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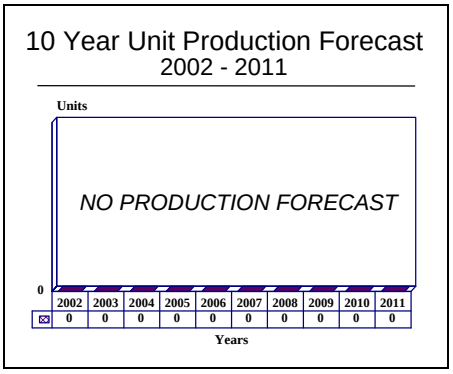
Navy Strategic Communications - Archived 09/2003

Outlook

- Minor system integration
- Minor E-6B aircraft enhancements
- No additional platforms or funding expected
- This report will be archived next year



Orientation

Description. The US Navy Strategic Communications program consists of strategic communications aircraft (E-6A/B TACAMO) and associated equipment, as well as enhancements to current shore-to-ship transmitting and receiving systems.

Sponsor

US Navy
Naval Air Systems Command
Washington, DC
USA
(TACAMO program manager)

US Naval Air Engineering Center
Lakehurst, New Jersey (NJ)
USA

US Naval Air Test Center
Patuxent River, Maryland (MD)
USA

US Naval Avionics Center
Indianapolis, Indiana (IN)
USA

US Naval Ocean Systems Center
San Diego, California (CA)
USA

Prime Contractors

Military Aircraft and Missile Systems
PO Box 516
St. Louis, Missouri (MO) 63166
USA
Tel: +1 314 232 0232
Web site: http://www.boeing.com
(Prime contractor for E-6A/B aircraft. Project H0793 TACAMO Avionics Block II upgrade)

Contractors

Honeywell, Inc
(formerly AlliedSignal Aerospace Corp – merged with Honeywell)
Guidance & Control Systems Division
PO Box 2245R
101 Columbia Road
Morristown, New Jersey (NJ) 07962-1057
USA
Tel: +1 973 455 2000
Fax: +1 973 455 4807
Web site: http://www.honeywell.com
(Subcontractor to Boeing for designing a digital automatic flight control system for E-6A/B)

Raytheon Co
Aircraft Integration Systems
(formerly Chrysler Technologies Airborne Systems)
PO Box 6056
Greenville, Texas (TX) 75403-6056
USA
Tel: +1 903 457 7229
Fax: +1 903 457 6070
Web site: http://www.raytheon.com/ais
(E-6A/B TACAMO avionics upgrade)

Rockwell International Corp
Rockwell Collins
400 Collins Road Northeast
Cedar Rapids, Iowa (IA) 52498
USA
Tel: +1 319 295 1000
Fax: +1 319 295 5429
Web site: http://www.rockwellcollins.com
(Project H0793 – HPTS)

Status. E-6A/B avionics Block II upgrade completed in 1999. The E-6A/B replaced TACAMO EC-130Q aircraft.

Total Produced. E-6A/B procurement totals 17 aircraft, including one refurbished prototype model. (Sixteen of the aircraft are in service; the 17th was originally going to be modified for the US Air Force as a JSTARS platform, but is now being held in reserve for special functions.)

Application. To ensure reliable, survivable, secure communications with ballistic-missile submarines and other strategic forces during and after nuclear attack.

Price Range. According to the 1999 US Navy Fact File, the program unit cost was roughly US$141.7 million per platform. The Block II upgrade was estimated at US$10 million per aircraft.

Technical Data

Technical Features. The main component of this program is the E-6A/B Mercury TACAMO (Take Charge and Move Out) survivable airborne communications aircraft, which is based on the Boeing 707-320B airframe (same as for the E-3 AWACS surveillance aircraft). The airframe has been hardened against thermal and blast effects, electromagnetic pulse (EMP), and gamma and neutron radiation. This protection level is said to be higher than that provided for the Air Force One presidential aircraft. The E-6A/B airframe is 75 percent common with that of the E-3, deleting the radome and supporting structure and adding wingtip electronic support measures (ESM) (ALR-66), satellite communications (satcom) pods, and the TACAMO mission electronics.

The E-6A/B aircraft is manned by a flight-deck crew of four, accompanied by up to eight mission specialists. The mission electronics include control consoles (basically the same as those used on the EC-130Q, which the E-3A replaces), but reconfigured into a V-shape for better ergonomics. There is an extensive communications fit, including ARC-182 VHF/UHF (secure voice), ARC-190 HF (one receiving, one transmitting), and AIC-32 crew-intercom (secure voice) radios, and a central communications console (satcom, crypto, and C^3 equipment, as well as emergency rocket communications receivers). The aircraft carries 58 antennas. Two trailing wire, very-low-frequency (VLF) antennas are deployed by winch. Extending 25,000 feet when fully deployed, the primary aerial is almost vertical and includes a 90-pound drogue at the end to ensure tension. The other wire is extended horizontally and is about 5,000 feet long.

Operational Characteristics. The basic mission calls for long patrols, with a refueled endurance specification of 15.4 hours, as well as the capability to orbit 1,000 nautical miles from the take-off point for at least 10.5 hours. After arrival at the mission area, the aircraft would deploy its two trailing wires and fly in a tight circle at a bank angle of 30 to 40 degrees, at close to stall speed, with flaps deployed. The size of the circle will depend on the frequency used. The circle pattern is necessary to ensure that the primary wire maintains a near vertical position (70 percent) which, when coupled to the horizontal wire, forms a huge dipole antenna. The signals transmitted by the TACAMO aircraft are received by submarines through a towed buoyant-wire antenna. The vertical antenna will never be closer than 1,000 feet to the surface of the water.

Although the main mission is submarine communications in times of emergency, the TACAMOs are still primarily concerned with surveillance. The TACAMOs can communicate with locations anywhere in the world using their extensive communications fit, and the aircraft will monitor strategic fleet communications, listening for any strategically coded signal for retransmission.

E-6B

Source: US Navy

Variants/Upgrades

TACAMO. There were two upgrade efforts involving the E-6A/B TACAMO. The Block I upgrade focused on the VLF/LF High Power Transmitter System (HPTS) and Dual Trailing Wire Antenna (DTWA) projects and their integration into TACAMO. This integration was required to ensure communications compatibility with the World Wide Airborne National Command Post (WWABNCP) aircraft and other US Air Force components that link TACAMO with strategic communications platforms and systems. Along with the development of the HPTS (VLF/LF), work also included the development of a dual trailing wire antenna system and an improved antenna coupler system.

The transmitter equipment (200 kW) provides the TACAMO aircraft with a state-of-the-art system that replaces the previously fielded tube-type equipment that has become logistically insupportable. The replacement DTWA provides the E-6A/B both short- and long-wire capability as well as provision for a utility wire deployment.

The Block II upgrade ensured communications capability with WWABNCP and focused on the integration of MILSTAR and GPS into TACAMO. EHF MILSTAR, MILSTAR processor, T/FSDS (Time/ Frequency Switching Distribution System) and GPS upgrades were included. The system was also improved for better reliability and maintainability, resulting in enhanced system communications capability.

Shore-to-Ship Communications. The Enhanced VERDIN System (EVS) involved a two-phase replacement of the obsolescent VERDIN processor and modulator/demodulator system. Phase I provided a form, fit, and function replacement processor that will host EVS Phase II improvements. EVS Phase II resulted in modulator/demodulator modifications and improvements to the communications systems. The Compact Very Low Frequency (CVLF) system replaced the VLF/LF receiver/demodulator and transmitter/ modulator (with the exception of the high-power elements) and the VERDIN and EVS processors.

Program Review

Background. Advanced TACAMO electronic communications suite designs were initiated in FY84 to accommodate phased system improvements. Full-scale development of a VLF receiver terminal was also initiated. In FY85, design of the advanced communications suite continued, along with advanced development of a solid-state VLF transmitter. In addition, advanced systems design of a lightweight VLF trailing wire antenna system was initiated. Advanced development of the VLF Power Amplifier Improvements was completed during FY86. Integration of a UHF satellite terminal compatible with AFSATCOM IIR was then initiated, and, in both FY86 and FY87, EHF MILSTAR engineering development models were procured. At the same time, a VLF diversity receive antenna was designed. During FY87, the UHF satellite terminal was integrated and full-scale engineering development of the Solid State Power Amplifier (SSPA) and Dual Trailing Wire Antenna (DTWA) was initiated.

By FY89, contractor installation/test of the HPTS on the E-6A/B had begun, and a draft acquisition plan for Block II had been prepared. At the same time, a contract was awarded to Smiths Industries to modify the flight management computer system (FMCS) for global positioning satellite (GPS) inputs. Contracts were also awarded to the Naval Avionics Center for T/FSDS development and to the Naval Ocean Systems Center

for the MILSTAR processor software effort. In FY90, lab tests of the HPTS engineering development models (EDM) were completed, and the EC-135 HPTS was delivered for contractor demo and test. Also, MILSTAR EDM testing was started at the Naval Air Development Center, the Project Master Plan was prepared, and the HPTS Logistic Support Analysis was completed.

The following year, FY91, was a busy one as work included the installation of the HPTS on the E-6A/B, delivery of the modified FMCS for GPS and the MILSTAR message processor software, the commencement of EDM development on the T/FSDS, and the release of the Block II RFP to industry. Also completed during FY91 were the E-6A avionics block upgrade and HPTS TECHEVAL testing in support of Production Milestone III. Finally, an Orbit Improvement Milestone II decision was made regarding EMD and an EMD contract was awarded.

In FY92, Block II full-scale development was begun, technical and operational evaluations of the HPTS were conducted (in an effort that ran through FY94), and the required documentation was completed. By the end of FY94, the avionics block-upgrade contract had been awarded and design reviews completed.

In FY95, the E-6A avionics block upgrade was installed, the Orbit Improvement developmental testing was conducted, and an Airborne Command Post (ABNCP) installation contract was awarded. The work specified to be performed under the contract was completed by the end of FY96. This effort was then followed by the installation of the ABNCP validation/verification system. The entire validation/verification process, including contractor testing, was completed by the end of FY97. This marked the end of the development process. Testing and installation would continue until FY99, when the entire Block II upgrade was scheduled to be finished.

Shore-to-Ship Communications Systems. Technical evaluation of the EVS processor was completed and operational evaluation was begun in FY84 and completed in FY85. The work being conducted under the Strategic Communications Assessment Program (SCAP) continued, along with development of the electric winch (for the OE-305 towed buoy antenna) and Phase IIA development of the Compact Very Low Frequency (CVLF) systems.

CVLF receiver development continued through FY86, and successful OPEVAL of the EVS processor was followed by procurement. Development work went forward on an improved model of VLF propagation, and the annual required update was conducted. Efforts during FY87 concentrated on delivering engineering development models of the CVLF receiver for development testing, planning the CVLF P3I and Fixed VLF improvement efforts, and continuing the SCAP.

In FY90, modifications were made to correct the CVLF receiver system deficiencies discovered in the FY89 Operational Assessment. Also, final reports on field testing of the Integrated VERDIN Transmit Terminal (IVTT) were submitted, and the performance specifications were outlined. In FY91, plans were made to replace the obsolete CVLF microprocessor with the Pace Semiconductor 1750A microprocessor to improve throughput and supportability. Finally, the Solid State Power Amplifiers Replacement (SSPAR) FSD procurement package was prepared.

Fabrication and testing of the CVLF systems with improved microprocessors was conducted in FY92. In addition, contracts were awarded for the development of CVLF strategic enhancements (including non-linear adaptive processing [NONAP]) and for SSPAR. In FY93, the Critical Design Review (CDR) was completed and a contract awarded for the design of the Pluggable COMSEC Module (PCM) for the CVLF systems.

CVLF receiver system production was delayed until the completion of the enhancement and NONAP development efforts. Developmental Testing/Operational Testing (DT/OT) and Milestone III slipped six years due to the delay. In FY94, Project X1083 Shore-to-Ship Communications was transferred to PE#0204163N Fleet Communications. (For additional information, see the report titled "Fleet Communication" in this binder.)

E-6B. The US Navy took delivery of its first E-6B from Raytheon E-Systems in May 1997. Raytheon's original E-6B contract with the US Naval Air Systems Command was worth US$82.3 million and included two options worth US$75.6 million for follow-on fabrication, installation, and testing of modification kits for four additional E-6 aircraft and two full mission trainers. Equipment being cross-decked from the EC-135 to the E-6B includes the airborne launch control system, UHF C3FDM radios, and the Digital Airborne Intercommunications Switching System, which was developed by Raytheon for the aircraft.

Under congressional direction, the US Navy's E-6A/B TACAMO aircraft assumed the strategic communications relay mission performed by US Air Force EC-135s. In January 1995, the Navy awarded a US$95.5 million contract to Chrysler Technologies Airborne Systems (CTAS), Waco, Texas, to modify up to six E-6As to an E-6B configuration.

The E-6B is designed to support the missions of the E-6A and the EC-135 at least until the year 2020. The upgrade included installation of a MILSTAR satellite communications terminal, GPS equipment, a Lockheed Martin mission computer system, an AlliedSignal vapor cooling system, and Hughes secure telephone and fax equipment. Other equipment was transferred from the EC-135.

Funding

All R&D funding (US$16.736 million) was completed as of FY96; no funding was requested for FY97 or for subsequent years. By FY97, development for the upgrade had been completed. Testing and installation of the upgrade was completed by the end of FY99.

Recent Contracts

No recent contract valued over US$5 million have been identified through public source information at this time.

Contractor	Award ($ millions)	Date/Description
Raytheon	31.4	Feb 1999 – A US$31.4 million ceiling amount undefinitized modification to previously awarded contract N00019-98-C-0022 for the integration, installation, and testing of ABNCP aircraft modifications for two E-6B production aircraft, two production kits, stripping and painting of the aircraft, engineering technical services, integrated logistics support, spare and repair parts, training services, and data. Contract completed August 2000.
Raytheon	8.1	Sep 1999 – FFP contract for the design, fabrication, and integration of cryptographic modification kits for 10 E-6B ABNCP aircraft, two laboratory assets, and one trainer, including training, training material, a logistics-management information program, and related data. Contract completed September 2000. (N00019-00-C-1137)
Raytheon	30.1	Jan 2000 – Modification to previously awarded contract N00019-98-C-0022 to exercise an option for FY00 integration, installation, and test of the ABNCP aircraft modifications for two E-6B production aircraft. This modification includes the installation of high-power transmit sets and retrofit kits, as well as spare and repair parts, integrated logistics support, and required data. Contract completed September 2000.
Boeing	20.8	Sep 2000 – A FFP contract for engineering and technical services and associated supplies to upgrade 15 E-6B aircraft. Contract completed January 2002. (N00019-00-C-0508)
Boeing	18.3	Dec 2000 – Modification to previously awarded contract N00019-99-C-1228 to exercise an option for testing the multifunctional display systems for integration and installation into the E-6B production aircraft. The contract also includes integrated logistic support, spare sets of parts and required data for the E-6B modifications. Contract completed October 2001. (N000-19-99-C-1228)
Raytheon	21.4	Nov 2001 – Modification to previously awarded FFP contract N00019-98-C-0022 to exercise an option for the procurement of one ABNCP retrofit kit and the installation of two ABNCP kits (one kit previously procured). The contract is expected to be completed in January 2003.

Timetable

Month	Year	Major Development
	1983	FSD contract for E-6A awarded
	1986	Prototype E-6A aircraft rolled out
	1987	First flight of E-6A prototype
Apr	1987	FSD contract for HPTS issued to Rockwell
Aug	1989	First two production E-6As accepted by Navy
	FY90	RFP released for Block II FSD
Aug	1990	Block II installation contract issued
Jun	1991	Last of production E-6As originally scheduled to be delivered
Oct	1991	Block II FSD contract awarded
	FY92	Block II TECHEVAL/OPEVAL
Feb	1992	SSPAR FSD contract award
Apr	1992	HPTS FSD completed; Navy production option for HPTS
Oct	1992	CVLF enhancements development contract awarded
Dec	1992	Milestone III AFP for CVLF receiver system
Jan	1993	Pluggable COMSEC Module (PCM) development contract awarded
	FY93	Prototype installation of Block II
May	1996	SSPAR operational testing completed
May	1997	First E-6B TACAMO aircraft delivered
Jul	1997	Pluggable COMSEC Module operational testing completed
Sep	1997	ABNCP installation completed
Jun	1998	ABNCP follow-on test and evaluation completed
	FY99	Last year of Block II upgrade installations; FOC for upgraded E-6A/B fleet
	FY00	Systems integration and enhancements continuing on minor level

Worldwide Distribution

Although this is a **US Navy** program, elements such as the HPTS and the DTWA are used in US Air Force EC-135 Airborne Command Post Aircraft. Currently, there are reportedly 17 E-6A/Bs (16 fielded with US Navy, one in reserve for special missions and testing). There is little, if any, possibility of export sales at this time.

Forecast Rationale

The Navy's TACAMO (Take Charge and Move Out) strategic communications aircraft function as a survivable communications link between the President, other top-level commanders, and commanders of US Navy submarines, bombers, and missile platforms during hostile actions.

The original TACAMO platform was the US Navy's EC-135 aircraft, which after 30 years of steady service was replaced by the E-6B in October 1998. The E-6B aircraft completed a Block II upgrade in December 1999 that ensured communications compatibility within the Strategic Connectivity System (which is the system that links TACAMO with other strategic communications platforms and systems). EHF MILSTAR, MILSTAR processor, Time/Frequency Switching Distribution System, and GPS upgrades were also installed aboard the E-6A/B as part of the block upgrade program. As well as providing the required compatibility, the installation of these systems provided a significant increase in reliability and maintainability, enhanced system communications capability, and provided increased supportability. The now completed Airborne Command Post modification was an extension of the application program that moved already-proven equipment from the EC-135 aircraft to the E-6A/B aircraft.

The US Navy's E-6B TACAMO aircraft fleet is considered fully staffed, upgraded, and in operation. No additional platforms are expected to be produced at this time. With the completion of the Block II upgrade, no direct additional funding is expected either. However, some continued modification and systems

integration tweaking is likely, which will probably come from platform maintenance funding instead of from the Navy Strategic Communications program, which for all practical purposes is now considered completed.

Ten-Year Outlook

The forecast chart has been omitted. Barring any sudden surge of activity, this report will be archived next year in September 2003.

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