

ARCHIVED REPORT

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SLQ-48(V) Mine Neutralization System

Outlook

- A legacy system still very much in active U.S. Navy service
- Being replaced by the SLQ-60 SMNS Seafox
- No further production forecasted; operation and maintenance only, thus the forecast chart has been omitted

Orientation

Description. The SLQ-48(V) mine neutralization system (MNS) is a remotely operated, unmanned minehunting submersible used aboard MCM 1 and MCH-51 class mine countermeasures (MCM) ships.

Sponsor

U.S. Navy
Naval Sea Systems Command (NAVSEA)
Washington, DC
USA

Status. In operational service. Production complete. Further production only for emergency replacement or repair parts.

Total Produced. According to Raytheon, the system's manufacturer, a total of 28 complete systems and 57 vehicles have been delivered to the U.S. Navy.

Application. Avenger class MCM ships and Osprey class minehunter coastal (MHC) ships. (Each ship usually carries at least two systems to ensure capability should one be lost or become inoperable.) System can be used on the Littoral Combat Ship (LCS); however, that ship class is being outfitted with the SLQ-60 Shipboard Mine Neutralization System (SMNS) Seafox.

Price Range. Cost of an SLQ-48(V) system was estimated at \$2.325 million based on contract cost averaging of a 1998 procurement order; valued at \$4.49 million in March 2024 dollars when adjusted for inflation.

Contractors

Prime

Raytheon	http://www.rtx.com/raytheon , 50 Apple Hill Dr, Tewksbury, MA 01876 United States, Tel: + 1 (978) 858-5000, Fax: + 1 (978) 858-9414, Email: ids@raytheon.com , Prime
Amentum	http://www.amentum.com , 13923 E Captain WJ Nelson Dr, Odon, IN 47562 United States, Tel: + 1 (812) 863-5001, Packager

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Technical Data

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Total weight	11,804 kg	26,000 lb
Vehicle weight	1,135 kg	2,000 lb
Umbilical length	1,068 m	3,500 ft
Vehicle size	3.8 x 1 m	12.5 x 3 ft

Characteristics

Vehicle speed	6 kt
MTBF	120 hr
MTTR	4 hr

Design Features. The SLQ-48(V) mine neutralization system (MNS) consists of a mine neutralization vehicle, an umbilical cable, a handling system, control consoles, and other equipment. Its closest equivalent is the French AP-104, with the capability to interface with the SYQ-13 combat system on MHC-51 class vessels.

When a mine is detected, the handling system lowers the MNS vehicle into the water. The vehicle is powered by onboard motors and guided by controllers via an umbilical cord.

The underwater vehicle carries two motors, a low-light-level television camera, and sonar and other detection systems. It is also equipped with two mine-cable cutters located in front under the camera, an explosive-laying device, a central processing unit (CPU), and other items. Due to internal foam, the underwater vehicle has a high crush strength, which makes deepwater operations possible.

Operational Characteristics. The SLQ-48(V) MNS is a tethered, remotely operated submersible equipped with a television and sonar. It is not a mine-location system; rather, it neutralizes mines that the ship's minehunting sonar or other systems have located. The SLQ-48(V) is more suited to deepwater operations, and can be effective in clearing shipping lanes.

SLQ-48(V) missions are accomplished using the following countermeasures:

Tethered Mine Countermeasures. Tethered mines are usually contact mines. They are moored to the sea bottom and tethered at a predesignated depth (usually deep enough so that they cannot be easily seen from a passing ship, but high enough to strike a ship's hull). The mine floats, waiting for a ship to run into it and thereby set off an explosion. Upon reaching a tethered mine, controllers aboard the ship guide the MNS vehicle to the tethering cable and sever it with one of the two cable cutters. The mine then floats to the surface, and shipboard personnel destroy it with small arms fire or other means. The vehicle is then guided to other mines or back to the ship and retrieved using the MNS handling system.

Bottom Mine Countermeasures. Bottom mines are designed to react to a change in water pressure or to the magnetic field of a ship passing overhead. They are usually placed in shallow water and can remain intact for years. Upon detecting a bottom mine, controllers guide the vehicle to the mine and place a timed explosive charge next to it. The vehicle is then guided to other mines, moved to a safe distance from the mine, or removed from the water by the MNS handling system. The timed charge detonates, destroying the original bottom mine in the process.

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Buried Mine Countermeasures. Neutralizing buried mines can be the most difficult of the SLQ-48(V)'s missions. Some mines are deliberately buried; others can be covered by tidal motion.

Variants/Upgrades

Mission Packages 1, 2, and 3 are used in the SLQ-48(V) mine neutralization system to neutralize bottom and moored mines. The MNS is used on both MHC and MCM ships.

SLQ-48(V) MP-1. Mission Package 1 (MP-1) neutralizes moored mines in shallow to deep water. The MP-1 is deployed by the SLQ-48(V) mine neutralization vehicle (MNV) by attaching the Mk 26 cable cutter to the cable of the moored mine. An acoustic signal is transmitted by the MHC/MCM ship to the cable cutter and the mine cable is cut, allowing the mine to rise to the surface. Mine neutralization is performed by explosive ordnance disposal or gunfire.

SLQ-48(V) MP-2. Mission Package 2 (MP-2) also neutralizes bottom mines in shallow to deep water. The MP-2, also known as the Explosive Destructor Mk 57, consists of the Mk 35 firing device and the Mk 14 explosive section. The explosive section is loaded with 60 pounds of PBXN-103 high explosives. The MP-2 is deployed by the SLQ-48(V) MNV by dropping it within a prescribed range from the bottom mine. An acoustic signal is transmitted by the MHC/MCM ship to the MP-2 for detonation. The mine is neutralized by sympathetic detonation or by damaging the firing circuit.

SLQ-48(V) MP-3. Mission Package 3 (MP-3) neutralizes moored mines in shallow water by remotely attaching an explosive device near a target mine. The MP-2 is the explosive element of the MP-3. A Mk 52 cable-gripping release (CGR), adapted from the MP-1's Mk 26 cable cutter design, is used to attach the explosive destructor to the mine's mooring cable. An acoustic signal from the MHC/MCM ship activates a latch in the CGR to release a set of floats that lift the explosive destructor near the mine case. A second acoustic signal detonates the destructor. The mine is neutralized by means of sympathetic detonation or by damaging the firing circuit.

SSQ-32. This is the variable-depth minehunting sonar developed for the MHC/MCM fleet. It locates mines for the SLQ-48.

SSQ-94 Trainer. This is an onboard combat system trainer for MCM and MHC ships. It includes an SLQ-48(V) module for crew training in system operation.

Barracuda EMNS. The Barracuda Expendable Mine Neutralization System is a replacement for the existing SLQ-48 on the 14 MCM Avenger class ships. The

Barracuda EMNS leveraged development of the Airborne Mine Neutralization System (AMNS). The BAE Systems Archerfish mine disposal underwater vehicle is a key element of EMNS. In November 2007, the U.S. Navy awarded Lockheed Martin an \$11 million System Development and Demonstration (SDD) contract to develop and integrate a new SLQ-60 MNS Seafox for the Navy's MCM 1 Avenger class ships.

AMNS. In October 2010, Raytheon received a \$14 million contract from the U.S. Navy to produce the ASQ-235 AMNS, to be deployed from helicopters (in particular, the MH-53). AMNS is deployed by the MH-60S multimission helicopter to locate and destroy underwater mines previously detected by Raytheon's AQS-20A minehunting sonar system.

Archerfish is the expendable mine neutralization component of the ASQ-235 AMNS.

The U.S. Navy is looking to develop a new mine neutralizer under the Barracuda program. This system could equip Littoral Combat Ships as part of their mine countermeasures suite.

The Barracuda system consists of an expendable in-water mine neutralizer with a warhead, a communications buoy, and associated support equipment. This system will destroy mines found by other mine detection systems.

The mine neutralizers could deploy from the LCS or an unmanned surface vessel (USV) such as the Textron Common Unmanned Surface Vehicle (CUSV). Shore-based sites will control the Barracudas launched from USVs.

(A market intelligence report on Archerfish/Barracuda is available in Forecast International's *Unmanned Vehicles Forecast – Land & Sea Systems*.)

SLQ-60 SMNS Seafox. This particular system has been developed and produced by Lockheed Martin (based upon an upgrade of Atlas Elektronik's original Seafox) for the U.S. Navy to replace the aged SLQ-48. The difference between the SLQ-48 and the SLQ-60 is that the SLQ-48 is reusable and can be reloaded with various mission packages, whereas the SLQ-60 is outfitted with a shaped charge that destroys the sea mine as well as itself.

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An airborne-launched version of Seafox is under development. It will likely operate in the same manner as the ASQ-235 AMNS.

(A market intelligence report on Seafox is available in Forecast International's *Anti-Submarine Warfare Forecast, Unmanned Vehicles Forecast – Land & Sea Systems, and Warships Forecast.*)



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Source: U.S. Navy



USS Avenger MCM 1 Mine Countermeasures Ship

Source: U.S. Navy

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Seafox MCM

Source: U.K. Royal Navy

Program Review

Background. The first SLQ-48(V) prototypes were fielded in 1978. Testing of the first engineering development system took place on the USS *Fidelity* oceangoing minesweeper. Production began in the mid-1980s. The first operational system went to sea on the USS *Avenger* (MCM 1) in 1988. The original work was performed by Honeywell Marine Systems. Alliant Techsystems took over the programs in September 1990 when Honeywell's Defense and Marine Systems business (Test Instruments Division) and its Signal Analysis Center left the parent company and together became an independent entity.

The Persian Gulf War. Iraqi forces deployed 1,167 mines during Operation Desert Shield, many of which were reproductions of World War I contact mines. The fields also included high-technology magnetic and acoustic mines, as well as some acoustic influence mines. This extensive use of mines was one of the first offensive uses of what had been primarily a defensive, protective weapon. The Iraqis used mines to disrupt sea lanes used for moving materiel into the theater and to protect the Kuwaiti coast from amphibious assault.

They also set mines adrift intentionally to randomly disrupt coalition naval operations.

The USS *Avenger* was the only mine countermeasures ship in the Persian Gulf equipped with the SLQ-48. The U.S. mine countermeasures force also included six MH-53 helicopters for airborne mine countermeasures, three old ocean minesweepers, and several explosive ordnance detachments. The coalition deployed a force of 32 mine countermeasures vessels. None but the British assets arrived in the theater before the war ended.

The USS *Tripoli* (LPH 10) struck a moored contact mine during the conflict, creating a 16 x 20-foot hole below the water line. The AEGIS cruiser USS *Princeton* (CG 59) was also damaged by what was reported to be an Italian-produced acoustic/magnetic mine. The ship was severely damaged, requiring \$17.6 million in repairs to return the vessel back to sea a year later.

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Old-Fashioned Mine Warfare Makes a Comeback in the Gulf War

In its final report to Congress on the Gulf War, the U.S. Department of Defense noted that although the Iraqi minefields were not placed to maximize their effectiveness and many mines were deployed improperly, mine warfare had a considerable effect on coalition maritime operations in the Persian Gulf. Mines were cited as one of several reasons why an amphibious invasion was not conducted.

In FY91, the Navy ordered the components needed to incorporate the SLQ-48(V) into the SSQ-94 MHC / MCM onboard combat system trainer. Critical Design Reviews of the SLQ-48(V) module were completed in FY92. The modules were tested and integrated in FY93. Also in FY93, the Navy announced its intent to develop a new mission package for the SLQ-48.

SLQ-48(V) Mission Package 3. Mission Package 3 (MP-3) was a replacement for the MP-1 (the mission objective of the MP-2 is different from that of the MP-1 and MP-3). It has a weight restriction of approximately 180 pounds and meets all requirements of the existing mission packages regarding magnetic signature, HERO/EMI, and capability to operate with standardized NATO signals. In 1998, Raytheon was awarded a contract worth \$9.3 million for production of SLQ-48(V) MP-2s and MP-3s. Contract work was completed by August 2000.

Mine Search System (MSS). At the Farnborough Air Show in the U.K. in September 1992, Lockheed Missiles & Space Company and the U.S. Defense Advanced Research Projects Agency (DARPA) announced that they had begun sea trials of an unmanned underwater vehicle to guide submarines or surface ships through a minefield or to autonomously survey an area for mines. The 40-foot-long MSS employs forward- and side-looking sonar and onboard data processing to locate and identify potential mines. Sea trials were conducted to demonstrate methods of avoiding mines – the system does not take action against the mines.

Integrated Acoustic Tracker. The Navy has developed an integrated acoustic tracker to track and display SQQ-32 sonar tow ball and SLQ-48(V) MNS positions relative to the ship, each other, and the target or threat to be avoided. It enhances the steering of the ship for transit and hover operations. The display also assists the SLQ-48(V) operator in performing mine neutralization operations.

U.S. Navy to Replace SLQ-48 with SLQ-60 SMNS Seafox

In November 2007, the U.S. Navy awarded Lockheed Martin an \$11 million SDD contract to develop a new Seafox, the SLQ-60 SMNS, for the Navy's MCM 1 Avenger class ships. The SMNS Seafox is designed to protect carrier and expeditionary strike groups by rapidly re-acquiring, targeting, and neutralizing moored and sea-bottom mines. The SLQ-60 SMNS Seafox deploys the Navy's chosen common mine neutralizer, BAE Systems' Archerfish mine disposal system – a remotely operated underwater vehicle that locates mines using sonar, enables the operator to identify the mine using video, and destroys the mine when commanded by the operator.

Under the terms of the contract, Lockheed Martin would develop hardware, software, and interfaces for the SMNS and integrate the system with the MCM ships. The company initially delivered two SLQ-60 SMNS Seafox engineering development models (EDMs) to the Navy for developmental and operational testing and evaluation. Lockheed Martin's Undersea Systems facility in Syracuse, New York, manages contract work.

For the U.S. Navy, SLQ-60 SMNS Seafox greatly reduces the time between mine detection and mine neutralization, improves mine countermeasure mission effectiveness, and reduces the amount of time that sailors are required to operate in minefields. The SLQ-60 SMNS Seafox will eventually replace the SLQ-48 MNS deployed on all MCM class ships.

The SLQ-60 SMNS Seafox leverages ongoing efforts in the Airborne Mine Countermeasures program. A deepwater neutralization version of the SLQ-60 SMNS Seafox is under development, with proof of concept testing in progress. Until the SLQ-60 is ready for the Fleet, the SLQ-48 will remain in operation.

U.S. Navy Orders Additional Seafox MDVs

The U.S. Navy ordered additional Seafox mine disposal vehicles in October 2012. The Seafox MDV took part in a major mine countermeasures exercise in the Persian Gulf in September 2012. Under an Urgent Operational Need contract from the Naval Surface Weapons Center, Indian Head, Maryland, Atlas North America was to deliver the Seafox MDVs to the U.S. Navy Central Command. All deliveries were expected to be completed within one calendar year.

The Seafox MDVs augment the SMNS Seafox and AMNS Seafox. U.S. orders could help to boost demand for Seafox among other navies.

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Besides the United States, Seafox clients include Belgium, Estonia, Finland, Germany, Japan, the Netherlands, Sweden, and the United Kingdom. Demand for Seafox is sufficient to keep the production run active for another 10 years. Atlas North America is a wholly owned subsidiary of Atlas Elektronik GmbH of Bremen, Germany.

Raytheon to Develop Expendable Mine Neutralization System

In April 2018, Raytheon won an \$83.3 million contract from the U.S. Navy for development of the Barracuda mine neutralization system.

The Barracuda is an expendable, autonomous unmanned underwater vehicle intended to identify and neutralize bottom, near-surface, and drifting sea mines. The system will field a shallow water capability and be an expendable modular neutralizer consisting of a kill mechanism, propulsion, sensors, and a communications buoy that enables wireless communication to the deployment platform.

The U.S. Navy will arm its Littoral Combat Ships with the Barracuda system. The mine neutralizers could

deploy from the LCS or a USV. The Barracuda could be available for development testing in the 2020s.

Work under this contract was completed by November 2022. The Raytheon unit is located in Portsmouth, Rhode Island.

Sparton and Raytheon Team on Next-Generation Mine Neutralization System

Sparton Corp announced in May 2018 that it had teamed with Raytheon to support the design, test, and deployment of the next-generation Barracuda mine neutralization system. Sparton will design and develop the deployment packaging and wireless communications buoy supporting Raytheon's mine neutralizer vehicle. Sparton will also support system fabrication.

U.S. Navy to Operate SLQ-48 Mine Neutralization System for as Long as Possible

In January 2019, the U.S. Navy announced it was overhauling and reconditioning its fleet inventory of SLQ-48 mine neutralization vehicles to sustain the system to the end of its full service life.

Funding

	U.S. FUNDING							
	FY23 QTY	FY23 AMT	FY24 QTY	FY24 AMT	FY25 QTY	FY25 AMT	FY26 QTY	FY26 AMT
RDT&E (U.S. Navy)								
PE#0603502N								
Surface & Shallow Water								
MCM*	-	83.8	-	34.6	-	29.4	-	33.8
	FY27 QTY	FY27 AMT	FY28 QTY	FY28 AMT	FY29 QTY	FY29 AMT	FY30 QTY	30 AMT
RDT&E (U.S. Navy)								
PE#0603502N								
Surface & Shallow Water								
MCM*	-	27.4	-	27.1	-	27.6	-	N/A

N/A = Not Available

All \$ are in millions.

Source: U.S. Department of the Navy FY25 RDT&E Program (R-2)

*This program funds SLQ-48(V) MP-3 upgrades as well as other mine countermeasures such as various USVs, the SLQ-60 SMNS Seafox, and the Barracuda EMNS, which is replacing the SLQ-48(V). Individual item funding for the SLQ-48(V) is not broken out beyond the project level. In FY21, several projects within the Surface & Shallow Water MCM program were realigned to another effort.

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Contracts/Orders & Options

The following is the most recent contract identified for the SLQ-48(V).

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Raytheon	83.3	Apr 2018 – Contract to develop the Barracuda expendable mine neutralization system. Work was completed by Nov 2022.

Worldwide Distribution/Inventories

This is a U.S. Navy program. International sales are possible, but if allowed, will likely be restricted.

Forecast Rationale

Although the SLQ-48 mine neutralization system suffers from parts obsolescence and a severe lack of qualified vendor sources, it continues to be as solid a workhorse as any old seadog. However, this legacy system has become too maintenance-intensive to warrant further production and has been kept alive through spare part replacements, retrofits, and upgrades – the system is that good at its job.

Eventually, the U.S. Navy will fully replace the SLQ-48(V) with the SLQ-60 SMNS.

The SLQ-48(V) will continue to receive operations and maintenance funding throughout the forecast period, as control system support, replacement hardware, and computer upgrades are usually needed as long as a system remains in use. Spare and repair parts will also remain in demand and can be expected to be procured through the next several years.

No major production run of the SLQ-48(V) system is forecast at this time. Any related manufacturing will likely be on a spares and repair-parts basis. Thus the forecast chart has been omitted.