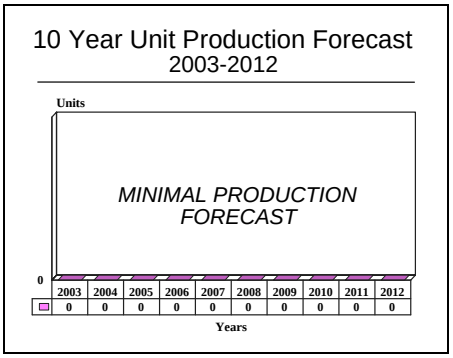
ALR-66(V)/606(V) - Archived 6/2004

Outlook

- Will remain operational for the foreseeable future
- Production ending, but logistics support continues
- Significant future production unlikely



Orientation

Description. Radar warning and electronic support measures receivers.

Sponsor
US Navy
Naval Air Systems Command
NAVAIR HQ
47123 Buse Road Unit IPT
Patuxent River, Maryland (MD) 20670-1547
USA
Tel: +1 301 342 3000
Web site: http://www.nawcad.navy.mil

Contractors
Northrop Grumman Corp
4747 Hellyer Avenue
San Jose, California (CA) 95150-7012
USA
Tel: +1 408 365 4222
Fax: +1 408 365 4947
Web site: http://www.northropgrumman.com

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

Total Produced. Through 2002, an estimated 1,259 systems had been produced.

Application. A/TA-4, A-7, C-130, E-6 TACAMO, F-4, F-16, P-3 AIP, SH-2, VC-10, and SH-3. A wide number of potential applications exist on other aircraft and ship platforms.

Price Range. Cost averages US$75,000 for a radar warning receiver and US$250,000 for an ESM system.

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

	Metric	US
Dimensions		
Typical		
Weight (avg)	27 kg	60 lb

Characteristics

Characteristics

Frequency	2 to 20 GHz
Coverage	360º
DF accuracy	Better than 10º
DF resolution	1.4º
POI	Near 100%
MTBF	
ALR-66(V)	630 hr
ALR-66(VE)	725 hr
ALR-606	725 hr
Reprogramming	
(Flight line)	90 sec
Emitter storage	
ALR-66(V)	1,800 emitter modes
ALR-66(V)3	1,500 emitter modes
Modes	Pulse Pulse Doppler CW ICW LPI Jitter/stagger pulse compression Frequency agile
Interfaces	RS-422 Mil-Std 1553B Ethernet (ALR-606)

Design Features. The ALR-66(V) family of programmable radar warning and signal intercept receivers provides continuous frequency coverage in the 2 GHz through 20 GHz range. The ALR-66(VE) has an option for 300 MHz to 2 GHz omni or direction-finding coverage. The systems feature crystal video and high-sensitivity receivers and were designed to handle a dense signal, a mixed scenario of sea- and land-based emitters, and airborne sensors.

The basic ALR-66A(V)1 provides warning and identification of all pulsed radars and of continuous wave (CW), interrupted continuous wave (ICW), low probability of intercept (LPI), 3-D, jitter/stagger pulse compression, and frequency agile radars, including known and unknown emitters. Emitter storage exceeds 1,800 emitter modes. Flight line reprogramming time is 90 seconds per platform with a Computer Memory Loader (CML). One, two or three symbols per emitter can be selected as set by the user.

Operational Characteristics. This digital, computer-controlled, fully programmable radar warning receiver was designed to operate in very dense signal environments. It can handle up to 15 radar threats at a time, identifying them as friendly or hostile and displaying them on a cathode ray tube (CRT) indicator. The system can be interfaced with countermeasures systems and, once a threat has been identified as hostile, will trigger the release of chaff or flares, or activating jammers. Complete 360º azimuth coverage is provided with direction-finding accuracy of better than 10°. DF resolution is 1.4º.

The ALR-66(V) radar warning receiver (RWR) and electronic support measures (ESM) systems provide rapid, unambiguous emitter identification in complex signal environments. They can detect and process signals from a mixed scenario of sea-, air- and land-based radar emitters. The equipment is lightweight, compact and adaptable to a wide variety of maritime patrol aircraft.

Variants/Upgrades

Configurations accommodate a range of installation and mission requirements, including fighter/attack aircraft, helicopters and fast patrol boats.

ALR-66A(V)1. This is the upgraded ALR-66(V) radar warning receiver. It uses a computer/processor that runs at up to 1.2 MOPS to distinguish threat signals from a mixed scenario of sea-, air- and land-based radar

emitters. The ALR-66A(V)1 covers frequencies from 2 GHz to 20 GHz, provides azimuth coverage over a full 360º, and has emitter storage in excess of 1,000 modes (100 radars). It is available with an electrically erasable, programmable, read-only memory (EEPROM), which allows the user to reprogram the library on the flight line or in-flight in as little as 90 seconds using the MX-10317 Computer Memory Loader.

The system can distinguish fire control from search radars. It can detect pulse-Doppler, CW, ICW, LPI, short dwell time 3-D, frequency-agile, jitter/stagger pulse repetition frequency (PRF), and pulse compression radars.

The ALR-66A(V)1 weighs 27 kilograms (59.5 lb), and has demonstrated a mean time between failures (MTBF) of 725+ hours.

ALR-66(V)2. This version was used on the P-3B for over-the-horizon (OTH) targeting. It used the nose antenna of the aircraft's P-80 radar, a technique that was not successful.

ALR-66A(V)3. This surveillance and targeting system is used by the P-3 multimission aircraft. The system forms an integral part of the US Navy's ocean surveillance system and can be used on both offensive and defensive missions.

The A-series sensors offer increased computer memory (1,800+ modes), with a shadow time of 2 μsec, the equivalent of 500,000 pps. They provide advanced capabilities, such as precision DF and high sensitivity for OTH detection. They also feature precise frequency measurement and advanced signal processing coupled with an expanded data memory.

The system uses multimode operator-interactive display and controls and precision emitter parameter measurement, has the capability to integrate with the primary sensors of older aircraft, and provides an EEPROM capability. The ALR-66(V)3 is in service worldwide.

ALR-66B(V)3. This successor to the ALR-66A(V)3 is integrated with the aircraft's radar antenna and provides ultra-high sensitivity and precision DF performance, but does not interfere with radar operation. It interfaces with other aircraft sensors on a non-interference basis and accommodates in-flight programming of up to 10 emitters of interest.

A dedicated spinning antenna can be used for 360º coverage and precision signal measurements. If a signal cannot be matched in the system's emitter library, the antenna displays the precise signal characteristics. It is part of the P-3 LAMPS III Block Upgrade kit.

ALR-66C(V)3. This version, for US and international applications, shares many characteristics with the ALR-66B(V)3. A belly-mounted spinning antenna was designed to provide ultra-high quadrant sensitivity and precision DF for over-the-horizon targeting. It can be integrated with other aircraft systems and sensors.

The system uses upgraded processing techniques and expanded memory for positive emitter identification in high signal-density environments. The EEPROM library is rapidly reprogrammable on the flightline and accommodates in-flight programming of up to 10 emitters of interest. The characteristics of detected emitters not found in the library are displayed with precise parameter measurements. The system has a multimode, operator-interactive plasma display and control unit. It is part of the P-3 Anti-surface warfare Improvement Program (AIP).

ALR-66(V)4. The ALR-66(V)4 can detect all pulse systems, including pulse Doppler and CW. It was designed for the E-6A TACAMO aircraft.

ALR-66(V)5. This advanced ESM/passive targeting system was selected as the ESM suite for the US Navy's terminated P-3C Update IV program. The ALR-66(V)5 had two independent subsystems operating in conjunction with one another: an electronic support measures subsystem and a targeting subsystem. The ESM subsystem was a high-sensitivity system that provided automatic continuous 360º coverage of the radio frequency (RF) environment with precise parameter measurement. The targeting subsystem provided higher sensitivity for over-the-horizon targeting.

Fully automated, the ALR-66(V)5 requires no operator intervention and can perform maritime surveillance and OTH targeting functions as well as automatic and continuous self-test and self-calibration.

ALR-66(V)6. This ESM variant was designed for shipboard applications, providing self-protection and an OTH targeting capability. It was installed on two US Navy PHM class patrol combatants but proved unsatisfactory and was removed.

ALR-66(V)7. This variant was designed for the C-130. The ALR-66(V)7 incorporates several features, including a superheterodyne and instantaneous frequency measurement (SHR/IFM) receiver, crystal video receivers, and C/D direction finding.

This system provides multiple receiver types for superior performance, automatic operation, rapid warning, operation in an ultra-high-density environment, comprehensive integrated logistics support, modular design for future growth, and independent system reprogrammability.

ALR-66(VE). This lightweight system was designed for use in fighters and helicopters as a drop-in replacement or upgrade for older RWRs (both analog and digital), such as the APR-25(V), APR-36/37(V), APR-39(V), ALR-45(V), and ALR-46(V), and was the standard US Navy ESM system on the LAMPS Mk 1 helicopter.

The ALR-66(VE) has an emitter storage capacity of more than 1,000 radar signals, and can be reprogrammed on the flight line in 90 seconds. All major radar parameters detected during a mission can be automatically recorded for post-flight analysis.

This variant can be installed on fighter aircraft ranging from Dassault Mirages and SEPECAT Jaguars to McDonnell Douglas F-16s and Northrop F-5s.

ALR-79(V). This is an ALR-66(V)1 with a jammer interface added. Built for Navy Persian Gulf operations, it has higher sensitivity and can interact with and control several active jammers automatically by means of frequency set-on and other features. It was installed on the SH-2F LAMPS I helicopter.

ALR-80(V). Announced in June 1985, this system was an outgrowth of the ALR-66(VE) and featured more powerful software, better performance and EEPROM. As with other ALR-66(V) variants, it was designed to be a drop-in replacement for other older systems and shared many features with other family members. It had a library storage capacity of more than 1,800 radar modes. Platform applications were high-performance fighter aircraft.

ALR-85(V). A variant configured for transport aircraft, this variant has been installed on the Taiwanese Indigenous Defense Fighter (IDF) and CN-235 in Korea. It features instantaneous frequency measurement and an SHR/IFM receiver that incorporates both wide and narrow bandwidths for high-sensitivity and high-density operation. The superheterodyne receiver is an especially effective detector for CW and pulse Doppler radars.

ALR-93(V). This sophisticated version of the ALR-85(V) reportedly has a fine DF interferometer. It is also effective in detecting very short pulse width signals (100 nsec). Library capacity is 2,000 signals.

ALR-606(V)1. The ALR-606(V)1 RWR/ESM system was based on the ALR-66(V)1 and developed especially for export. It is an exact replacement for older analog and digital RWR systems and features full digital signal processing, a high-intensity CRT, 2 GHz to 8 GHz coverage, and alphanumeric symbology. It is suited for newer helicopters like the Sea King, Super Puma, Gazelle, Alouette III, and Lynx and for maritime patrol aircraft such as the Fokker F-27M, Embraer EMB-111, Atlantique, and de Havilland Dash 7 and 8. An EEPROM provides the user with the ability to reprogram display symbols and program parameters.

ALR-606(V)2. The ALR-606(V)2 surveillance and direction-finding system was destined for maritime patrol aircraft and features an OTH emitter locator. The system is integrated with the aircraft's main search radar antenna to provide high sensitivity and accurate direction finding without degrading radar performance. It was used on the S-2 Tracker patrol aircraft.

ALR-606(VE). This ALR-606(VE) fully digital radar warning receiver is based on ALR-66(VE) technology and has the same hardware configuration. The ALR-606(VE) was designed for the export market as an item-for-item replacement for older analog and digital RWR systems in aging fighter aircraft (F-5A through F-104, F-4, A-7, A-4, etc.), and provides full digital signal processing, high-intensity CRT, 2 to 20 GHz coverage, and alphanumeric symbology. It is suited for new generation fighter aircraft such as the F-20, F-16, Mirage, etc. An EEPROM provides reprogrammable capability for display symbols and program parameters.

Among other features, the ALR-606(VE) provides 360º coverage, offers a processor memory of 18,000 words (68k total), weighs 29.3 kilograms, and has an MTBF of over 500 hours.

LANCER. A variant of the ALR-66(V)5, the LANCER ESM modular design offers a flexible system configuration for several different functions or missions, including RWR, ESM and passive targeting, either individually or jointly. The basic architecture was designed to accommodate future growth, since enhanced capabilities can be added modularly.

LANCER provides continuous, automatic 360º coverage of the radio frequency environment, while the targeting subsystem provides a high sensitivity for OTH targeting.

LOCATOR. This shipboard RWR was based on the ALR-66(V) series. It was designed as a lightweight system that would provide patrol boats, frigates and destroyers with automatic self-protection capability. LOCATOR provides pinpoint analysis of friendly and hostile signals in order to provide information on which to base decisions for deploying defensive weapons.

Program Review

Background. The ALR-66(V) was developed in the early 1970s for US Navy P-3 ASW aircraft and LAMPS Mk I, SH-2 and SH-3 helicopters. It replaced the ALD-2(V) and ALR-52(V). During the early 1980s, the ALR-66(V)1 was updated to the ALR-66(VE) configuration so that it could interchanged with older RWRs. The ALR-66(VE) became the standard Navy ESM system aboard LAMPS Mk I helicopters, and frequency coverage was extended.

In FY82, (then) General Instrument received a contract to update ALR-66(V) systems and related equipment on P-3B aircraft. Approval for service use of the ALR-66(V)2 was granted in March 1983. In FY84 the Navy corrected the operational deficiencies of the ALR-66(V) in SH-2F helicopters, and an additional 20 ALR-66(V)s were produced. The P-3C ALR-66(V)3 OPEVAL was completed in December 1984. The Japanese government selected the ALR-66(V)3 surveillance and targeting system under a multiyear contract for the P-3C Orion aircraft of the Japan Maritime Self-Defense Force.

In 1994, the Royal Air Force began to outfit some of its C-130K Hercules transports with electronic warfare systems. One system was to be a UK-specific variant of the ALR-66(VE) coupled with the AAR-47(V) passive missile approach warning system, ALQ-157(V) IR jammer, and ALE-40(V) chaff/flare dispenser.

The US Navy Anti-surface warfare Improvement Program (AIP) was a new start in FY94. It would enhance the capability of a minimum of 43 P-3Cs in the anti-surface role. The Navy planned to upgrade more than 100 aircraft as funds became available. Under the upgrade, the aircraft would be equipped with the following anti-surface warfare systems: APS-137(V)5 high-resolution Inverse Synthetic Aperture Radar (ISAR) for long-range target detection/classification; an upgraded version of the ALR-66(V) ESM; a long-range electro-optical day/night imaging sensor for targeting, continuous surveillance, and battle damage assessment; and an upgraded ASQ-212(V) mission computer. Additionally, the aircraft would be configured to carry AGM-65D Maverick missiles.

The aircraft were also to be fitted with the ALE-47(V) chaff/flare dispenser and the AAR-47(V) missile warning receiver for self-protection. The first 10 modified aircraft were delivered to the Navy in FY98.

In early 1995, the Netherlands Ministry of Defense announced a US$125 million program to upgrade the Dutch Navy's 13 P-3Cs. The aircraft were upgraded with the ASQ-212(V) Central Computer, APS-137(V) ISAR, and ALR-66(V) ESM.

In late 1995, Norway's government approved an upgrade program for that country's four P-3C aircraft. New equipment to be installed included the ASQ-212(V) central processing system, the APS-137(V)5 inverse synthetic aperture radar (ISAR), improved Litton ALR-66B(V)6 ESM gear, and new UHF Satcom equipment.

In a July 1998 *Commerce Business Daily*, the Naval Air Systems Command announced a pending basic ordering agreement to retrofit several ALR-66A(V)3 components to bring the radar to the ALR-66B(V)3 configuration. They included 77 E-J amplifier/receivers, 124 C/D-Band amplifier/receivers, 15 computer converters, and six computer memory loader accessory kits. Except for the computer memory loader accessory kits, all equipment would be government-furnished equipment (GFE). Acceptance tests would be performed on an additional 140 E-J amplifiers from a previous order. The effort was sole-sourced to Litton Applied Technology.

In late 1998, the Navy deployed the first AIP versions of the P-3.

In a January 2003 Pre-solicitation Notice (Solicitation Number: N00253-03-R-0012), the Naval Undersea Warfare Center Division Keyport announced a need for a vendor to assist in the establishment of a depot repair facility for refurbishment of the ALR-66(V) radar warning receiver system – specifically, the C/D-Band Amplifier. ALR-66(V) system test sets will be used to qualify the repaired units. The contractor will develop test, repair, and alignment procedures for this amplifier, along with applicable software and source code. In addition, the contractor will provide training in test procedures and in use of equipment. The vendor will be selected under a full and open competition.

Funding

Funding is from platform and Operations & Maintenance lines.

Recent Contracts

(Contracts over US$5 million)

Contractor	Award ($ millions)	Date/Description
Litton Advanced Systems	5.3	Nov 2001 – Indefinite quantity contract for repair and overhaul of components of the ALR-66(V) and ALR-67(V) systems. Options bring the overall value of this contract to US$32,345,323. Completed September 2002. (N00383-02-D-001G)

Timetable

Month	Year	Major Development
Nov	1974	Initial contract to General Instrument
	1978	Option exercised for 150 units for SH-3H helicopter
	1980	Morocco negotiates for 50 ALR-66(V) units
	1981	Greek Air Force negotiates for approximately 120 ALR-66(V) units
	1982	Last system delivered to LAMPS Mk I program for SH-3H
	1984	Sales to Middle Eastern country (ALR-66(VE)) and Venezuela (ALR-606(V)2) announced
Jun	1985	General Instrument announces ALR-80(V) variant. ALR-66(V) receives approval for limited production for P-3C
Jan	1986	Sale of ALR-66(V)3s to Japan for P-3Cs announced
Feb	1986	Approval for full production of ALR-66(V)3
Jun	1986	Sale of ALR-66(VE) to New Zealand for A-4s announced
Jun	1987	RAF order for undisclosed number of ALR-66(VE)s
Jan	1991	Initial Update IV software release planned
Oct	1992	P-3 Update IV terminated
Feb	1997	Announcement of US Navy's intent to procure up to 25 P-3 Update III Block Upgrade kits, including the ALR-66B(V)3
	1998	First AIP deployed
	2003	Last unit production

Worldwide Distribution

Greece. The Hellenic Air Force uses the ALR-66(VE) system on its 49+ A-7 aircraft and will be installing the ALR-66(V)2 on its S-70B ASW helicopters.
Japan. Japanese P-3C ASW aircraft carry the system.
Korea. Korea ordered eight P-3s, delivered in FY94/95.
Morocco. Morocco carries the system on an unspecified aircraft.
The **Netherlands.** Upgraded its 31 P-3s with the ALR-66(V).
New Zealand. The ALR-66(VE) system is carried on the A/TA-4K (14 aircraft).
Norway. Installing the ALR-66B(V)6 in its four P-3 aircraft.
Portugal. Six Portuguese P-3B carry the ALR-66(VE) system.
United Kingdom. Selected Special Operations C-130s carry the ALR-66(VE).
United States. The Navy uses the system on its P-3C, E-6 TACAMO, SH-2F, SH-2C, and SH-3H platforms. The Navy had installed the system on its PGH hydrofoil craft.
Venezuela. Unspecified aircraft carry the ALR-66(V)2 and ALR-66(VE) system.

Other identified users are **Finland**, **Italy**, **Kuwait**, and **Taiwan**.

Forecast Rationale

The ALR-66(V) is a popular, widely used family of RWR/ESM systems. It is primarily used on anti-submarine warfare (ASW) helicopters, maritime surveillance aircraft (P-3B/C), cargo aircraft and some fighters. During the Persian Gulf War, the Navy found that the P-3 could perform as a multimission sensor platform, and not just as an ASW aircraft. Many members of the Allied Coalition found P-3s valuable since they could pick out enemy combat ships from among non-combat commercial vessels. The Orion has become a valued signals intelligence/electronics intelligence (SIGINT/ELINT) asset to support operations around the world.

The US Navy completed the original procurement of the ALR-66(V)3 for the P-3C fleet and it is in kit production for the P-3 Update III Block Upgrade.

Other applications for the popular and capable ALR-66(V) may develop since it is popular on the FMS market. Use of the P-3C internationally as a submarine hunter and maritime surveillance platform reinforces the need for spare and repair parts throughout the world.

The ALR-66(V) will remain in operation for many more years. Rather than being replaced with new-production systems, some installations would be refurbished equipment.

Ten-Year Outlook

No significant future production expected. Logistics support will continue.

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