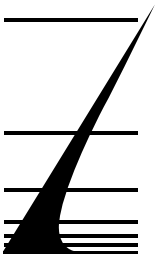
# The Market for Airborne ASW Sensors

Product Code #F672



A Special Focused Market Segment Analysis by:



FORECAST INTERNATIONAL

# Analysis 1
# The Market for
# Airborne ASW Sensors
# 2010-2019

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# PROGRAMS

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# Introduction

Aviation assets are undoubtedly the most mobile, flexible and cost-effective ASW systems available to the world's navies. Whether they are shore-based long-range maritime patrol aircraft or ship-based short-range helicopters, aircraft form the primary means of defense against a submarine attack and the key weapon in an offensive against enemy submarine forces. They owe this position to a synergistic range of capabilities that provide an unchallenged series of tactical options for an ASW operator.

Aircraft feature the mobility required to quickly counter developing threats and exploit fleeting contacts and are equipped with sensors that enable them to re-acquire and prosecute contacts. They also have the ability to carry a range of weapons that have a reasonable capability against most types of submarine. Even better from the aircraft crew's point of view, the submarines they are hunting can't shoot back – or at least not now. That situation may change within the period covered by this forecast.

Ironically, this primacy of aviation assets as an ASW tool has evolved despite the extreme difficulties facing the sensors such aircraft deploy. Aircraft, by their nature, fly above the sea; submarines, by their nature, sail underneath it. Between the two is a virtually impermeable barrier that defeats most attempts to detect one from the other. Under certain circumstances, aircraft can visually detect submarines; under equally constrained circumstances, submarines can hear aircraft. Anything more than that represents the interesting technical challenge that drives the market for airborne ASW sensors.

## *Arriving on the Scene*

Coincidentally, both the aircraft and the submarine started to appear in military use at about the same time and each was the centerpiece of the efforts of a small, dedicated cadre of enthusiasts who sought to gain recognition for the advantages offered by the new technologies. As aviation technology developed, aircraft quickly established themselves as an effective operational counter to submarines because they were found to be uniquely suited to a number of anti-submarine roles. Although these roles have evolved with passing years and changing technology, their basic structure remains unchanged. Today, the fundamental makeup of airborne ASW forces remains long-range maritime patrol aircraft to provide extended-duration area coverage, and shipborne helicopters to provide point cover and fast reaction. The sensor requirements of ASW aircraft are, obviously, determined by the role of the aircraft in question. The types of aircraft used for ASW operations fall into the following broad groups.

**Long-Range Maritime Patrol Aircraft (LRMPA).** These are the large, land-based aircraft used for long-duration maritime patrol. They were initially a specialized subset of general-purpose maritime reconnaissance aircraft but quickly evolved into a much more specialized type. The earliest aircraft in this category were flying boats, but, by the middle of World War II, land-based aircraft had demonstrated a convincing superiority over the flying boats and essentially supplanted them. A few flying boats remain in service, primarily with Russia, China and Japan, but these are exceptional cases that reflect unique operational circumstances. The overwhelming majority of the world's LRMPA now predominantly operate from land airbases.

The primary characteristics of the LRMPA group are payload (expressed as offensive weaponry), endurance, (a function of fuel load and engine efficiency), and sensor sophistication. Finally, the aircraft are required to be reliable. Frequently operating at low altitude, far from land and in foul weather, the aircraft must, above all, be dependable. Speed, defensive armament, armor protection, and agility are conspicuous by their absence from the list of high-priority characteristics. Interestingly, the most successful LRMPA have been derived from civilian airliners rather than military aircraft such as long-range bombers.

The role of LRMPA can be defined as area coverage. Their long endurance allows them to loiter in an operational area for prolonged periods and provide coverage for areas far removed from friendly territory. By the mid-1940s, their capability to find a surfaced submarine had developed to the point where submarines, at least those that had to spend a significant proportion of their time surfaced, had been driven from the sea. The primary sensor used in this role was surface search radar, which could detect hostile submarines operating on the surface over wide areas.

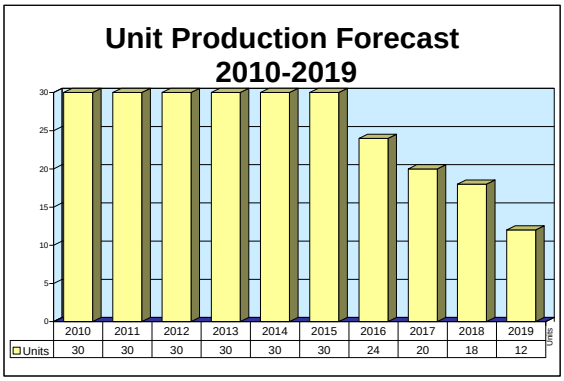
Attacking submarines was a more difficult problem. If they could be caught on the surface, they could be bombed with a reasonable chance of success. The problem was that the submarines would usually dive when the LRMPA was spotted, depriving it of a target for its bombs. An early solution was the air-dropped depth charge that could be dropped on the predicted position and depth of the submarine. This could work once, but a second pass was impossible. By the time it

**Continued…**

# AQS-22 ALFS (Airborne Low Frequency Sonar)

## Outlook

- Production should parallel production of the MH-60R helicopter, which is the main platform for the AQS-22
- A few additional units may be produced for various other platforms
- The U.S. Navy may procure a total of 271 MH-60R helicopters
- Look for solid production for several years




## Orientation

**Description.** The AQS-22 Airborne Low Frequency Sonar (ALFS) is a U.S. Navy helicopter-borne low-frequency active/passive dipping sonar used to locate, identify, and track submarines.

**Sponsor**
U.S. Navy
Naval Air Systems Command
Arlington, VA
USA

**Status.** In production.

**Platform.** SH-60B LAMPS Mk III, SH-60F Seahawk, and other shipborne ASW helicopters; in particular, the MH-60R multimission helicopter, which is replacing the SH-60B and SH-60F.

**Application.** U.S. Navy's principal anti-submarine warfare (ASW) helicopter-borne dipping sonar.

**Price Range.** Estimated cost is $4.226 million per unit, based on a review of contract cost averaging from a June 2008 contract award.

## Contractors

### Prime

| | |
|---|---|
| **Raytheon Integrated Defense Systems** | http://www.raytheon.com, 50 Apple Hill Dr, Tewksbury, MA 01876 United States, Tel: + 1 (978) 858-5000, Fax: + 1 (978) 858-9414, Email: IDS@raytheon.com, Prime |

## AQS-22 ALFS (Airborne Low Frequency Sonar)

## Subcontractor

| | |
|---|---|
| **General Dynamics Corp** | http://www.gd.com, 2941 Fairview Park Dr, Suite 100, Falls Church, VA 22042-4513 United States, Tel: + 1 (703) 876-3000, Fax: + 1 (703) 876-3125 (Performance Software) |
| **Thales Underwater Systems** | http://www.thalesgroup.com/naval, 525 Route des Dolines, BP 157, Sophia Antipolis, 06903 France, Tel: + 33 4 92 96 30 00, Fax: + 33 4 92 96 39 50, Email: TUS@thales-underwater.com (Dipping Sonar Subsystem) |

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

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

AQS-22 ALFS

Source: Raytheon


U.S. Navy's SH-60R/MH-60R Multimission Helicopter

Source: Sikorsky

AQS-22 ALFS (Airborne Low Frequency Sonar)

# Technical Data

The AQS-22 ALFS (Airborne Low Frequency Sonar) provides ASW sonar detection for the U.S. Navy's SH-60R. According to Navy RDT&E documents, the ALFS dipping sonar has three to six times the capability of its predecessor, the AQS-13F, in terms of square miles of ocean searched. In addition to performing long-range active sonar search, ALFS detects and classifies submarine threats. The system's advanced sonobuoy data processing capability comes in the form of the AT&T Technology UYS-2 Enhanced Modular Signal Processor (EMSP).

ALFS is reported to be modular in design, allowing easy installation, removal, and maintenance of the system for flexibility in outfitting SH-60B/F/R aircraft for secondary missions when required.

While specific system parameters have not been released, ALFS is said to be an improvement over the previously used AQS-13F. The AQS-13F's parameters include an operating depth of 1,450 feet with a 50-foot hover; operating frequencies of 9.2, 10, and 10.7 kHz; a sound pressure level of 216 dB with a ±1 dB reference; range scales of 1, 3, 5, 8, 12, and 20 thousand yards; and a weight of 617 pounds. The average raise speed is 22 feet per second (fps), lowering speed is 16 fps, and water exit speed is 5 fps.

# Variants/Upgrades

**EMSP Alternative.** To keep the program's schedule and costs in line, the U.S. Navy conducted a survey to review potential alternatives to the AT&T UYS-2 EMSP as the ALFS signal processor. The Navy has remained committed to the UYS-2. However, it appears that ALFS may be the only large application of the UYS-2, as other ASW applications have been reduced in scale or terminated.

# Program Review

**Background.** The ALFS program grew out of the U.S. Navy's concern over the high-speed, deep-diving, very quiet Soviet nuclear submarines that began appearing in the late 1980s. Program research was carried out under PE#0604219N Airborne Anti-Submarine Warfare Development: Project W0485 Carrier ASW Helicopter Avionics Improvement. During the early 1980s, most of this program's efforts were focused on the AQS-13F dipping sonar.

### *Deep-Diving Soviet Submarines Spark Need for Better Airborne ASW*

By mid-FY89, five competing consortia had formed to bid for the ALFS program. The consortia included Allied Signal Aerospace's Bendix, which teamed with British Aerospace and FIAR to develop the Helras dipping sonar; and Martin Marietta, which teamed with Diagnostic Retrieval Services to develop the High Performance Active Sonar. Subsequently, Martin acquired Gould's ASW operations in Baltimore, Maryland, forcing Plessey to seek a new partner. Plessey eventually teamed with IBM to offer its Cormorant sonar. Lockheed Sanders of the U.S. teamed with the U.K. firm GEC Avionics to develop the Osprey dipping sonar, and Thomson-Sintra and Hughes Aircraft collaborated on a variant of Thomson's Folding Light Acoustic System for Helicopters (FLASH).

In FY90, the U.S. Navy invited competitors to tender a bid on ALFS. Subsequent to the invitation, the U.S. Navy sought submission of an alternative plan incorporating the UYS-2 EMSP into the configuration. It was estimated that such a plan would have cost each competitor $1 million to develop. Three of the competitors – Plessey, Martin Marietta, and Bendix – sent letters to the Navy opposing the move. Shortly after the letters were sent to the Navy, the invitation was rescinded.

### *ALFS Design First Based on FLASH Sonar*

The U.S. Navy selected the team of Hughes/Thomson-Sintra ASM in December 1991 to develop the ALFS. That team's design was believed to be based on Thomson's FLASH low-frequency dipping sonar. FLASH operates at three frequencies, all below 5 kHz, with 24 pre-formed beams. The processing system featured the Motorola 68000 microprocessor in a bus environment and was programmed in the Ada language. Thomson (now Thales) reportedly supplied the expandable sonar array and reeling winch subsystem. Hughes (now Raytheon) was responsible for supplying the overall engineering/development models for testing.

PE#0604212N ASW and Other Helo Developments: Project H0485 ALFS. ALFS hardware and software design was finalized in FY93

## AQS-22 ALFS (Airborne Low Frequency Sonar)

and a Critical Design Review was conducted. During this period, ALFS/UYS-2 integration continued while system-level testing was started. The ALFS integration contract was awarded as a component of the Block II contract. Government software development testing was initiated, and the ALFS/UYS-2 non-recurring engineering continued.

### *First ALFS Units Start Production*

Manufacture and delivery of ALFS preproduction units started in FY94. The contractor's initial in-water test period ended at this time. Other project achievements for the year included full ALFS subcomponent integration, design verification testing, and factory acceptance testing of initial engineering development models. Also, software development testing and a systems engineering analysis were conducted.

Software configuration item preparation and testing were completed in FY95, along with reliability and maintainability testing and environmental and functional qualification tests. Also, the ALFS preproduction EDM units for developmental testing (DT-IIA) were delivered. In other efforts, electromagnetic interference testing was conducted, and the effort to develop the acoustic system was begun. DT-IIA lake and OT-IIA flight testing were conducted in FY96, and system-level SH-60R/ALFS integration began before the end of the year.

The FY97 agenda called for analyzing test data and implementing fixes identified during DT-IIA and OT-IIA in preparation for system TECHEVAL and OPEVAL, which were scheduled to coincide with Block II testing under Project H1707 MMH Upgrade Development (also part of PE#0604212 ASW and Other Helo Developments). In FY99, the remainder of ALFS development was transferred to Project H1707 MMH Upgrade Development, where the system was added to the SH-60B helicopter's existing acoustic suite in hopes of greatly enhancing the platform's ASW and anti-surface warfare (ASuW) missions.

PE#0604216N Multimission Helicopter Upgrade Development: Project H1707 MMH Upgrade Development. Transferred to this program in FY99, the ALFS effort continued its focus on unit refurbishment, deficiency corrections, integrated logistics support, and engineering and testing.

Efforts during FY01 were centered on multiple low-rate initial production (LRIP) reviews. Combined technical and operational evaluation of ALFS and the MH-60R platform was begun in the summer of 2001 and continued through mid-2002. (The MH-60R helicopter became operational in 2006.) In an important development, in the summer of 2001, the original SH-60R program underwent a major restructuring. The U.S. Navy decided to build totally new helicopters rather than upgrade existing ones. The new helicopter was designated the MH-60R.

Plans for FY03 called for continuing acoustic processor (including ALFS) development, integration and testing, and for correction of deficiencies encountered during testing and integration in order to support TECHEVAL and OPEVAL.

In other efforts, work progressed on the design and implementation of common commercial off-the-shelf (COTS) signal processing to replace aging signal processors.

### *AQS-22 Passes Technical Tests, Production Begins*

From January to May 2001, the AQS-22 successfully completed deep-water dipping trials under high sea conditions in the Atlantic Ocean. Lockheed Martin then successfully integrated the AQS-22 into a prototype helicopter for ground and flight tests. Lockheed Martin won an $88 million SH-60R LRIP contract in 2000 to provide the U.S. Navy with seven MH-60R multimission helicopters.

### *Sikorsky MH-60R Approved for Full-Rate Production*

The U.S. Navy approved full-rate production of its next-generation anti-submarine and surface attack helicopter, the MH-60R Seahawk, on March 31, 2006. In an effort to realize long-term cost savings, the Navy may procure up to 271 MH-60R helicopters – 144 of them via a joint multiyear contract with the Army that combines air vehicle purchases from Sikorsky Aircraft Corp of Stratford, Connecticut, with procurement of the Army's UH-60M and the Navy's MH-60S.

# Funding

**U.S. FUNDING**

| | FY08 QTY | FY08 AMT | FY09 QTY | FY09 AMT | FY10 QTY | FY10 AMT | FY11 QTY | FY11 AMT |
|---|---|---|---|---|---|---|---|---|
| **RDT&E (U.S. Navy)** | | | | | | | | |
| PE#0604216N | | | | | | | | |
| Multimission Helicopter Upgrade Development: | | | | | | | | |
| Project H1707 | | | | | | | | |
| MH-60R Dev.(a) | - | 74.2 | - | 69.8 | - | 81.9 | - | N/A |

All $ are in millions.

N/A = Not Available.

Source: U.S. Department of the Navy FY10 RDT&E Budget Item Justification R-2

(a) In FY98, ALFS funding and milestones were incorporated into Project H1707 as part of the LAMPS III Improvement program. This project contains funding for efforts in addition to ALFS.

# Contracts/Orders & Options

| Contractor | Award ($ millions) | Date/Description |
|---|---|---|
| Digital System Resources | 25.0 | Jul 2003 – U.S. Navy contract with a potential total value of $25 million for further development and testing of the AQS-22. The primary objective was to provide engineering services and software products to support performance testing of the AQS-22. DSR was to maintain and improve the software tools previously developed and delivered to support AQS-22 laboratory and field tests, implement corrections for deficiencies in the MH-60R acoustics processing, and support planning and analysis of performance testing. Work completed Aug 2008. (N68335-03-D-0105) |
| Raytheon | 50.8 | Feb 2007 – Contract for the manufacture, qualification, and delivery of 19 full-rate production Lot V MH-60R AQS-22 ALFS systems and related program support. Work was to be performed in Portsmouth, RI (60 percent) and Brest, France (40 percent), and was expected to be completed in Sep 2009. This contract was not competitively procured. The Naval Air Systems Command, Patuxent River, MD, was the contracting agency. (N00019-07-C-0013). |
| Raytheon | 15.4 | Nov 2007 – Contract for three additional AQS-22 systems; development toward a technology refresh of the sonar transmitter-receiver control module; provision of automated test equipment for analog and digital modules; and provision of increased acoustic test capabilities. Work under the contract is being performed at Raytheon's Maritime Mission Center, Portsmouth, RI. (Contract number not available). |
| Raytheon | 89.0 | Mar 2008 – Two U.S. Navy contracts with a total value of $89 million for the AQS-22 ALFS. Raytheon will provide whole-life engineering to support AQS-22 systems already in the fleet, enhancing operational readiness. To date, Raytheon has delivered 14 AQS-22 systems and is under contract for an additional 28. Work will be performed at Raytheon's Seapower Capability Center, Portsmouth, RI, and by AQS-22 partners DRS Sonar Systems, Gaithersburg, MD, and Thales Underwater Systems, Brest, France. Work is expected to be completed by 2010. |

## AQS-22 ALFS (Airborne Low Frequency Sonar)

| Contractor | Award ($ millions) | Date/Description |
|---|---|---|
| Raytheon | 63.4 | Jun 2008 – Contract from the U.S. Navy for AQS-22 ALFS. Under the contract, IDS will manufacture, integrate, test, and deliver 15 new ALFS systems, as well as provide miscellaneous "weapons replaceable assemblies for unit under test" and air maintenance trainer assets. To date, Raytheon has delivered 16 AQS-22 systems and is currently under contract for 43. This contract followed two ALFS contracts totaling $89 million to provide spares for whole-life support of deployed systems. Work will be performed at Raytheon's Seapower Capability Center, Portsmouth, RI, and by AQS-22 partner DRS Sonar Systems, Gaithersburg, MD. Work is expected to be completed by January 2011. |
| Raytheon | 17.1 | Dec 2008 – A firm-fixed-price, indefinite delivery/indefinite quantity long-term contract for overhaul of various weapons replaceable assemblies on the ALFS utilized on the MH-60R helicopter. Work will be performed in Portsmouth, RI (10 percent) and Brest, France (90 percent), and is expected to be completed by Dec 2010. Contract funds will not expire before the end of the current fiscal year. This contract was not competitively procured. The Naval Inventory Control Point is the contracting agency. (N00383-09-D-009F) |
| Raytheon | | Apr 2009 – A firm-fixed-price delivery order against a previously issued basic ordering agreement to provide intermediate "I" level support equipment for the AQS-22 ALFS, including reeling machine test benches and cable assemblies. Work will be performed in Johnstown, PA (90 percent) and Portsmouth, RI (10 percent), and is expected to be completed in Jan 2011. Contract funds in the amount of $3 million will expire at the end of the current fiscal year. The Naval Air Warfare Center Aircraft Division, Lakehurst, NJ, is the contracting agency. (N68335-07-G-0005) |
| Raytheon | 81.1 | Sep 2009 – A firm-fixed-price contract for the procurement of 23 FY09 full-rate production Lot VII AQS-22 ALFS for the MH-60R program. Work will be performed in Brest, France (72 percent); Portsmouth, RI (26 percent); and Gaithersburg, MD (2 percent), and is expected to be completed in Nov 2012. Contract funds will not expire at the end of the current fiscal year. This contract was not competitively procured. The Naval Air Systems Command, Patuxent River, MD, is the contracting agency. (N00019-09-C-0096) |

# Timetable

| Month | Year | Major Development |
|---|---|---|
| | FY91 | Procurement of AQS-22 ALFS EDM |
| Dec | 1991 | AQS-22 ALFS completes Milestone II |
| | FY94 | Delivery of AQS-22 ALFS preproduction units |
| | FY95 | Software development testing |
| Feb | 1998 | AQS-22 ALFS TECHEVAL |
| Jul | 1998 | AQS-22 ALFS OPEVAL |
| | 1998 | AQS-22 ALFS platform integration |
| | 1999 | First AQS-22 ALFS delivery to the Fleet for operational testing |
| | 2000 | LRIP program review |
| Jun | 2001 | AQS-22 ALFS TECHEVAL and OPEVAL |
| Nov | 2002 | Contract for four AQS-22 LRIP units |
| Dec | 2004 | Contract for 10 AQS-22 production units |
| | 2006 | MH-60R helicopter platform introduced to U.S. Navy Fleet |
| | 2009 | System in full production and integration aboard the MH-60R helicopter platform |

AQS-22 ALFS (Airborne Low Frequency Sonar)

## Worldwide Distribution/Inventories

The AQS-22 ALFS is a **U.S. Navy** system.

## Forecast Rationale

Raytheon's AQS-22 Airborne Low Frequency Sonar (ALFS) is a U.S. Navy helicopter-borne low-frequency active/passive dipping sonar used to locate, identify, and track submarines. The system is currently in full-rate production for the U.S. Navy, with its primary platform being the MH-60R helicopter. (A small number of units are being produced for various other platforms.) The only thing that may hamper AQS-22 production would be some slippage in the timetable for production of the MH-60R, which is unlikely at this time. Barring that, production of the AQS-22 is expected to ramp up to 30 units per year in 2010 and to remain at about that level through completion of the order in parallel with MH-60R helicopter production.

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION

| Designation or Program | High Confidence | | | | | Good Confidence | | | Speculative | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Total |
| **Raytheon Integrated Defense Systems** | | | | | | | | | | | | |
| **AQS-22 <> United States <> Navy <> UH-60/S-70 MH-60 R** | | | | | | | | | | | | |
| | 77 | 30 | 30 | 30 | 30 | 30 | 30 | 24 | 20 | 18 | 12 | 254 |
| | | | | | | | | | | | | |
| **Total** | 77 | 30 | 30 | 30 | 30 | 30 | 30 | 24 | 20 | 18 | 12 | 254 |

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☐ American Express

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| | U.S. | World |
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275-2 Yangjae Dong
Seocho-Gu Seoul 137-722 KOREA
Phone: (82) 2 572 4349 or (82) 2 572 4371
Fax: (82) 2 572 4370
E-Mail: nhk@forecast1.com
Website: www.forecast1.co.kr
Contact: Ms. Nam Hee Kim

# TERMS AND CONDITIONS

### DISCOUNT PRICING
Discount Pricing – Codes prefaced by CH, RH, Z, P or RTPS, and multi-user subscriptions, include a discount that is reflected in the marketed cost.

### BOOKSELLER DISCOUNTS
For information, call 203.270.0633 or 800.451.4975 (Toll-Free U.S. & Canada). E Mail: info@forecast1.com.

### NEW CLIENTS
Payment in full is required with the initial order.

### TERMS
Net 30 days. For overdue accounts we reserve the right to assess interest of 12% annually, and add collection fees.

### PURCHASE ORDER
If company requires, please submit a purchase order to ensure timely delivery.

### RETURNS OR REFUNDS
Due to the nature of our products, no returns are accepted and no refunds are provided.

### FORMS OF PAYMENT
We accept VISA, MasterCard, American Express, or a company check drawn on a U.S. bank in U.S. dollars. Wire Transfer Details: Contact customerservice@forecast1.com or call 203.270.0633.

Please ensure bank charges are not deducted from the total amount due. Note: Include the quotation or invoice number with your payment.

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