

# ARCHIVED REPORT

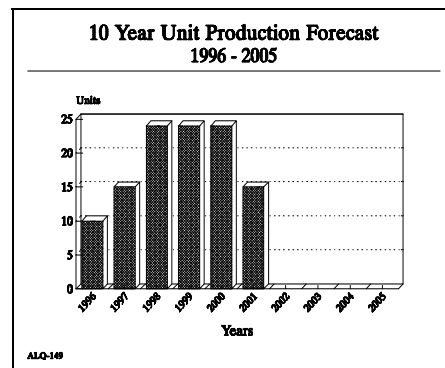
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## ALQ-149 - Archived 4/97

### Outlook

- EMD nearing completion
- LRIP depends on final outcome of ADVCAP termination
- P3I program already underway



### Orientation

**Description.** Airborne Tactical communications jammer.

**Sponsor**

US Navy

Naval Air Systems Command

EW Program Office PMA-272

AIR-21414W

Washington, DC 20361-2140

USA

Tel: +1 703 692 3122

(NAVAIR HQ is in the process of moving to the Naval Air Warfare Center, Patuxant River, Maryland)

(EA-6B Program)

**Contractors**

Lockheed Martin Corp

6801 Rockledge Drive

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USA

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**Status.** EMD nearing completion, initial production decision pending.

**Total Produced.** Through 1994, seven engineering development models had been produced; a limited number (estimated three) of initial production units had been produced but not delivered due to EA-6B ADVCAP termination action.

**Application.** EA-6B Avionics Improvement Program.

**Price Range.** Unit cost for production models is estimated at US\$800,000.

## Technical Data

|                  |  |        |
|------------------|--|--------|
| Dimensions       | Metric   | US     |
| Weight:          | 182 kg   | 400 lb |
| Characteristics  |  |        |
| Frequency Range: | Includes 20 to 70 MHz  |        |
| LRUs:            | Eight<br>Receivers<br>Signal Processors<br>Control Equipment   |        |
| Antennas:        | 13<br>Separate communications and radar intercept elements<br>High-speed scanning with re-check<br>Locate, identify, prioritize signals<br>Look-thru cycle coordinated with other jammers<br>Share ALQ-99 jamming transmitters<br>AYK-14 processor |        |

**Design Features.** The ALQ-149 jammer was designed to be software-programmable and cover a wide frequency band, including 20-70 MHz as required by the Marine Corps. The ALQ-149 was to be carried internally by the EA-6B ADVCAP variant. The system would interface with the ALQ-99 Tactical Jamming System to create a full-spectrum communications and radar jamming capability. The ALQ-149 would add the ability to jam certain lower frequency long-range early warning radars.

The transmitters would be carried in the ALQ-99 jamming pod. The ALQ-149 consists of eight wire rack assemblies (WRAs), each plugged into a pigeonhole within a footlocker-size rack mounted in the aft equipment bay. The system has built-in test capability to isolate faults to the WRA level and the plug-in nature of the WRAs allows for removal and replacement on the flight deck.

The outboard portion includes an acquisition subsystem with separate communications and radar intercept processing elements. These coordinate ALQ-149 activity with that of the ALQ-99. The analysis subsystem acquires communication and radar signals and determines the appropriate jamming response based on internal logic tables and a stored threat parameter library. A central processor interfaces the EW operation with other aircraft systems, including the mission computer. By using established look-through cycles it would be possible for the two jammers to operate simultaneously.

The ALQ-149 was originally planned for the ICAP II EA-6B, the variant fielded with the Fleet. Developmental problems, many traced to over-ambitious specifications, caused the fielding delay.

**Operational Characteristics.** The acquisition subsystem contains separate communications and radar intercept and processing elements designed to coordinate their activities with the ALQ-99 radar jammer. The analysis subsystem acquires communications and radar signals and determines the appropriate jamming responses. The results of this analysis are transferred to the AYK-14 computer, the core of the aircraft's central processing system.

The system would evaluate and prioritize receiver threat signals, establishing jamming priorities and sending the appropriate signals to the jammers.

The jamming pod system is reported to have the capability and flexibility to simultaneously jam any threats identified. The system would periodically re-examine the signals and update its operation as needed. The on-board portion would consist of an acquisition subsystem with separate communications and radar intercept processing elements that interact with the ALQ-99 EW jammer.

Pertinent threat information and the ALQ-149 status are presented on the EA-6B's ALQ-99 cockpit display. The electronic countermeasures officer would monitor the operation of the communications jammer's automatic responses, modifying or overriding automated actions. Manual jamming control would be possible from the cockpit. The threat library could be reprogrammed while in flight. Ground programming would be via the TSQ-142 TEAMS mission planner.

The acquisition subsystem separates intercepted communications and radar signals. The high speed search capability would reportedly be able to find potentially hostile signals as soon as they appear. The analysis subsystem would identify every new signal and period-

ically re-examine these signals, updating the jamming process as needed. The analysis system also performs a direction-finding function.

The characteristics of received signals are processed in the AYK-14 computer, where they are compared to a pre-mission library of data. The system determines the threat

potential of each signal, establishes jamming priorities, and sends the appropriate commands to the jammers.

The ALQ-149 and ALQ-99 are operationally compatible. The two systems have coordinated look-through cycles so the jammers can operate simultaneously without interference. Data from both jammers is coordinated and correlated for display to reduce operator workload.

## Variants/Upgrades

In August 1991, the Navy contracted Lockheed Sanders to upgrade the producibility, reliability, and maintainability of the ALQ-149 by replacing the existing receiver with a more reliable set-on receiver. Other Pre-Planned Product Improvements contracted included a new digital wide-band signal processor and changes to the

power supply and distribution system. These modifications will enable the EA-6B to better counter low frequency radars as well as communications and data links in a dense signal environment. They will also decrease jammer response times.

## Program Review

**Background.** The ALQ-149 will replace the ALQ-92 tactical communication countermeasures system on EA-6B aircraft. The Sanders ALQ-92 system was limited in frequency, has no analysis capability except operator aural analysis, and is vulnerable to enemy threats. It is incompatible with the EA-6B ALQ-99 tactical jamming system.

An ALQ-149 Advanced Development Model (ADM) was delivered to the Naval Research Lab during the fourth quarter of FY80. In FY81, the Navy completed ADM test and evaluation and decided to enter full-scale development. The Navy began a competitive source selection in FY82.

Sanders and ITT teamed against the AIL Division of Eaton Corporation and GTE Sylvania/Magnavox. After a year-long competition the Navy selected Sanders/ITT for the development effort. In May 1983,

the Navy awarded an initial US\$5.3 million contract for seven engineering development models.

Sanders and the Navy signed a contractual agreement in mid-1986 that established Sanders as prime contractor of the ALQ-149 in lieu of the previous ITT/ Sanders joint venture arrangement. The Navy was dissatisfied with the joint venture and said it would only deal with one program prime contractor in the future. The service said it would continue development of the Sanders onboard portion of the system and initiate competitive bidding on the jamming portion.

The first of seven systems was delivered by Sanders in March 1988. These systems were used for reliability development tests, software checkout, and onboard

testing. The contract contained options for up to 95 systems.

In August of 1991, the Navy awarded Lockheed Sanders a pre-planned product improvement contract worth US\$20 million. On April 15, 1993, the Navy announced that it was going to place an order with Lockheed Sanders to install, test, and integrate a Pre-Planned Product Improvement version of the ALQ-149 into the EA-6B Avionics Improvement airplane.

PE 0604270N, Project E0556 - EW Counter Response (EA-6B Advanced Capability (ADVCAP)). This PE funds the continuing development or integration of all EW systems for the EA-6B Electronic Countermeasures Support Aircraft. The Project funds the continuing development or integration of all EW systems for the EA-6B Electronic Countermeasures Support Aircraft.

In FY90, the Navy conducted a reliability development and weapon replaceable assembly maintainability demonstration on the ALQ-149. During FY91, engineers continued software development for the baseline ADVCAP capability and continued integration of the ALQ-149 on EA-6B. They continued software development and logistics support development for the ALQ-149 (ADVCAP).

FY92 accomplishments included software development and logistics support for the ALQ-149 (ADVCAP) and continued integration work on the ALQ-149.

In FY93, engineers continued software development, logistics and test support for Radar Processor Group (RPG) and ALQ-149 (US\$16.898 million) and integration of the RPG and ALQ-149 on the EA-6B ADVCAP (US\$4.852 million). The program office completed OT-

IIA testing of ALQ-149/RPG in support of Milestone IIA (US\$1.240 million)

In FY94, planners began a Joint Tactical Air Electronic Warfare Study (JTAEWS) (US\$5.000 million in FY94 funding) and integration studies of ALQ-149 into EA-6B ICAP-II (US\$5.845 million FY94 funding). The Navy terminated the EA-6B ADVCAP program. Congress began pressuring the service to develop a lower-cost upgrade for the Prowler. The Navy was encouraged to use prior-year funds to upgrade their premier jammer.

On February 7, 1994, the Navy issued termination notices for the EA-6B Avionics Improvement Program, Vehicle Enhancement Program, and transitioning the J52-P-409 aircraft engine from full-scale development to initial production. The Navy said that it was terminating the EA-6B ADVCAP (Advanced Capability Program) for budgetary reasons. According to information provided to Forecast International, the Navy estimated that by terminating these three contracts it would save approximately US\$60 million already obligated funds and avoid exposing additional funds for government furnished equipment and government test support. All contracts were terminated for the convenience of the government.

The Avionics Improvement Program (contract N00019-89-C-0121 with Grumman Aerospace Corporation, Bethpage, New York) would have incorporated numerous common and improved avionics into the aircraft. It included a new Receiver-Processor Group (RPG) for the ALQ-99 jammer, updated avionics/displays, and added the ALQ-149 countermeasures system.

The Vehicle Enhancement Program was to have enhanced the EA-6B's flight characteristics by incorporating various aerodynamics fixes to enhance life, directional stability, and stall characteristics. This contract, N00019-88-C-0227, was also with Grumman Aerospace Corporation, Bethpage.

The J52-P-409 engine for the Prowler was to have been transitioned from full-scale development into initial production. Contract N00019-92-C-0125 had been originally awarded to United Technologies Corporation, Pratt & Whitney Division, Government Engines & Space Propulsion, West Palm Beach, Florida.

Navy officials told Forecast International that the termination actions were strictly budget-driven; and that planners would continue to study ways to accomplish many of the electronics enhancements to the electronic warfare systems on one of the Gulf War star performers.

#### FY95 Congressional Action on EA-6B ADVCAP:

*Defense Authorization.* The Navy requested US\$38.4 million for EA-6B modifications, including various structural and common configuration modifications, such

as the Block 89A wing center sections, pod hardback, and band 9/10 transmitter modifications. After debate, the authorization conferees denied the FY95 modification funds.

The conference committee directed the Secretary of the Navy to proceed with a lower cost alternative to ADVCAP. The conferees expressed concern about possible delays while the Navy waited for the results of a joint Navy/Air Force electronic warfare study. They were concerned that a delay could preclude the ability to capitalize on prior ADVCAP investment or capturing current technology.

*Defense Appropriation.* The Defense Appropriation conference added US\$25 million to the RDT&E EW Development program for development of a follow-on program to ADVCAP. They also required the DoD to submit a development plan by December 31, 1994, in conjunction with the results of the Joint Tactical Air Electronic Warfare requirements study.

The conferees included bill language which would permit the Navy to use prior-year funds to begin non-developmental engineering changes and procure a lower-cost follow-on system and aircraft upgrades. They directed the Navy to give high priority consideration to incorporating already developed systems, or systems already under development into the follow-on systems.

#### FY96 Congressional Action on EA-6B ADVCAP:

*Defense Authorization.* Congress continued to focus on the ADVCAP termination, expressing dismay that the Navy had failed to fund EA-6B improvements other than the ADVCAP capability upgrades, enhancements impacting reliability, maintainability, and safety. The Senate Armed Services Committee also stated that they believed that the Navy decision "incorrectly ignored the EA-6B's dwindling capability against a wide array of threats."

The Navy's position was complicated by an Air Force decision to cancel the EF-111A SIP upgrade and retire their jammers on a phased basis by FY2000. Twenty additional EA-6Bs would be required to support the Air Force stand-off jamming mission. The Committee saw the Navy airborne EW program as drifting backwards. "The committee sees no coherent DoD plan for a joint future capability to conduct integrated strike air warfare. The JTAEWS analysis was supposed to define the future shape of airborne EW by examining the dominant elements of EW: jamming, self-protection, suppression of enemy air defenses (SEAD), and stealth. However, the budget does not even implement the results of that analysis."

In a scathing continuation, the SASC said, "The Department has ignored congressional intent time and

again in this matter. With no coherent plan, and with disregard for Congressional direction, the Department appears to hope the problem will solve itself. The committee believes that this is an unacceptable situation. The combatant commanders will not launch strikes without EW support, yet airborne electronic warfare is not important enough to receive upgrade funds. Unfortunately, because of previous and planned cancellations, the combatant commanders now have less EW capability available now than they had during Desert Storm."

The Senate report directed the DoD to include a warfighting capability improvement component in planned EA-6B upgrades. They recommended adding US\$40 million for a robust Band 9/10 capability upgrade for the EA-6B fleet and directed the Navy to work with the Air Force to ensure that technologies developed in the EF-0111A SIP program for Band 9/10 jammers are used in the EA-6B program.

The Senate also recommended an additional US\$140 million to upgrade 20 EA-6Bs to the Block 89 configuration to support the additional Air Force standoff jamming mission. The House of Representatives approved the original request for Navy EW RDT&E without comment.

The House and Senate completed its conference action; but the bill was vetoed by the White House for a variety of philosophical and political reasons, none involving the EA-6B. A new conference was held, removing the objectionable language (on missile defense and UN operations) and the bill signed by the President.

*Defense Appropriation.* House and Senate conferees completed work on an initial appropriation bill, which was rejected by this House of Representatives and sent back to conference. Issues had nothing to do with the EA-6B. The conferees were able to come to a new agreement and the legislation became law December 1, 1995.

The bill provided US\$165 million for modifications and improvements to the EA-6B; with US\$100 million to modify 20 more aircraft to support the Air Force jamming mission. The conference appropriated US\$40 million to buy 60 shipsets of Band 9/10 jammer transmitters and US\$25 million to buy 30 USQ-113 radio countermeasures sets. The bill added US\$10 million to the original request, of US\$87.44 million. These funds were for the Navy to begin developing a reactive jamming capability for the EA-6B and to improve the aircraft's connectivity with other critical warfighting platforms.

## Funding

|                          | FY94 |      | US FUNDING |       | FY96 |       | FY97 (Req) |       |
|--------------------------|------|------|------------|-------|------|-------|------------|-------|
|                          | QTY  | AMT  | QTY        | AMT   | QTY  | AMT   | QTY        | AMT   |
| <u>RDT&amp;E (USN)</u>   |      |      |            |       |      |       |            |       |
| PE0604270N               |      |      |            |       |      |       |            |       |
| EW Development           |      |      |            |       |      |       |            |       |
| E0556 EW Counter         |      |      |            |       |      |       |            |       |
| Response                 | -    | 31.7 | -          | 24.5  | -    | 3.3   | -          | 2.7   |
| <u>Procurement (USN)</u> |      |      |            |       |      |       |            |       |
| EA-6B Reman              | -    | 77.6 | -          | 0.0   | -    | 0.0   | -          | 0.0   |
| EA-6B Mods               | -    | 23.1 | -          | 38.5  | -    | 0.0   | -          | 59.4  |
|                          | FY98 |      | FY99       |       | FY00 |       | FY01       |       |
|                          | QTY  | AMT  | QTY        | AMT   | QTY  | AMT   | QTY        | AMT   |
| <u>RDT&amp;E</u>         |      |      |            |       |      |       |            |       |
| (USN estimate)           |      |      |            |       |      |       |            |       |
| E0556                    | -    | 2.6  | -          | 3.2   | -    | 3.2   | -          | 3.3   |
|                          | FY98 |      | FY99       |       | FY00 |       | FY01       |       |
|                          | QTY  | AMT  | QTY        | AMT   | QTY  | AMT   | QTY        | AMT   |
| <u>Production</u>        |      |      |            |       |      |       |            |       |
| (USN estimate)           |      |      |            |       |      |       |            |       |
| EA-6B Mods               | -    | 80.7 | -          | 142.1 | -    | 165.0 | -          | 208.0 |

NOTE: The Figures are from the FY96 Program Element Descriptors. The Appropriation conference added to the requested US\$149.8 for EA-6B modifications and upgrades.

|                    | FY94 |      | FY95 |      | FY96 |     | FY97 (Req) |     |
|--------------------|------|------|------|------|------|-----|------------|-----|
|                    | QTY  | AMT  | QTY  | AMT  | QTY  | AMT | QTY        | AMT |
| RDT&E (USAF)       |      |      |      |      |      |     |            |     |
| PE0604270F         |      |      |      |      |      |     |            |     |
| EW Development     |      |      |      |      |      |     |            |     |
| 2066 EF-111A (SIP) | 58.1 | -    | 56.3 | -    | 0.0  | -   | 0.0        |     |
| Procurement (USAF) |      |      |      |      |      |     |            |     |
| EF-111A (SIP)      | -    | 23.4 | -    | 23.5 | -    | 0.0 | -          | 0.0 |

All US\$ are in millions.

**Analysis.** The EA-6B has proven itself during Red Flag/Maple Flag combat training exercises as well as actual combat in the Persian Gulf War. Upgrades have kept the jammer able to counter the existing and projected threat, but continue to be needed to match the system to the potential threat and to incorporate technology advancements important to the overall performance of the system. The jammers have a proven track record of being able to effectively disrupt or debilitate hostile early warning capabilities.

The ALQ-149 will enhance the EA-6B's communications and radar jamming capability by replacing the aging and inadequate ALQ-92. The ALQ-149 will specifically concentrate on communications and low-band early warning radar jamming and interface with the EA-6B's ALQ-99 tactical jammer. During the Persian Gulf War, field commanders had to rely on Air Force Compass Call aircraft to jam Iraqi communications nets, in spite of the EA-6B's superior performance in blinding the Iraqi air defense system.

Integration testing of the ALQ-149 and EA-6B Advanced Capability systems, especially the Receiver-Processor Group, has allowed the Navy and contractor to develop a set of required improvements which can be developed and incorporated into actual production units, if called for.

The Navy's termination of the ADVCAP upgrade contracts has drawn significant reaction from Congress. The Navy needs to find money to fund production of new tactical aircraft, such as the F/A-18E/F and V-22; but it appears that trying to find it at the expense of the EA-6B enhancements did not work. The Pentagon's Bottom-Up Review and Congress have been favorably disposed toward technology solutions to military need, and support the ADVCAP upgrade over other Navy "wish-list" items.

Navy officials told Forecast International that canceling the EA-6B upgrade was one of many ideas considered as a way of finding funds for the FY95-to-FY99 time-frame, but it was an option the sea service decided to exercise. Congressional sources have told Forecast International that this will not happen. Legislative provisions bear this out.

Congress is not going to allow a full termination of EA-6B upgrades. The legislators have been very specific in directing the Navy to re-initiate EA-6B improvements, although a reduced-scale program will be permitted. Litton and AIL have combined to offer a lower cost upgrade which, they claim, will give 80 percent of ADVCAP's capability at 20 percent of the cost. This design would reduce the capacity of the new system from ADVCAP (but it still would be four or five times that of the current system), reducing the amount of software that needs to be developed new, cutting back to one AYK-14 mission computer (two planned for ADVCAP), and using a less complex direction-of-arrival technique. These improvements will probably include the ALQ-149.

Boosting the need for EA-6B upgrades was the USAF decision to retire the EF-111A and turn to the EA-6B fleet for escort and stand-off jamming. This boosts the likelihood of a more complete ADVCAP-like upgrade of the Prowler fleet. FY96 legislation directed the Air Force to maintain a small EF-111A force to insure that it does not abandon its only escort/stand-off jammer too quickly. Reporting requirements makes it necessary for the Air Force to justify its planning to a skeptical Congress. There is also a desire on Capitol Hill that upgrade work for the EF-111A SIP is not lost, that design work is applied to the EA-6B ADVCAP replacement program.

## Recent Contracts

(Contracts over US\$5 million.)

| Contractor | Award<br>(\$ millions) | Date/Description   |
|------------|------------------------|--|
| Grumman    | -                      | Feb 1994 — TERMINATION: Navy contract N00019-89-C-0121 with Grumman Aerospace Corporation, Bethpage, New York, awarded July 24, 1990, for the engineering, manufacturing, and development of the Avionics Improvement Program for the EA-6B aircraft, has been terminated for the convenience of the government. The total contract price of the items to be terminated is US\$359,434,489, all of which has been obligated  |
| Grumman    | -                      | Feb 1994 — TERMINATION: Navy contract N00019-88-C-0227 with Grumman Aerospace Corporation, Bethpage, New York, awarded May 26, 1989, for the Vehicle Enhancement Program for the EA-6B aircraft is being partially terminated. The total contract price of the items to be terminated under this contract is US\$6,800,000, all of which has been obligated  |
| P & W      | -                      | Feb 1994 — TERMINATION: Navy contract N00019-92-C-0125 with United Technologies Corporation, Pratt & Whitney Division, Government Engines & Space Propulsion, West Palm Beach, Florida, awarded on September 3, 1992, for services and supplies in support of transitioning the J52-P-409 aircraft engine from full-scale development to initial production, has been terminated for the convenience of the government. The J52-P-409 engine is used to power the EA-6B aircraft. The total estimated cost and fixed-fee is US\$9,000,000, all of which has been obligated |

## Timetable

|     |      |  |
|-----|------|--|
|     | 1983 | Contractor selected and engineering development model contract awarded. ALQ-149 engineering development model development initiated. |
| May | 1984 | ALQ-149 passed Critical Design Review  |
|     | 1988 | Delivery of initial engineering development models   |
| 2Q  | 1992 | Initial low rate production decision   |
| Mar | 1993 | ADVCAP LRIP decision, contract awarded   |
|     | FY93 | EA-6B ADVCAP Milestone IIA   |
| Jul | 1993 | ADVCAP LRIP (original plan)  |
| Dec | 1993 | Band 2/3 DT-IIH TECHEVAL   |
| Apr | 1994 | OT-IIB OPEVAL, ALQ-149 P3I system delivery   |
| Feb | 1994 | ADVCAP Contract terminations announced   |
| Dec | 1994 | Alternate upgrade plan and Joint Tactical Air EW Study due to Congress   |

## Worldwide Distribution

This is a **US** only program to date. The EA-6B ICAP II has been approved for export to **Japan, Korea**, and most **NATO** countries. The ALQ-149 may not be included with an export EA-6B.

## Forecast Rationale

The production of the ALQ-149 was to keep pace with the production of EA-6B ADVCAP upgrades. Production depends on the outcome of directed program revisions since the Navy's termination of the ADVCAP program.

Congressional intervention will prevent a complete end to Prowler upgrades, so the jammers will be installed as part of a scaled-down effort or as an addition to ICAP II Prowlers. The international market is interested again in

Prowlers, but affordability is still a problem, and it is not likely that FMS Prowlers would include the ALQ-149.

EA-6Bs will be flying well into the next century and will require a series of upgrade modifications and operational improvements to keep the EW system abreast of a changing threat environment, and incorporate new developments in hardware and software. The following forecast anticipates that the upgrade program will continue in a modified form and will include the ALQ-149. It

assumes that the Congressional "suggestions" to the Navy will be taken to heart.

An ALQ-149 P3I program is already under way. One special focus is on incorporating non-Soviet weapon parameters into the jammers. There will be an active logistics support effort through the life of the airplanes and continued programs to upgrade and enhance their electronics and avionics systems.

## Ten-Year Outlook

|             |                    | ESTIMATED CALENDAR YEAR PRODUCTION |    |    |    |                 |    |    |    |             |    |    |                |  |
|-------------|--------------------|------------------------------------|----|----|----|-----------------|----|----|----|-------------|----|----|----------------|--|
|             |                    | High Confidence                    |    |    |    | Good Confidence |    |    |    | Speculative |    |    |                |  |
|             |                    | Level                              |    |    |    | Level           |    |    |    |             |    |    |                |  |
| Designation | Application        | thru 95                            | 96 | 97 | 98 | 99              | 00 | 01 | 02 | 03          | 04 | 05 | Total<br>96-05 |  |
| ALQ-149     | EA-6B ADVCAP (USN) | 4                                  | 10 | 15 | 24 | 24              | 24 | 15 | 0  | 0           | 0  | 0  | 112            |  |