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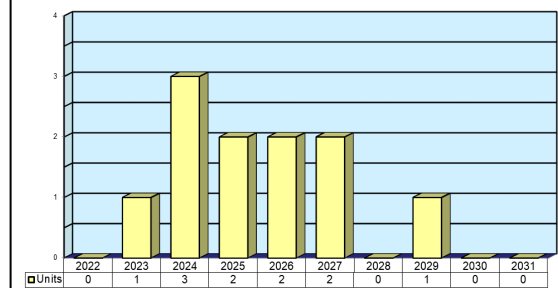
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AES-1 Airborne Laser Mine Detection System (ALMDS)

Outlook

- Production of 11 AES-1 ALMDSs is forecast from 2022 through 2031
- All production is speculative
- The U.S. Navy was expected to award a recompeted ALMDS contract in FY21; however, the contract has yet to be awarded

Unit Production Forecast
2022-2031



Orientation

Description. The AES-1 Airborne Laser Mine Detection System (ALMDS) is designed for aerial mine detection via laser (LIDAR) scanning. Its components are contained within a single pod that communicates through primary and auxiliary umbilical cables linked to the operator's console.

The AES-1 ALMDS is a component of the Mine Countermeasures Mission (MCM) package for U.S. Navy MH-60s. As part of the MH-60's MCM package, the ALMDS is paired with the Raytheon Technologies ASQ-235 Airborne Mine Neutralization System.

Sponsor

U.S. Navy
 Naval Surface Warfare Center
 Coastal Systems Station-Dahlgren Division
 Panama City, FL
 USA

Status. The AES-1 is in production.

Application. The AES-1 ALMDS pod is flown on board MCH-101 and MH-60S helicopters.

Price Range. Per the U.S. Navy's FY22 budget, the AES-1 ALMDS had an average price of \$10.6 million per unit through 2021. (Notably, however, the price per unit in contracts awarded in 2017 and 2018 averaged \$14.0 million.) The Navy is now recompeting the ALMDS contract, and the system is expected to be reduced in cost if a new contract is awarded.

AES-1 Airborne Laser Mine Detection System (ALMDS)**Contractors****Prime**

Northrop Grumman Aerospace Systems, Military Aircraft Systems	http://www.northropgrumman.com , 2000 W NASA Blvd, PO Box 9650, Melbourne, FL 32901 United States, Tel: + 1 (321) 951-5000, Prime
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Subcontractor

Arete Associates	http://arete.com , 3194 N Swan Rd, Tucson, AZ 85712 United States, Tel: + 1 (520) 571-8660 (Receiver Sensor Assembly)
CPI Aerostructures Inc	http://www.cpiaero.com , 91 Heartland Blvd, Edgewood, NY 11717 United States, Tel: + 1 (631) 586-5200, Fax: + 1 (631) 586-5840 (Pod Structures)
Curtiss-Wright Defense Solutions	http://www.curtisswrightds.com/company/locations-santa-clarita.html , 28965 Ave Penn, Santa Clarita, CA 91355 United States, Tel: + 1 (661) 257-4430, Email: ds@curtisswright.com (Electronics Chassis)
Cutting Edge Optronics	http://www.northropgrumman.com/who-we-are/cutting-edge-optronics , 20 Point West Boulevard, St. Charles, MO 63301 United States, Tel: + 1 (636) 916-4900, Fax: + 1 (636) 916-4994, Email: st-ceolaser-info@ngc.com (Laser Transmitter)
Meggitt Defense Systems	http://meggittdefense.com , 9801 Muirlands Blvd, Irvine, CA 92618 United States, Tel: + 1 (949) 465-7700, Fax: + 1 (949) 465-9560, Email: MDSI-info@meggitt.com (Thermal Management System)

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**AES-1 ALMDS**

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Diameter	53 cm	21 in
Length	2.7 m	107 in
Weight	365 kg	805 lb
Characteristics		
Emitter	Pulsed Laser	
Receiver	Streak Tube	
Scan Type	LIDAR	
Scan Method	Scan area generated by platform's forward motion	
Moving Parts	No	
Mount Type	Carriage Stream, Tow, Recovery System	
	Bomb Rack Unit 14 (BRU-14)	

AES-1 Airborne Laser Mine Detection System (ALMDS)

The AES-1 ALMDS is a podded system that utilizes lasers to detect mines in littoral waters. It flies on board helicopters, using a standard BRU-14 mount. Designers of the system made use of technologies developed for the Magic Lantern system, the ATD-111 system, and the Advanced Airborne Hyperspectral Imaging system. Among these is Light Detection and Ranging (LIDAR) technology.

The ALMDS scans a wide path as the helicopter flies, utilizing its platform's movement instead of moving

parts to generate the scan area. Other features include the ability to generate a topographic view of the ocean floor, together with a computer-enhanced image of the shapes, sizes, and locations of mines.

The objective of AES-1 ALMDS designers was to build a sensor that could accurately locate and identify mines in a single pass over the target area while minimizing threats to the helicopter.



An AES-1 ALMDS Unit Mounted on a U.S. Navy MH-60S

Source: U.S. Navy, Dave Sussman

Program Review

In 1997, the U.S. Congress ordered the Navy to conduct a competitive field test of existing airborne mine countermeasures. The mine detection systems tested failed to meet the Navy's performance requirements. However, the test did show that existing technologies were sufficiently mature to develop a next-generation airborne minesweeping system. The Navy concluded that incorporating the technologies produced for the Magic Lantern system, the ATD-111 system, and the Advanced Airborne Hyperspectral Imaging system

would reduce the risks associated with development of a future minehunting device.

As a result of the 1997 field test, the U.S. Navy decided to develop and manufacture the AES-1 Airborne Laser Mine Detection System (ALMDS).

In April 2000, the U.S. Navy awarded Northrop Grumman a \$40.3 million contract for AES-1 engineering and manufacturing development (EMD). In 2001, Northrop Grumman completed both the preliminary and final designs, and toward the end of the

AES-1 Airborne Laser Mine Detection System (ALMDS)

year, began building three engineering demonstration models (EDMs).

AES-1 ALMDS EMD activities continued through 2002, and in 2003, contractor testing was conducted, along with an operational assessment on a "platform of opportunity." The three AES-1 ALMDS EDMs were completed in December 2003.

Production Begins

In June 2005, the U.S. Navy announced that the AES-1 ALMDS had reached Milestone C, signifying that the system had completed its System Development and Demonstration (SDD) phase and was ready to enter production.

Production began officially under a September 2005 contract awarded to Northrop Grumman; the contract included options totaling \$124.5 million. The initial award was \$45.5 million for low-rate initial production (LRIP) of three AES-1 pods. Options totaling \$79 million allowed for an additional six LRIP AES-1 pods, one full-rate production lot of six pods, two training systems, and integrated logistics support.

Northrop Grumman announced delivery of the first pod in January 2007.

First International Customer

The AES-1 ALMDS nearly had its first international customer in 2009. In July, the U.S. Defense Security Cooperation Agency notified Congress of a possible Foreign Military Sale of eight MH-60S helicopters to the Republic of Korea. These helicopters would each be equipped with an AES-1 ALMDS pod.

The deal, though, would ultimately not occur. In January 2013, the ROK placed an order for eight

AW159 Wildcats, selecting the Italian helicopter over the rival MH-60S.

Northrop Grumman did, however, eventually secure an international order. In February 2012, the company announced that the Japan Maritime Self-Defense Force had purchased four ALMDSs as part of its ongoing procurement of MCH-101 helicopters.

In June 2013, delivery of the first ALMDS to Japan was reported to be on schedule for later that season. However, the first Airborne Mine Countermeasures-equipped MCH-101 (MCH-101 AMCM) was not handed over to the JMSDF until February 2015, marking the first operational AES-1 ALMDS in a non-U.S. military.

Initial Operational Capability

After beginning development in the '90s, the AES-1 ALMDS was officially declared to have reached Initial Operational Capability (IOC) in November 2016. The Navy had been taking delivery of the system since 2007 and, after slowly taking delivery of additional units, deemed the system "ready for prime time."

This IOC status, though, may have been granted prematurely. In July 2018, following an investigation, the U.S. Department of Defense Inspector General released a lengthy report that can be encapsulated as follows: the Navy MH-60S's Mine Countermeasures Mission (MCM) package – which includes the ALMDS, AMNS, and COBRA – was immature and should not have been declared to have reached IOC status. As a result, the IG recommended that procurement of the items in the MCM package be delayed so that they could properly complete operational test and evaluation.

Funding

	U.S. FUNDING							
	PRIOR AMT	FY20 AMT	FY21 AMT	FY22 AMT	FY23 AMT	FY24 AMT	FY25 AMT	FY26 AMT
RDT&E (U.S. Navy)								
<i>PE#0603596N –</i>								
<i>(U)LCS Mission Modules</i>								
Proj. 2550 – Mine								
Countermeasure (MCM)								
Mission Package	40.175	39.110	26.775	49.989	N/A	N/A	N/A	N/A
 <i>PE#0604373N – Airborne Mine</i>								
<i>Countermeasures (AMCM)</i>								
Proj. 4026 – Net-Centric								
Sensor Analysis for Mine								
Warfare (NSAM)	62.756	9.593	9.912	9.924	N/A	N/A	N/A	N/A

AES-1 Airborne Laser Mine Detection System (ALMDS)

	<u>PRIOR QTY</u>	<u>PRIOR AMT</u>	<u>FY20 QTY</u>	<u>FY20 AMT</u>	<u>FY21 QTY</u>	<u>FY21 AMT</u>	<u>FY22 QTY</u>	<u>FY22 AMT</u>
Procurement (U.S. Navy)								
<i>LI#1601 –</i>								
<i>LCS MCM Mission Modules</i>	-	347.972	-	64.789	-	189.397	-	40.630
Hardware – MC003 – Organic								
Airborne Mine Countermeasures								
(OAMCM) Systems Cost								
3.1.2) ALMDS	8	85.107	0	0.000	0	0.000	0	0.000
3.1.4) ALMDS Technology								
Refresh and Obsolescence								
Upgrades	-	3.900	-	0.981	-	3.105	-	0.000
<i>LI#4248 – Legacy Airborne MCM</i>	-	507.605	-	5.998	-	6.674	-	4.446
5 – ALMDS	12	109.326	0	0.408	0	0.000	0	0.000
7 – OAMCM	-	115.094	-	0.000	-	0.000	-	0.000

	<u>FY23 QTY</u>	<u>FY23 AMT</u>	<u>FY24 QTY</u>	<u>FY24 AMT</u>	<u>FY25 QTY</u>	<u>FY25 AMT</u>	<u>FY26 QTY</u>	<u>FY26 AMT</u>
Procurement (U.S. Navy)								
<i>LI#1601 –</i>								
<i>LCS MCM Mission Modules</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hardware – MC003 – Organic								
Airborne Mine Countermeasures								
(OAMCM) Systems Cost								
2.1.2) ALMDS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2.1.4) ALMDS Technology								
Refresh and Obsolescence								
Upgrades	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>LI#4248 – Legacy Airborne MCM</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5 – ALMDS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7 – OAMCM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All dollars are in millions.

N/A = Not Available

Source: U.S. Department of the Navy, FY22 Budget Estimates, Research, Development, Test & Evaluation, Navy, Vol. 2, Budget Activity 4, May 2021;

U.S. Department of the Navy, FY22 Budget Estimates, Research, Development, Test & Evaluation, Navy, Vol. 3, Budget Activity 5, May 2021;

U.S. Department of the Navy, FY22 Budget Estimates, Other Procurement, Navy, Budget Activity 1, May 2021;

U.S. Department of the Navy, FY22 Budget Estimates, Other Procurement, Navy, Budget Activity 3, May 2021

AES-1 Airborne Laser Mine Detection System (ALMDS)

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Northrop Grumman	24.91	Mar 2008 – Modification to a previously awarded contract from the U.S. Navy for a second LRIP lot of three AES-1 units. Work was expected to be completed by Jan 2010. (N61331-05-C-0049)
Lockheed Martin	5.55	Apr 2009 – CPFF, FFP, IDIQ contract for engineering and technical support for integration of the Organic Airborne Mine Countermeasures (OAMCM) systems for the MH-60S. The five systems include the AQS-20A Advanced Sonar System, Airborne Mine Neutralization System (AMNS), ALMDS, Rapid Airborne Mine Clearance System (RAMICS), and Organic Airborne and Surface Influence Sweep (OASIS). Work was expected to be completed by Apr 2014. (N61331-09-D-0009)
Northrop Grumman	9.50	Jun 2010 – Modification to a previously awarded contract from the U.S. Navy for continued post-delivery technical support (PDTs) and provisioned item order support for AES-1 system units. This modification increased the contract ceiling and period of performance in order for the contractor to provide PDTs of AES-1 LRIP units. The PDTs consisted of the following: modification and/or repair of delivered hardware; modification or build of new AES-1 system components to resolve producibility, obsolescence, and end-of-life issues; update of the technical data package with respect to the changes implemented; the maintenance of delivered hardware and software; and provision of the software upgrades and modifications required to optimize the performance of AES-1. The modification also provided the required engineering services, consisting of systems engineering; configuration and data management; quality assurance; manufacturing, test and evaluation; the generation of presentations, white papers, and trade studies; and the development, tracking, and updating of metrics. Work was expected to be completed by Dec 2010. The Naval Surface Warfare Center, Panama City, FL, was the contracting activity. (N61331-05-C-0049)
Northrop Grumman	45.00	Oct 2010 – Contract from the U.S. Navy for Phase 3 of LRIP of the AES-1 system. The contract includes the production of four pods, product development, and the provision of spares and support.
Northrop Grumman	Unknown	Feb 2012 – Procurement by the JMSDF of four ALMDS.
Northrop Grumman	27.06	Apr 2012 – Mod to a previously awarded contract from the U.S. Navy for low-rate production of the AES-1 ALMDS. Work was expected to be completed by Apr 2014. The Naval Surface Warfare Center, Panama City, FL, was the contracting activity. (N61331-10-C-0023)
Northrop Grumman	35.51	Dec 2014 – Firm-fixed-price contract for the fabrication, integration, test and production of ALMDS and the delivery of equipment and engineering services to support those systems. This contract includes options which, if exercised, would bring its cumulative value to \$163,572,967. Work was expected to be completed by Feb 2021. Fiscal 2013 and 2014 Other Procurement (Navy) funding in the amount of \$33,822,775 was obligated at time of award. The Naval Sea Systems Command, Washington, DC, was the contracting activity. (N00024-15-C-6318)

AES-1 Airborne Laser Mine Detection System (ALMDS)

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Northrop Grumman	Unknown	Feb 2015 – A contract from the U.S. Navy for the production of five ALMDS pod subsystems, support equipment, and spares, plus technical support.
Northrop Grumman	8.68	Sep 2015 – A firm-fixed-price modification to a previously awarded contract for AES-1 spares in support of Littoral Combat Ships. Work was expected to be completed by Jul 2017. The Naval Sea Systems Command, Washington, DC, was the contracting activity. (N0024-15-C-6318)
Northrop Grumman, Aerospace Systems	20.14	Feb 2016 – A firm-fixed-price, cost-plus-fixed-fee modification to a previously awarded contract for the exercise of options for ALMDS, depot services and software support, and support equipment for the Program Executive Office, Littoral Combat Ships. Work was expected to be completed by Mar 2018. Fiscal 2016 Other Procurement (Navy) and Operations and Maintenance (Navy) funding in the amount of \$19,732,562 was to be obligated at time of award. The Naval Sea Systems Command, Washington, DC, was the contracting activity. (N00024-15-C-6318)
Northrop Grumman, Aerospace Systems	8.41	Mar 2016 – An FFP modification to a previously awarded contract for a provisioned item order of ALMDS retrofit kits, supporting Program Executive Office Littoral Combat Ships. Work was expected to be completed by Dec 2018. (N00024-15-C-6318)
Northrop Grumman	17.85	Feb 2017 – A firm-fixed-price, cost-plus-fixed-fee modification to a previously awarded contract to exercise options for the ALMDS. Work was expected to be complete by Mar 2019. Fiscal 2017 Other Procurement (Navy), fiscal 2017 RDT&E (Navy), and fiscal 2017 Operations and Maintenance (Navy) funding in the amount of \$17,012,675 would be obligated at time of award. The Naval Sea Systems Command, Washington, DC, was the contracting activity. (N00024-15-C-6318)
Northrop Grumman, Aerospace Systems	15.30	Jun 2018 – An FFP modification to a previously awarded contract to exercise options for fabrication, integration, testing, system production, and delivery of peculiar support equipment for the ALMDS program. Work was expected to be completed by Jun 2020. (N00024-15-C-6318)
Northrop Grumman, Aerospace Systems	15.14	Apr 2019 – FFP modification to a previously awarded contract to exercise an option for the ALMDS pod system. Work was expected to be completed by Aug 2021. (N00024-15-C-6318)
Northrop Grumman Systems	11.47	Mar 2020 – FFP and fixed-price-incentive firm-target modification to a previously awarded contract for ALMDS/AMNS kits, common support container kits, and a 20-foot, reduced weight basic outfitting assembly to support the LCS Mission Modules Program. Work is expected to be completed by Nov 2022. (N00024-17-C-6311)
Northrop Grumman Systems	17.58	Mar 2021 – FPIF and FFP modification to a previously awarded contract for procurement of six organic airborne mine countermeasure kits and related equipment for integration into the LCS framework. Work is expected to be completed by Apr 2024. (N00024-17-C-6311)

AES-1 Airborne Laser Mine Detection System (ALMDS)



AES-1 ALMDS Flying on a JMSDF MCH-101

Source: Northrop Grumman

Worldwide Distribution/Inventories

The AES-1 ALMDS is in operation with the U.S. Navy and Japan Maritime Self-Defense Force.

Forecast Rationale

Northrop Grumman's AES-1 Airborne Laser Mine Detection System (ALMDS) is a podded LIDAR system that allows rotorcraft to detect surface and near-surface mines in littoral waters.

The ALMDS had a long path from RDT&E to production. Although development began in the late '90s and the first unit was delivered in 2007, IOC was declared only in late 2016 – and even then, a 2018 report by the U.S. Department of Defense Inspector General revealed that the IOC declaration was premature and that the system had not yet been proven operationally effective.

Perhaps due to the AES-1's extended gestation or to its high cost, the ALMDS program has only one customer outside of its U.S. home market. That customer is Japan.

There is a realistic yet dwindling chance that the ALMDS could secure further orders from international customers. A possible buyer is the U.K. Royal Navy, with which the system was tested in 2019. However, some reports indicate that this operation was conducted

to test the deployability of the MH-60's MCM package from a friendly, non-U.S. vessel, and not as a demonstration. At this time, any forecast for non-specified international customers should be considered highly speculative.

Japan has obtained four ALMDS units to date, but, alongside a potential order for 12 MCH-101s, may purchase up to four more. Additional production destined for Japan should also be considered speculative.

On the other hand, additional procurement for the U.S. is much more likely. Deliveries could resume in 2023 or 2024, following resolution of the IG's concerns and the award of a recompleted contract.

Following two recent U.S. presolicitations for AES-1 ALMDS units, in February 2020 and December 2020 (for up to 32 units and up to seven units, respectively), a new production contract was expected to be awarded sometime in 2021. However, as of the Navy's FY22 budget estimates, no procurement funding had been

AES-1 Airborne Laser Mine Detection System (ALMDS)

allotted for FY21 or FY22. As of March 2022, no new contract is known to have been awarded.

Given that the Navy's FY22 budget estimates lack information beyond FY22 and the general scarcity of public information about the AES-1 ALMDS program, it is unknown if the Navy is still planning additional procurement. Since the Navy's 2020 presolicitations varied so widely in unit count (up to 32 units and up to seven units), it is also difficult to peg a total number to the force's requirement. These factors make the Navy's

future delivery count uncertain and speculative. It is possible that with the ALMDS program's difficult history, no contract will be awarded.

If additional units are ordered, Northrop Grumman would be retained as the prime contractor. The company was the only manufacturer to respond to the Navy's recompleted AES-1 ALMDS sources sought notice.

Note: The production history includes prototype units.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence				Good Confidence				Speculative			
	Thru 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Northrop Grumman Aerospace Systems												
AES-1 ALMDS <> Japan <> Navy <> MCH101												
Note: Ongoing Production is Speculative												
	4	0	0	1	0	0	0	0	0	0	0	1
AES-1 ALMDS <> United States <> Navy <> MH-60 S												
Note: Ongoing Production is Speculative												
	15	0	1	2	1	2	1	0	0	0	0	7
AES-1 ALMDS <> Worldwide												
Note: Speculative												
	0	0	0	0	1	0	1	0	1	0	0	3
Subtotal	19	0	1	3	2	2	2	0	1	0	0	11
Total	19	0	1	3	2	2	2	0	1	0	0	11