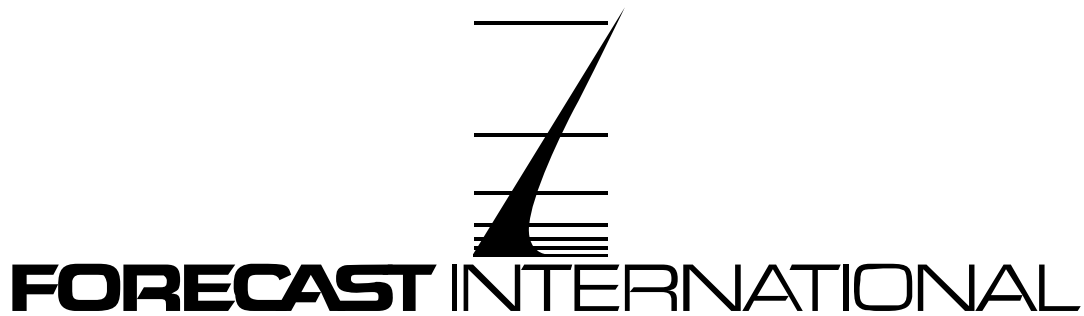


The Market for Airborne and Space-Based Electro-Optical Systems

Product Code #F633

A Special Focused Market Segment Analysis by:



Analysis 1

The Market for Airborne and Space-Based Electro-Optical Systems 2010-2019

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PROGRAMS

The following reports are included in this section: (**Note:** a single report may cover several programs.)

AAQ-13/AAQ-14 LANTIRN
AAQ-21/22 (Star SAFIRE)
AAQ-24 DIRCM (Nemesis)
AAQ-27
AAQ-28(V) (Litening II/ER/AT)
AAQ-33 Sniper XR/PANTERA
AAR-47(V)
AAR-54(V)
AAS-42
Aerial Common Sensor (ACS)
AES-1
Airborne Laser (YAL-1A)
Airborne Reconnaissance Low (ARL)
ALQ-212 (ATIRCM)/AAR-57 (CMWS)
ALR-94(V) (INEWS - F-22 EW Suite)
Arrowhead
ASQ-170(V)/AAQ-11(V) (TADS/PNVS)
ASQ-228/Advanced Targeting Forward-Looking Infrared (ATFLIR)
ASTAMIDS
AVR-2(V)
AVS-9 Night Vision Goggles
Damocles
Electro-Optical Targeting System (EOTS)
EO Sensors & Countermeasures Technology (U.S. Air Force)
EPX
IR/EO CM Technology (Air Force)
LAIRCM (Large Aircraft IRCM)
Night Vision Advanced Technology Airborne Systems
NUDET Detection System
OEPS-27
Panoramic Night Vision Goggles
PIRATE
SBIRS High
STSS (Space Tracking and Surveillance System)
TADIRCM (Tactical Aircraft Directed IRCM)
TIALD

Introduction

Optics is the study of the electromagnetic spectrum that covers visible, infrared, and ultraviolet light, as well as X-rays and microwaves. The human eye can only see part of this spectrum; we do not see ultraviolet, infrared, X-rays or microwaves. An electro-optical system refers to an electronic device that emits, modulates, transmits or senses light.

Some electro-optical devices are very complex. For example, the Airborne Laser (ABL) program funded the development of an airborne chemical oxygen-iodine laser (COIL) with an air-based boost missile-defense capability to equip a modified Boeing 747. Others, such as night vision goggles, are simpler. Night vision goggles collect available visible and near-infrared light (450-950 nanometers), then use an image intensifier tube to electronically multiply the light to present the user with an intensified image in low-light situations.

The military focuses on using new developments in EO technology to obtain an advantage for the warfighter. The Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base is dedicated to discovering, developing and integrating technologies in the air, space and cyberspace domains. The AFRL Sensors

Directorate includes separate technology branches to study EO sensors, EO combat identification measures, EO threat and target detection measures, and EO countermeasures.

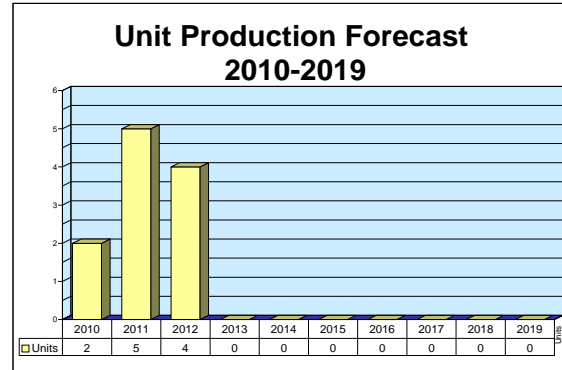
Wright-Patterson's Physics & Electronics Directorate hosts an opto-electronics program that in part studies optics, electromagnetics, communications, and signal processing. The U.S. Air Force states that this area of research considers all aspects of producing and receiving complex electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. It also covers aspects of the phenomenology of lasers and non-linear optics. This area not only considers the advancement of physical devices to enable such activities, but also explores sophisticated mathematics and algorithm development for the purpose of extracting information from complex and/or sparse signals. This activity impacts space object imaging, on-demand sensing modalities, distributed multilayered sensing, automatic target recognition, and navigation efforts. It also enables the provision of secure, reliable communications.

* * *

AES-1

Outlook

- Forecast International expects Northrop Grumman to sell 11 AES-1 systems to the U.S. Navy and Republic of Korea in the next 10 years
- The Republic of Korea represents the first international purchase of the AES-1
- The need for next-generation mine-countermeasures technology is driving AES-1 buys



Orientation

Description. The AES-1 is an airborne laser mine detection system developed by Northrop Grumman Corp. It is designed for high-speed helicopter flight, and uses a helicopter-mounted laser to detect and contain floating and anchored sea mines.

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. Discovering and containing anchored and floating sea mines.

Price Range. According to a U.S. Navy FY10 procurement budget document, the cost of a single AES-1 is \$7,433,000 in FY10 dollars.

Contractors

Prime

Northrop Grumman Corp	http://www.northropgrumman.com , 1840 Century Park E, Los Angeles, CA 90067-2199 United States, Tel: + 1 (310) 553-6262, Fax: + 1 (310) 201-3023, Email: onewebmaster@ngc.com, Prime
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 Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

AES-1

Technical Data

The AES-1 is a laser-based system that is mounted in a helicopter. 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 laser is configured to scan an extremely wide path of the ocean while the helicopter flies at high speed. 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 goal of AES-1 designers was to build sensors that could accurately locate and identify mines in a single pass over the target area while minimizing threats to the helicopter.

Northrop Grumman produces the system pod and workstation for the AES-1. It is also responsible for integrating the AES-1 into the aircraft employing it, the MH-60 helicopter. Arete Associates provides the LIDAR system used in the AES-1.



The U.S. Navy employs the AES-1 for hunting sea mines.

Source: Public Domain

Program Review

In 1997, the U.S. Congress directed 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 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.

U.S. Navy Develops AES-1

As a result of the 1997 field test, the U.S. Navy decided to develop and produce the airborne laser mine detection system (ALMDS), or AES-1. AES-1 research and development was conducted under Project 2047

(ALMDS) within Program Element #0604373N (Airborne Mine Countermeasures). Production and procurement of the AES-1 is funded under the following U.S. Navy budget items: Airborne Mine Countermeasures, S0075; and Littoral Combat Ship (LCS) Modules, LM001.

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 completed both the preliminary and final designs of the AES-1. Toward the end of 2001, Northrop Grumman began building three engineering demonstration models (EDMs) of the AES-1.

AES-1 EMD continued into 2002. During 2003, the Project 2047 conducted testing AES-1 contractor testing, along with an operational assessment on a "platform of opportunity." In December 2003, Northrop Grumman completed building the three AES-1 EDMs.

Northrop Delivers First AES-1 Pod to U.S. Navy

In June 2005, the U.S. Navy announced that Northrop Grumman's AES-1 had reached Milestone C of the U.S. DoD's Defense Acquisition Management Framework. Attaining Milestone C signified that the AES-1 had completed the System Development and Demonstration (SDD) phase and was ready to enter production.

In September 2005, the Navy awarded Northrop Grumman a contract and options totaling \$124.5 million to manufacture the AES-1. The initial contract award totaled \$45.5 million for low-rate initial production (LRIP) of three AES-1 pods. This contract includes options totaling \$79 million for an additional six LRIP AES-1 pods, one full-rate production lot of six pods, two training systems, and integrated logistics support.

In January 2007, Northrop Grumman announced it had delivered one LRIP AES-1 pod to the U.S. Navy.

In March 2008, the U.S. Navy awarded Northrop Grumman a \$24.91 million modification to a previously awarded contract (see **Contracts/Orders & Options**) for a second LRIP lot of three AES-1 units. Work under this contract modification was expected to be completed by January 2010.

In July 2009, the U.S. Defense Security Cooperation Agency (DSCA) notified the U.S. Congress of a possible Foreign Military Sale of eight AES-1 systems to the government of the Republic of Korea. According to the DSCA, the Korean Navy will use these systems to in mine warfare detection and mine neutralization operations to maintain critical sea-lines of communication and coastal access around the Korean Peninsula.

On December 16, 2009, Northrop Grumman delivered the first low-rate initial production (LRIP) Phase 2 AES-1 system to the U.S. Navy (this system is part of the LRIP Phase 2 contract awarded in March 2008 – see **Contracts/Orders & Options**).

Funding

U.S. FUNDING								
	FY08	FY08	FY09	FY09	FY10	FY10	FY11	FY11
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (U.S. Navy)								
PE#0604373N								
Project 2047	-	12.41	-	6.44	-	11.12	-	TBD
Procurement (U.S. Navy)								
Airborne Mine Countermeasures, S0075	-	15.32	-	0.00	-	20.41	-	TBD
Procurement (U.S. Navy)								
LCS Modules, LM001	-	0.00	-	7.43	-	7.43	-	TBD
	FY12	FY12	FY13	FY13	FY14	FY14	FY15	FY15
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (U.S. Navy)								
PE#0604373N								
Project 2047	-	TBD	-	TBD	-	TBD	-	TBD
Procurement (U.S. Navy)								
Airborne Mine Countermeasures, S0075	-	TBD	-	TBD	-	TBD	-	TBD
Procurement (U.S. Navy)								
LCS Modules, LM001	-	TBD	-	TBD	-	TBD	-	TBD

All dollars are in millions.

Source: U.S. Department of the Navy FY10 RDT&E and procurement budget documents

TBD = To be determined

AES-1

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Northrop Grumman Corp	40.3	Apr 2000 – U.S. Navy contract for AES-1 EMD R&D. Under the contract, Northrop conducted system engineering and design, as well as work related to development and fabrication; testing; and qualification, operation, and maintenance training. It also prepared documentation and offered management services in support of this effort, as well as all materials, software, and services necessary to ensure successful performance of this program. Work under this contract was completed in Dec 2004. The Naval Surface Warfare Center, Coastal Systems Station-Dahlgren Division, Panama City, FL, was the contracting agency. (N61331-00-C-0022)
Northrop Grumman Corp	124.5	Sep 2005 – A U.S. Navy firm-fixed-price/incentives letter contract for three LRIP units of the AES-1. Work under this contract was expected to be completed by February 2010. The Naval Surface Warfare Center, Panama City, FL, was the contracting agency. (N61331-05-C-0049)
Northrop Grumman Corp	24.91	Mar 2008 – The U.S. Navy awarded Northrop Grumman a \$24,912,910 modification to a previously awarded contract (N61331-05-C-0049) for a second LRIP lot of three units for the AES-1. Work was expected to be completed by Jan 2010.
Northrop Grumman Corp	Unknown	Jul 2009 – The U.S. Defense Security Cooperation Agency notified the U.S. Congress of a possible Foreign Military Sale of eight AES-1 systems to the government of the Republic of Korea.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Apr	2000	Contract awarded to Northrop Grumman for AES-1 EMD
	2001	Northrop Grumman completes preliminary and final AES-1 designs
	2003	Northrop Grumman finishes building three AES-1 EDMs
Sep	2005	U.S. Navy awards Northrop Grumman a contract to manufacture the AES-1
Jan	2007	Northrop Grumman delivers one LRIP AES-1 pod to the U.S. Navy
Mar	2008	U.S. Navy awards Northrop Grumman a \$24.91 million modification to a previously awarded contract for a second LRIP lot of three AES-1 units
Dec	2009	Northrop Grumman delivers the first LRIP Phase 2 AES-1 system to the U.S. Navy

Worldwide Distribution/Inventories

Northrop Grumman has sold its AES-1 to the **U.S. Navy** and possibly to the **Republic of Korea** (see **Contracts/Orders & Options** section above).

Forecast Rationale

The AES-1 is an airborne laser mine detection system manufactured by Northrop Grumman Corporation. It is designed for high-speed helicopter flight, and uses a helicopter-mounted laser to detect and contain floating and anchored sea mines.

As indicated in the **Ten-Year Outlook**, Forecast International estimates that Northrop Grumman will sell approximately 11 AES-1 pods to the U.S. Navy and the Republic of Korea in the next 10 years. The need of the United States and the Republic of Korea for next-generation mine-countermeasures technology is driving these buys.

According to the U.S. Navy, the AES-1 will be a vital component of the mine-warfare mission package designed for the Navy's Littoral Combat Ship, as the Navy plans to install the AES-1 on the MH-60S helicopter as part of the Organic Airborne Mine Countermeasures (OAMCM) suite of systems. The MH-60S helicopter is one of the vehicles intended for deployment on the LCS.

The possible Foreign Military Sale of the AES-1 to the Republic of Korea represents the first international procurement of the AES-1. Northrop Grumman has always maintained that there is potential for international sales of the system.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Northrop Grumman Corp (Prime)												
AES-1 Military <> Korea, South <> Navy												
	0	1	4	3	0	0	0	0	0	0	0	8
AES-1 Military <> United States <> Navy												
	6	1	1	1	0	0	0	0	0	0	0	3
Subtotal	6	2	5	4	0	0	0	0	0	0	0	11
Total	6	2	5	4	0	0	0	0	0	0	0	11

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DVD	\$50	\$95	(Civil/Commercial & Military)			DVD	\$50	\$95
Binder & DVD	\$95	\$180	Binder	\$1,575	\$2,975	International Military Markets		
Binder & RT	\$45	\$85	DVD	\$50	\$95	(A Subset of G&I above)		
Worldwide Inventories			Military Market Library			Binder	\$270	\$510
Aerospace Systems			Binder	\$1,440	\$2,720	DVD	\$50	\$95
CD	\$50	\$95	DVD	\$50	\$95	Naval		
Weapons Systems			Civil/Commercial Library			Binder	\$90	\$170
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CD	\$50	\$95	DVD	\$50	\$95	Power		
Power Systems			Market Intelligence Group Libraries			Binder	\$90	\$170
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Focused Market Segment Analyses			Binder	\$360	\$680	Weapons		
Hard Copy	\$25	\$45	DVD	\$50	\$95	Binder	\$180	\$340
			Electronics			DVD	\$50	\$95
			Binder	\$360	\$680	<small>NOTE: No charge for Real-Time format.</small>		
			DVD	\$50	\$95	2011 Historic Art Calendar		
						\$5.95 \$12.95		

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