The contract included options which, if exercised, would bring its cumulative value to $45,009,130. Work was performed in Fairfax, VA (40 percent); Wake Forest, NC (30 percent); and Hanover, MD (30 percent). Work was completed by Sep 2012. The Naval Sea Systems Command was the contracting activity. (N00024-11-C-6287)
Argon ST	14.7	Dec 2011 – A firm-fixed-priced, indefinite delivery/indefinite quantity contract for procurement of four SLQ-25A/C systems and spare parts. This contract combined purchases for the U.S. Navy (66 percent) and, under the FMS program, the government of Canada (34 percent). The work was performed in Smithfield, PA, and completed by Dec 2012. This contract was not competitively procured. The Naval Sea Systems Command was the contracting activity. (N00024-12-D-6216)

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Contractor	Award ($ millions)	Date/Description
Argon ST	14.8	Jan 2012 – A follow-on award under Argon's contract for the U.S. Navy's SSTD program. Under this firm-fixed-price agreement, Argon will provide continuous production and delivery of new SSTD systems, as well as optional cost-plus-fixed-fee enhancements to existing SSTD systems, over a period of five years. Work was expected to be completed in 2017. Work would be done primarily at Argon's facilities in Lemont Furnace and Smithfield, PA. Argon won its original contract for the SLQ-25C system (NIXIE) from the U.S. Naval Sea Systems Command in 2006.
3Phoenix	9.1	Apr 2014 – A follow-on, cost-plus-fixed-fee modification to a previously awarded contract (N00024-11-C-6287) from the U.S. Navy for the procurement of engineering services for the development, integration, testing, and logistic support of the Torpedo Warning System. The TWS provides surface ships with the ability to detect torpedoes and thereby employ defensive measures, including maneuvering and hard- and soft-kill countermeasures. Work was performed in Chantilly, VA (46 percent); Fairfax, VA (28 percent); Houston, TX (18 percent); Wake Forest, NC (6 percent); and Hanover, MD (2 percent). Work was completed by Oct 2014. FY14 RDT&E funding in the amount of $9,042,080 was obligated at time of award. The Naval Sea Systems Command was the contracting activity.
3Phoenix	24.8	Oct 2015 – A modification to a previously awarded contract (N00024-11-C-6287) for the procurement of engineering services for development, integration, testing, and logistic support of the TWS. Work was performed in Wake Forest, NC (43 percent); Chantilly, VA (25 percent); Fairfax, VA (22 percent); and Houston, TX (10 percent). Work was completed Oct 2016. FY15-16 RDT&E (U.S. Navy) funding in the amount of $6,200,000 was obligated at time of award. The Naval Sea Systems Command was the contracting activity.
Argon ST	10.2	Sep 2016 – A modification to a previously awarded contract (N00024-12-D-6216) from the U.S. Navy for the procurement of nine SLQ-25A/C countermeasure decoy systems and spares in support of Undersea Defensive Warfare programs. Work will be performed in Smithfield, PA, and is expected to be completed by Jul 2018. Fiscal 2016 Other Procurement (Navy) funding in the amount of $10,206,776 was to be obligated at time of award. The Naval Sea Systems Command is the contracting activity.
Argon ST	11.6	Oct 2017 – A modification to a previously awarded contract (N00024-12-D-6216) for the procurement of eight SLQ-25A/C countermeasure decoy systems and spares in support of the Undersea Defensive Warfare Systems Program Office. Work will be performed in Smithfield, PA, and is expected to be completed by Sep 2019. Fiscal 2016 and 2017 Shipbuilding and Conversion (Navy) funding in the amount of $11,691,997 was to be obligated at time of award. The Naval Sea Systems Command, Washington, DC, is the contracting activity.

Timetable

Month	Year	Major Development
	1985	System tested against stationary torpedo testbed
	1986	In-water testing of torpedo countermeasures components
	1987	U.S. Navy conducts design studies on anti-torpedo concepts
	1988	Launch platforms tested for specific systems; SSTD Phase I systems installed
Oct	1988	U.S. and U.K. sign MoU
	1989	System and subsystem development continue; industrial teams formed
	1990	System technical evaluation
	1991	System operational evaluation

Month	Year	Major Development
Mar	1994	SSTD Milestone I
	1995	Projects consolidated into single program; D&V testing
	1996	Milestone III decision
	1997	D&V testing completed; other NATO countries start SSTD programs after being denied access to U.S./U.K. results
4Q	1997	Integration of Torpedo Alertment Processor completed
	1999	Small funding allocation on part of U.S.
	2000	U.S. Navy portion ends; Navy efforts focus on SLQ-25A
	2001	U.K. SSTD contract awarded to Ultra Electronics
Feb	2005	First installation of SSTD system on U.K. Royal Navy ship
Jun	2007	U.K. Royal Navy SSTD full-fleet in-service date
Jun	2009	U.S. Navy upgrades SLQ-25(V) to "D" configuration
Sep	2011	TWS EDM contract
4Q	2012	SLQ-25X production solicitation canceled; SLQ-25A/C continues in use
4Q	2013	TWS prototype completed
3Q	2014	TWS EDM demonstration
	2015	U.S. Navy SSTD prototypes installed and tested on two ships
	2018	Milestone C decision; low-rate initial production
	2019	Developmental testing to begin
	2020	Full-rate production contract
	2021	IOC and FRP scheduled

Worldwide Distribution/Inventories

This program started as a joint venture between the **United States** and **United Kingdom**. A U.S./U.K. SSTD Joint Project MoU was signed on October 26, 1988, by the undersecretary of defense (acquisition) for the U.S. and the chief of defense procurement for the U.K. It covered aspects related to D&V, engineering development modeling, and production/deployment, and also involved cost-share arrangements and a determination of exchange rates and industry participation levels. The MoU required each country to seek national approvals and formally declare its intent to continue with the program prior to each phase. The U.S. stopped its direct work on the joint venture SSTD in favor of continuing with the SLQ-25(V), which it then stopped work on in favor of other SSTD systems. Work on SSTD-related subsystems continues.

The SLQ-25(V) NIXIE torpedo defense system is currently in service worldwide, including in **Australia**, **Canada**, **France**, **Greece**, **Japan**, **New Zealand**, **Portugal**, **South Korea**, **Spain**, **Turkey**, and the **United States**.

Forecast Rationale

The U.S. Navy's Surface Ship Torpedo Defense (SSTD) program provides a detect-to-engage layered torpedo defense capability. The four major systems that comprise SSTD are the SLQ-25 NIXIE system, the Torpedo Warning System (TWS), the Countermeasure Anti-Torpedo (CAT), and the Acoustic Device Countermeasure (Surface ADC Mk 2). CAT and TWS are development programs. The CAT program develops a canisterized anti-torpedo torpedo (ATT). The TWS program develops the torpedo detection, classification and localization systems required to employ CAT. The TWS and CAT systems make up the Anti-Torpedo Torpedo Defense System (ATTDS).

The ATTDS provides a hard-kill torpedo defense capability on high value units (HVUs). The program has fielded five ATTDS engineering design model (EDM) systems on CVNs. Each EDM system consists of one TWS with a loadout of up to eight CATs. The program delivered its first prototype system in FY13, and delivered and installed its fifth and final system in FY17. In the first quarter of FY18, the ATTDS program completed the development of system salvo software and conducted a Quick Reaction Assessment (QRA) test.

Production of the systems was accelerated due to the lack of hard-kill torpedo defense on HVUs. The program installed one hybrid prototype system in FY13 on USS *George H.W. Bush* (CVN 77). The next prototype was delivered in FY14; this system was delivered in a roll-on/roll-off (RORO) configuration and installed on USS *Theodore Roosevelt* (CVN 71). The next two installs occurred in FY15: one additional

Surface Ship Torpedo Defense

RORO on USS *Eisenhower* (CVN 69) and one EDM on USS *Harry S. Truman* (CVN 75). The fifth system was purchased in FY16 and has been installed on the USS *Nimitz* (CVN 68). The CVNs with EDM systems were equipped with ROROs by the end of FY18.

The SLQ-25 (NIXIE) is a towed countermeasure system. The SLQ-25 program develops countermeasure technologies and capabilities to improve ship survivability against future torpedo threats.

New technologies and capabilities are being developed under the Future Naval Capabilities (FNC), Small Business and Innovative Research (SBIR), and other RDT&E initiatives. Under these initiatives, new and emerging hardware and software are evaluated in representative acoustic environments against projected threats through both digital and hardware-in-the-loop simulations to determine their effectiveness and impact on ship survivability. The technology is then incorporated into the appropriate product line.

Given how the U.S. Navy is doing more with fewer ships, the value in preserving platforms has risen dramatically.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR RDT&E FUNDING (in millions US$)

Designation or Program	High Confidence				Good Confidence				Speculative			
	Thru 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Argon ST (Prime)												
SSTD <> United States <> Navy Note: U.S. Navy Program Not To Be Confused With U.K. Royal Navy SSTD Effort												
	655.76	8.57	.00	.00	.00	.00	.00	.00	.00	.00	.00	8.57
Total	655.76	8.57	.00	.00	.00	.00	.00	.00	.00	.00	.00	8.57

Analysis 1
The Market for
Airborne ASW Sensors
2019-2028

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* * *

The Market for Airborne ASW Sensors

Executive Summary

This latest edition of Forecast International's "The Market for Airborne ASW Sensors" examines current trends in geopolitics, defense issues, military technology, and the global airborne anti-submarine warfare market in order to formulate market forecasts for the years 2019 through 2028. Based upon an analytical assessment, which uses a representative sampling of seven companies and 27 individual line item forecasts of programs and systems, Forecast International expects the airborne ASW sensors market to be worth at leas illion over the course of the 10-year forecast period reviewed.

The market decreases from a projected worth of $2 n 2023. Th million, fo mainder of ed value of $971.48 million in 2028.

Much of the projected market decline can be attributed to major wind-downs and completions in program production (with the APY-10, APS-153, AQS-22 and ASQ-508 being cases in point) and the lack of any significant technology breakthroughs in submarine hunting.

* * *

As this analysis is limited to a sampling of existing and future programs, the projected 70.77 percent illion) decline in sales between 2019 and 2028 indicates that almost three-quarters of the programs examined will be completed by the end of the 10-year forecast period.

Raytheon is forecast to be the leading airborne ASW sensors firm in the sample group, with 28.79 percent of the anticipated 10-year market share, valued at illion. Telephonics Corp (HQ, Griffon Corp) will be number two, with a 19.36 percent market share, which translates to illion in value. Thales is number three with a projected 15.27 percent of the airborne ASW sensors market and a 10-year sales total of million. Toshiba pulls in at number four ent and sales valued at er five with a market share of 8.33 percent and sales valued at illion. China Electronics Technology Group Corp is forecast to hold 3.88 percent wo , and L3 Technologies finishes the reviewed list at number ercent market share worth

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