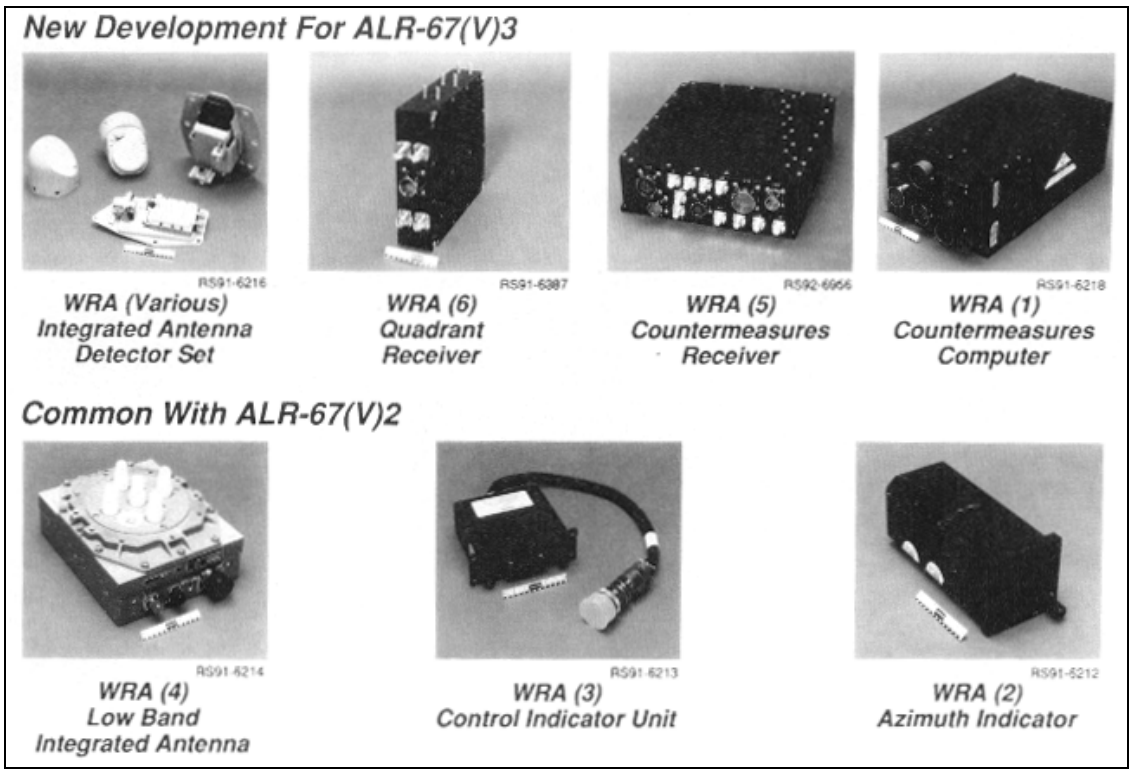
# ADVANCED SPECIAL RECEIVER (ASR) AN/ALR-67(V)3




**Navy ACAT II Program**

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|---|---|
| Total Number of Systems: | 698 |
| Total Program Cost (TY$): | $1.8B |
| Average Unit Cost (TY$): | $1.1M |
| Full-rate production: | 1QFY00 |

**Prime Contractor**

Hughes Aircraft Company

## SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The AN/ALR-67 (V)3 Advanced Special Receiver (ASR) contributes to ***full-dimensional protection*** by improving individual aircraft probability of survival through improved aircrew situational awareness of the radar-guided threat environment.

ASR is a radar warning receiver (RWR) intended to supersede the AN/ALR-67E(V)2, and provides extended capabilities in detection and processing of air defense threat radars of the mid-1990s and beyond. It functions cooperatively with the onboard suppression and defensive systems (high-speed anti-radiation missile (HARM), countermeasure dispensers, and radio frequency (RF) jammer) via data exchanged over the Electronic Warfare multiplex bus and the HARM data bus. The (V)3 ASR is applicable to the F/A-18C/D/E/F, while the (V)4 ASR will be applicable to the F-14A/B upgrade, F-14D, and AV-8B (when/if funded). The (V)3 ASR differs from (V)4 only in the housing of one Weapon Replaceable Assembly (WRA-5) which was split into two portions to alleviate structural limitations to the F/A-18 tail. Except for WRA-5 and new brackets required for antennas and additional wiring, the bulk of ASR hardware is a form and fit replacement for AN/ALR-67E(V)2 hardware. ASR provides an

order of magnitude increase in processing power. ASR collection categories include: (1) high band pulse (2-40 GHz); (2) high band continuous wave; (3) low band pulse less than 2 GHz; and (4) millimeter wave MMW (28-40 GHz). ASR provides signal detection, direction finding, and identification of RF and MMW threat emitters including scanning, pulse-Doppler and continuous wave tracking, acquisition and early warning radar, and missile guidance. The Low Band Integrated Array in the ASR was not changed from the ALR-67E(V)2. The software re-programmable threat library user data file (UDF) development and maintenance process and infrastructure for the ASR is intended to support improved operational timeliness of UDF updates (i.e., tactical reprogramming). The software support activity for the ALR-67 V3, NAWC-WD Pt. Mugu, began supporting the system well before it entered full-rate production.

## BACKGROUND INFORMATION

The ASR is a Navy program that achieved Milestone II in 2QFY87 and Milestone III in 3QFY99. At the present time, the ASR program is in full-rate production for the F/A-18 E/F aircraft.

DT&E was conducted at NAWC-AD Patuxent River, NAWC-WD China Lake, NAWC-WD Pt. Mugu, Air Force Material Command Western Test Range, and at contractor facilities from 1992-1998. The ALR-67 (V)3 was originally scheduled to enter OT-IIA flight testing in August 1996. In preparation for this, a two week combined DT/OT test period was scheduled at the Air Combat Environment Test and Evaluation Facility at Patuxent River in March 1996 to examine RWR performance. This testing revealed severe deficiencies that required additional development due to immaturity of the ALR-67 (V)3 system and its integration in the F/A-18 C/D, causing the Navy to restructure the program with an 18-month schedule extension. An extensive DT&E period with OT assistance was begun, consisting of multiple complementary/parallel test events/flights conducted by the operational test director with OT aircraft at China Lake, CA. Supplementary to China Lake test events, ALR-67 (V)3 was deployed to the NATO exercise Trial Mace IX in 1QFY98. This deployment provided an opportunity to validate system performance in an open-air environment against several Gray emitters that were not available in the U.S. T&E infrastructure, except as Hardware-in-the-Loop or installed system test facility simulations. At the completion of DT with OT assistance, a determination was made by the program director that ALR-67 (V)3 hardware/software had sufficiently matured to enter Technical Evaluation (the final phase of DT&E) and OT-IIA.

OT-IIA was conducted from October 1997-January 1998. OT-IIA was conducted in an operational threat environment derived from threat data contained in the Office of Naval Intelligence Threat Assessment (014-97). The purpose of OT-IIA was to assess the potential operational effectiveness and operational suitability of the ALR-67 (V)3 system to support an LRIP decision. As a result of OT-IIA, COMOPTEVFOR concluded that the system was potentially operationally effective and potentially operationally suitable with recommended improvements in identification, localization (Direction Finding accuracy), built-in test (BIT), reliability, maintainability, and reprogrammability. These and other changes were incorporated into the design tested in OT-IIB (OPEVAL).

## TEST & EVALUATION ACTIVITY

OT-IIB was conducted from June 1998-February 1999 in an operational threat environment, with over 550 sorties and 967 flight hours flown. The purpose of OT-IIB was to determine the operational effectiveness and suitability of the ALR-67 (V)3 system, and to continue tactics development to support promulgation of the OPTEVFOR tactics guide. OT&E was conducted at Eglin AFB (Florida), Sardinia

(Italy), the ECR (China Lake), Nellis AFB (Nevada), Alaska, and onboard an aircraft carrier (Southern California). DOT&E examined ALR-67 (V)3 in its entirety in two operational scenarios—a four F-16s versus four F/A-18s at Nellis AFB and in a combined air and ground scenario with a robust Integrated Air Defense System known as the Graduation Exercise at China Lake. DOT&E evaluated individual aspects of system performance during both operational scenarios and other operational testing at China Lake.

Analysis of operational testing was comprised of both qualitative and quantitative measures, including direct system performance measures and evaluation of system performance via pilot reports. A key feature throughout the evaluation was direct side-by-side comparisons by the same pilots in the same scenarios with the current F/A-18 RWR, the ALR-67E (V)2. ALR-67 (V)3 demonstrated superior performance when compared to ALR-67E (V)2.

## TEST & EVALUATION ASSESSMENT

Based on results from OPEVAL completed in February 1999, the August 1999 B-LRIP report stated that ASR is operationally effective and operationally suitable. ALR-67 (V)3 demonstrated improved detection, identification, localization, and warning to a wide range of threat RF radar systems when compared to the ALR-67E (V)2. It also demonstrated that it improved pilot situational awareness, contributing to more effective mission accomplishment. The ALR-67 (V)3 demonstrated overall high reliability during flight testing with 23 mission critical and nine non-mission critical failures during 967 flight hours. Of the failures, nine were due to BIT false alarms, seven were due to radome or antenna failures, six were due to actual hardware failures of the weapons replaceable assemblies (WRAs), and the rest were software and non-critical failures. Analysis of failure data indicates the system meets objective criteria in most cases, with antenna radome reliability, maintainability, and logistics supportability as areas needing improvement. The demonstrated Mean Time Between Critical Failure was 42 hours (threshold 17 hours).

To realize the potential of ALR-67 (V)3 and correct deficiencies noted in testing, further development and FOT&E is required to resolve the following: (1) identify and correct causes of ALR-67 (V)3 radome/antenna failures; (2) correct maintainability/logistic supportability issues; (3) verify and retest system MMW performance; (4) improve system BIT interpretability and troubleshooting guides; (5) correct threat signal blanking between the ALR-67 (V)3 and ALQ-126B; (6) demonstrate the capability to create and promulgate an operational UDF in a timely manner; and (7) complete ALR-67 (V)3 user manuals. Additional improvements recommended include: (1) correct joint interoperability and identification of friendly AI radar problems; (2) improve Inertial Navigation System smoothing rate to provide the most accurate estimate of threat placement (RWR display symbology); and (3) improve the HARM command launch computer interface to properly indicate actual HARM status rather than an ALR-67 (V)3 degrade when the last HARM is fired.

DOT&E has continued to monitor and report ALR-67 (V)3 test and evaluation activity, with FOT&E being conducted from July-November 1999. Early analysis of those results show improvements to the OT-IIB system, though some unique F/A-18 E/F integration problems still require correction during further FOT&E. The Navy has embarked on a proactive program to correct deficiencies noted during OT-IIB and FOT&E to ensure an operationally effective and suitable system prior to fleet introduction.