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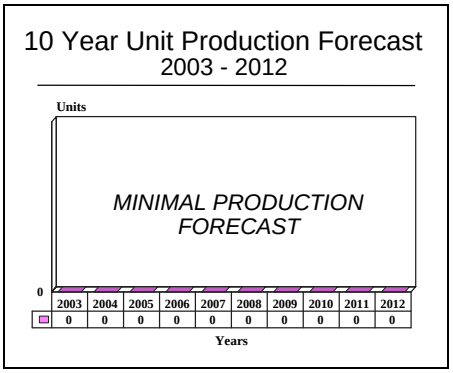
ALR-73(V) - Archived 6/2004

Outlook

- ALR-73(V) extended the life of the E-2C surveillance system
- Production ended, logistics support continues
- Replaced by ALQ-217(V) in Hawkeye 2000



Orientation

Description. Airborne electronic support measures (ESM) passive detection system.

Sponsor

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Contractors

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Web site: http://www.northropgrumman.com

Status. In service, in production, ongoing logistics support.

Total Produced. Through 2002, an estimated 250 units had been produced.

Application. E-2C

Price Range. Estimated cost of the ALR-73(V) is US$1.8 million.

Price is estimated based on an analysis of contracting data and other available cost information, and a comparison with equivalent items. It represents the best-guess price of a typical system. Individual acquisitions may vary, depending on program factors.

Technical Data

Characteristics

Frequency coverage	500 MHz to 18 GHz
4-band step sweep	
Bands	4
Processing	Any 2 of 4 bands simultaneously
Coverage	360º in 4 quadrants (52 antennas)
DF accuracy	+/- 2º

Characteristics (continued)

Features	Low false alarm rate Independently controlled receivers (4) Automatic overload logic AYK-14 processor Degraded mode operation

Design Features. The ALR-73(V) electronic support measures (ESM) passive detection system (PDS) performs direction-finding on signals of interest and has an automatic superheterodyne receiver/processor and phase interferometer as well as an amplitude comparison system. The receiver features four-band simultaneous coverage and is computer-controlled for operational flexibility. Key design features are a high probability of intercept in dense signal environments, automatic operation, high reliability, and ease of maintenance.

Fifty-two antennas (located, in four groups of 13, on the nose, tail and tip of the horizontal tailplanes) provide 360º coverage. Each antenna has dual processing channels and digital closed-loop rapid-tuned local oscillators that step-sweep through targeted frequency bands, providing instantaneous frequency measurement (IFM) with fast time-response and high-accuracy frequency determination.

A signal preprocessor takes the receiver output and performs pulse-train separation, direction-finding correlation, band-tuning and -timing, and built-in testing. The general-purpose digital computer controls the electronic surveillance operations and varies frequency coverage, dwell time and processing time in accordance with preset algorithms. The system measures signal direction of arrival, frequency (by superheterodyne rather than IFM techniques), pulse width, amplitude and scan rate, sending these data to a central processor which identifies the signal by source.

New emitters are immediately reported to the processor, with redundant contacts eliminated for a set period to lower the processor data rate. Low-priority frequency bands are monitored at a reduced scan rate and the system output is interfaced with the aircraft's central processor.

A Group II E-2C upgrade included the installation of a Raytheon Model 940 computer to replace the L-304. The new processor was based on the Digital Equipment 2100 Model A500MP and featured 15 times the processing power in a unit half the weight and one-third the size of the older computer. The new processor makes the Hawkeye better able to take advantage of the detection capabilities of the ALR-73(V).

Operational Characteristics. The ALR-73(V) system acquires direction-finding and radio frequency data from distant emitters for probable source identification. Threat information is processed and correlated with detection and tracking information from the search radar and Identification Friend or Foe receiver/transmitter. Emitter information is displayed at the edge of the main radar plan-position indicator (PPI). A digital display of the information is also available.

The ALR-73(V), in addition to identifying aircraft or cruise missiles, alerts the E-2C crew to the presence of anti-ship missiles. As soon as the missile's tracking radar is switched on prior to launch, a flashing alarm notifies the operator of the presence of a high-priority threat. The PDS detects emissions at distances up to twice that of the aircraft's radar, greatly expanding the Hawkeye's surveillance envelope. The PDS is one of the inputs to the Navy's Cooperative Engagement Capability system, which is being introduced into the Fleet.

Should the E-2C's radar malfunction, the ALR-73(V) can provide threat information independently. During electronic warfare operations, an EA-6B Prowler jamming aircraft usually flies with an ALR-73(V) -equipped E-2C, so that the two sensors can provide passive triangulation on hostile radars.

The E-2C is the only carrier-based airborne early warning command post in the world, and has been the Navy's AEW command post for over 30 years. The sensor can monitor a surveillance area of six million cubic miles. Automated features reduce operator workload and optimize radar performance without the need for operator intervention.

High-altitude flight extends the radar horizon beyond that of surface ship sensors, a significant part of naval tactical planning. The system automatically modifies track processing as required to maintain track integrity at land-sea interfaces. The Hawkeye's beyond-the-horizon targeting has made it the sensor heart of the Navy's Cooperative Engagement Capability program.

Variants/Upgrades

The ALR-73(V) is an improved successor to the ALR-9(V). It features an upgraded processor and maximized probability of intercept. It is one of the oldest systems on the updated Hawkeye. Instead of upgrading it for the Hawkeye 2000, the Navy decided to replace it with another SIGINT system, the ALQ-217(V), which is smaller and lighter and covers a broader frequency range.

Program Review

Background. The ALR-59(V) was designed in the late 1960s. Full-scale development for the E-2C Hawkeye began in 1970. Full-scale production began in 1972, with the first units delivered in 1973.

The ALR-59(V) PDS was a fully automatic, super-heterodyne receiver/processor system configured for simultaneous four-band coverage. It used a phased interferometer, aided by an amplitude-comparison system, to achieve high-accuracy direction-finding. The broadband system had computer-controlled parallel and independent scanning capability to assure mission flexibility.

In March 1980, (then) Litton Amecon received a US$5 million contract from Grumman to upgrade the ALR-59(V). The three-year contract called for redesign of the processor, antenna array, and system software to cope with advanced enemy electronic threats. The improved version featured a bearing accuracy of less than +/-2º. Because of the extensive nature of the upgrade, the system was re-designated the ALR-73(V).

Advanced technology, including an improved interferometer, was incorporated into the original ALR-59(V) to bring it up to the ALR-73(V) standard. This effort was conducted as part of the E-2C Block Upgrade I modification program. That program was completed in 1994.

In 1991, the Navy began the E-2C Group II upgrade. L-304 high-speed processors and new tactical displays were added to improve the operators' ability to use the data available from the PDS.

The Navy stopped acquiring new E-2Cs in FY92. But aging airframes made it necessary to rebuild or replace many aircraft. Because it could cut the price of a replacement by 20 percent, the Navy decided to procure 36 new aircraft. Northrop Grumman unveiled the first new aircraft at the company's new assembly line in St. Augustine, Florida, in February 1997. The company moved the production line from Calverton, Long Island, New York, to Florida in late 1994.

The Mission Computer Upgrade (MCU) program replaced the Hawkeye's L-304 computer. Although it did not directly impact the APR-73(V), it improved the overall ability of the E-2C to effectively use the data from the APS-145(V) radar and other sensors.

The L-304 was upgraded many times, but the old technology had become increasingly costly to produce and maintain.

A September 1994 contract worth US$25 million was awarded to Raytheon for a new mission computer based on off-the-shelf technology: the Raytheon Model 940, a hardened version of the Digital Equipment Corporation 2100 MA500MP processor.

Hawkeye 2000. The US Navy introduced upgrades to the E-2C that would make it possible to accomplish the AEW mission through 2015, as well as enhancing the ability to execute the drug-interdiction mission. These upgrades included improved avionics such as multifunctional cockpit displays, the addition of an infrared search-and-track system, a new central computer, in-flight refueling capability, an updated or new electronic surveillance system, and self-protection systems, as well as further radar improvements.

The Hawkeye 2000 is the latest generation E-2C. Enhancements to the Group II E-2C will make it possible for the Hawkeye to remain in service beyond 2015. It was designed to offer improved situational awareness, over-the-horizon communications, and non-organic data access. It in addition offers enhanced Theater Missile Defense capabilities, and is able to generate a better theater composite tactical picture through Cooperative Engagement Capability improvements.

The baseline Hawkeye 2000 includes the APS-145(V) and improved IFF system, the Joint Tactical Information Distribution System (JTIDS), GPS, and a CAINS II navigation system. The core of the new airplane is an open architecture central mission computer featuring commercial off-the-shelf (COTS) technology. New 333 MHz processors have a nine GB removable cartridge memory and identical ACIS 9 GHz workstations, and are half the volume and one-third the weight of the L-304 computer.

The ALQ-217(V) SIGINT system is also included.

Funding

No further production funding expected.

Recent Contracts

(Over US$5 million)

Contractor	Award ($ millions)	Date/Description
Litton	9.3	Jul 1995 – Requirements contract for the purchase of various repair parts for the ALR-59/73(V) passive detection system. Completed June 1997. (N0083-95-D-210F)

Timetable

Month	Year	Major Development
	FY70	ALR-59(V) development begins
	FY72	Production begins
	FY75	Initial deployment
	1983	Conversion to ALR-73(V) begins
	FY97	Restart of new E-2C procurement for USN
Feb	1997	First new Hawkeye comes off Florida production line
Apr	1998	First French E-2C delivered, first Hawkeye 2000 flight
Late	2001	Delivery of the first Hawkeye 2000
	FY02	Hawkeye 2000 IOC
	2003	Delivery of third French E-2C; Advanced Hawkeye development
	2004	Fifth and sixth E-2C delivered to Taiwan
1Q	FY06	End of multiyear procurement
	2010	All-Hawkeye 2000 fleet planned
	2015	Projected life of E-2C fleet, possible replacement

Worldwide Distribution

The ALR-73(V) is carried by the E-2C aircraft of **Egypt**, **France**, **Israel**, **Japan**, **Singapore**, **Taiwan**, **Thailand** (order for four pending), and the **United States**. **Saudi Arabia**, **Oman**, **Qatar**, **UAE**, **Kuwait**, **Turkey**, and **Bahrain** have expressed an interest in the Hawkeye to meet newly established AEW requirements, but the 737-based MESA aircraft may take over that market. In many nations, funding may be problematic, and newer aircraft are serious competitors.

Forecast Rationale

The E-2C is the airborne eyes and ears of US carrier battle groups. The ALR-73(V) contributes to this situational awareness and is an important input to the Navy's Cooperative Engagement Capability system. Tests proved that CEC can expand the surveillance horizon and improve the integrity of a battle group's situational awareness. CEC is approved for fleet-wide application.

Hawkeyes have flown from carriers to protect the Fleet for 30 years. The Fleet will have fully converted to Hawkeye 2000s by 2010.

The ALR-73(V) upgrade helped extend the useful life of the E-2C and was an important adjunct to US production of E-2Cs. The Navy will procure systems to support new-aircraft production, replacing the ALR-73(V) with a smaller, more capable sensor, the ALR-217(V).

Ten-Year Outlook

No production beyond logistic support components expected.

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