ERIK SIMONSEN PHOTO

This head-on view of the E-3 Sentry shows its distinct rotodome. Measuring 30 feet wide and 6 feet thick (9.1 by 1.8 meters), it scans at six revolutions per minute. When not in operation, it continues to rotate once every four minutes.

Still keeping watch

How the E-3 Sentry AWACS evolved to meet its mission

By Erik Simonsen

From the original concept of an airborne system to provide command and control data, as well as strategic air defense of North America, the Airborne Warning and Control System has proven itself far beyond initial expectations. AWACS has evolved into the primary airborne battle management command and control aircraft.

Preliminary conceptual thinking for such a system began during the early 1960s, when the requirement arose for beyond-the-horizon surveillance combined with tracking of low-flying targets unhindered by ground clutter. The program was managed by the U.S. Air Force's Electronic Systems Division at Hanscom Air Force Base in Bedford, Mass. By mid-1965, Boeing, Douglas and Lockheed responded to a Request for Proposal from the Air Force. All were awarded study contracts to examine various state-of-the-art technologies for operating an Airborne Early Warning and Control System. The original radar system contenders were Westinghouse Electric and Hughes Aircraft.

In 1966, Lockheed was dropped from the competition as Boeing and Douglas began the Concept Formulation Phase. Commercial derivatives figured prominently, with Boeing offering the 707-320B platform, and McDonnell, which had since merged with Douglas in 1967, proposing a derivative of the commercial DC-8. Both contractors responded to a final Request for Proposal from the Air Force in December 1968, and subsequently Boeing received a go-ahead to continue testing for an additional six months. A full-scale AWACS mockup crew station was built in the Boeing Development Center using actual 707-320 fuselage sections.

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The U.S. AWACS has a flight crew of four and from 13 to 19 mission specialists aboard. The aircraft has an endurance of more than eight hours unrefueled.

In July 1970, Air Force Secretary Robert Seamans Jr. announced the selection of Boeing as prime contractor to proceed with development of AWACS. However, under the "fly before buy" contract, feasibility of the system and a radar down-select would take place first. If everything worked, then Boeing would receive funding for two prototypes and eventual production.

What's interesting to note is that if McDonnell Douglas had won, Boeing (as a result of the subsequent 1997 merger) would be supporting the E-3 (DC-8) aircraft type today.

Each of the two Boeing prototypes (designated EC-137D) would test the competing radar systems. First flight of the No. 1 prototype (EC-137D #71-1407) took place on Feb. 9, 1972. After more than 600 hours of in-flight testing, the Westinghouse (today, Northrop Grumman) high-pulse repetition frequency pulsed Doppler radar was declared the winner.

The first production E-3A was delivered to (then) Tactical Air Command in March 1977. Of the 34 aircraft produced for the U.S. Air Force, 33 remain in inventory and have been upgraded to the E-3B and C configuration.

The Air Force and NATO's 17 aircraft are powered by four Pratt & Whitney TF-33-PW-100/100A turbofans with 21,000 pounds of thrust each. The French E-3F, Saudi Arabia's E-3A and the United Kingdom's E-3D are powered by the CFM International CFM-56-2A-2/3, each generating 24,000 pounds of thrust. The increased thrust allows for a higher operating altitude, thus extending the horizon for the radar. Additionally, Japan operates four AWACS aircraft based on the Boeing 767-200ER airframe.

In all weather conditions, AWACS sensor and computer subsystems of radar, identification friend or foe (IFF) and electronic support measures collect and correlate detailed battlespace information. These include position, tracking and identification of friendly, neutral and hostile aircraft and ships, as well as location and identification of emitters. The systems also transmit information to major land- or sea-based command centers via tactical digital information links and can continue to perform while remaining resistant to Electronic Attack. With a range of more than 335 miles (540 kilometers), the radar is capable of tracking targets into the stratosphere and can eliminate ground clutter to track low-flying targets.

All AWACS aircraft have undergone several upgrades over the years and now operate using the Block 30/35 mission system. The latest Block 40/45 upgrade now under System Development and Demonstration for U.S. AWACS utilizes a new, fully open-architecture PC-based mission system, upgraded communications/navigation systems/radar equipment and new mission computing capability. This is the largest single modification to the Air Force's fleet since the first delivery in 1977. TS-3, the first 40/45 upgraded aircraft, began flight testing in July 2006 and will continue through 2007.

In addition, these upgrades ensure AWACS as a centerpiece for network-enabled capability and a potent force multiplier. A veteran of Operations Urgent Fury, Just Cause, Desert Storm, Desert Thunder/Viper/Fox, Allied Force, Noble Eagle, Enduring Freedom and Iraqi Freedom, the E-3 Sentry will continue to improve and serve for many more decades. ■

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These two images show early configurations for a 707-based AWACS aircraft. The illustration on the left shows Boeing's initial configuration for the AWACS, which featured a tail-mounted rotodome mounted on a forward-swept vertical stabilizer. On the right, the 707 aircraft featured eight efficient turbofan engines. Reduction in required endurance time enabled the standard 707 Pratt & Whitney engines to be retained.