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DeHavilland Dash-8 Aircraft Airborne System Testing

S. P. Herrlinger*
USAF Air Warfare Center, Tyndall Air Force Base, Florida 32403

The 84th Test Squadron, a part of the USAF Air Warfare Center in the Air Combat Command, was tasked with assessing the operational effectiveness and suitability of the DeHavilland Dash-8 Aircraft (E-9A) airborne platform/telemetry relay aircraft. The E-9A is an integral part of the Gulf Range instrumentation system at Tyndall AFB and Eglin AFB, Florida. It supports air-to-air (AA) missile firings against aerial drone targets for fighter pilot training and for test and evaluation. The ability to command fighters and targets and to receive telemetry data is currently limited to line of sight (LOS) because of land-based transmitters and receivers. Future operations will be conducted over-the-horizon (OTH), rather than with present LOS systems, because of the increasing number of near-shore pleasure boats and lower altitude missile launches. The E-9A is designed to extend the effective range of existing land-based instrumentation systems. It does this by providing the telemetry, communications, and drone control relay required to support OTH missions in the Gulf of Mexico. It also provides radar surveillance of boats in the Gulf to establish a clear area free of boats for missile launches. This publication covers the qualification operational test and evaluation of the E-9A which was an evaluation of its capability to provide Gulf Range users with radar sea surveillance, telemetry relay, ultrahigh frequency (UHF) radio relay, and Gulf Range drone control relay.

Introduction

TYNDALL and Eglin Air Force Bases, located along the Gulf of Mexico in Florida, possess a Gulf Range instrumentation system which supports Weapons System Evaluation Program (WSEP) missions, and test and evaluation of air-to-air (AA) missile firings against drone targets. Participating fighter aircraft must currently remain within line of sight (LOS) of land-based transmitters and receivers used for command and control. Presently, drone targets and missiles must also remain within LOS of land-based receivers for telemetry data reception from missile launch to impact. Future Gulf Range AA missile firings will involve ranges and altitudes for fighter aircraft, missiles, and drone targets that are not LOS, but are over-the-horizon (OTH).

The E-9A aircraft is part of an overall upgrade to the Gulf Range AA instrumentation to support future OTH missions. The system consists of a modified, instrumented DeHavilland Dash-8 aircraft designated as the E-9A (Fig. 1), a ground support van (GSV), and a high-frequency (hf) ground receiving station. There are only two E-9As in the USAF inventory, and both are stationed at Tyndall AFB.

The E-9A is designed to provide telemetry and communications relay required for land-based transmitters and receivers to support OTH mission participants. Additionally, the E-9A locates an over-water range area clear of boats for missile launches, called a "shoot box," with its sea surveillance radar. The E-9A can also be configured to support OTH Gulf Range drone control.[1]

The E-9A has four onboard instrumentation subsystems which are designated as prime mission equipment (PME). These four subsystems (shown in operation in Fig. 2) are the 1) telemetry relay subsystem, 2) ultrahigh frequency (uhf) voice relay subsystem, 3) radar sea surveillance subsystem, and 4) the Gulf Range drone control relay data link subsystem (DLS). This article focuses on operational testing of these four main subsystems. Qualification operational test and evaluation (QOT&E) of the E-9A was conducted by the 84th Test Squadron (TS), USAF Air Warfare Center (USAFAWC), Air Combat Command, Tyndall AFB, from February 1990 to April 1991. The USAFAWC is presently resolving QOT&E-identified aircraft system deficiencies through further ground and flight testing.

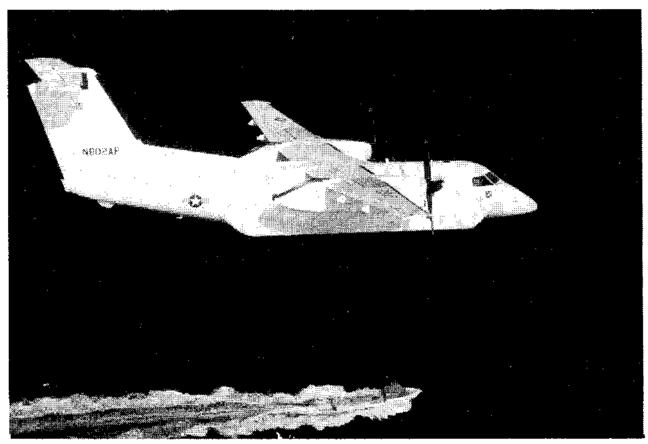

Fig. 1 E-9A aircraft.

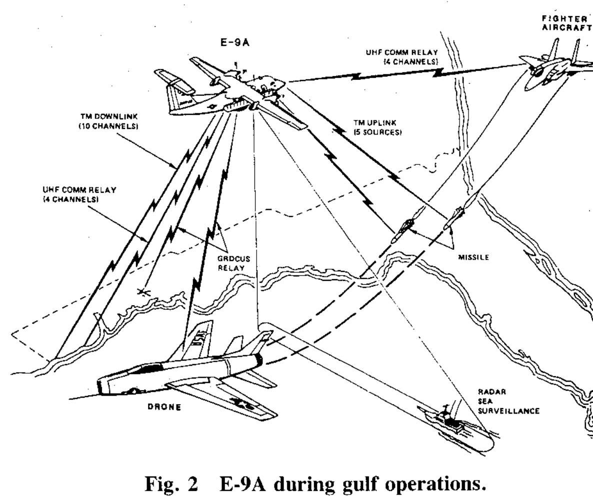

Fig. 2 E-9A during gulf operations.

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*Captain, 84th Test Squadron.

Four Aircraft Subsystems

For the telemetry relay subsystem, the E-9A received telemetry data from airborne missile sources through a phased array antenna built into the right side of the E-9A aircraft. Up to five single or dual S-band telemetry sources were received by the 120-deg field-of-view, phased array antenna. The received telemetry data were then recorded on board the E-9A aircraft and simultaneously retransmitted by up to 10 transmitters for ground reception at Gulf Range telemetry receiving sites.[2] The E-9A was designed to receive telemetry data from a distance of up to 100 nautical miles (n.m.i.) from sources moving at velocities of up to Mach 5. Typically, the E-9A was only 20–30 nm from the source during testing. The E-9A usually flew at 15,000–20,000 ft mean sea level (MSL) for telemetry relay and retransmitted telemetry back to Tyndall AFB at distances ranging from 20 to 110 nm (Fig. 3).

Two-way uhf voice relay between ground and airborne fighter/mission aircraft was established with the uhf voice relay subsystem. The E-9A had eight uhf receiver/transmitters. This allowed for up to four separate uhf relay links to be simultaneously established between mission controllers on the ground and airborne mission participants. Although designed to be as far as 200 nm from land-based receiver/transmitter sites,[2] the E-9A typically relayed uhf communications to ground sites up to 100 nm from fighters which were 30–50 nm from the E-9A (Fig. 4).

The E-9A sea surveillance radar was an AN/APS-128K phased array, X-band radar operating at 9.3–9.5 gigahertz

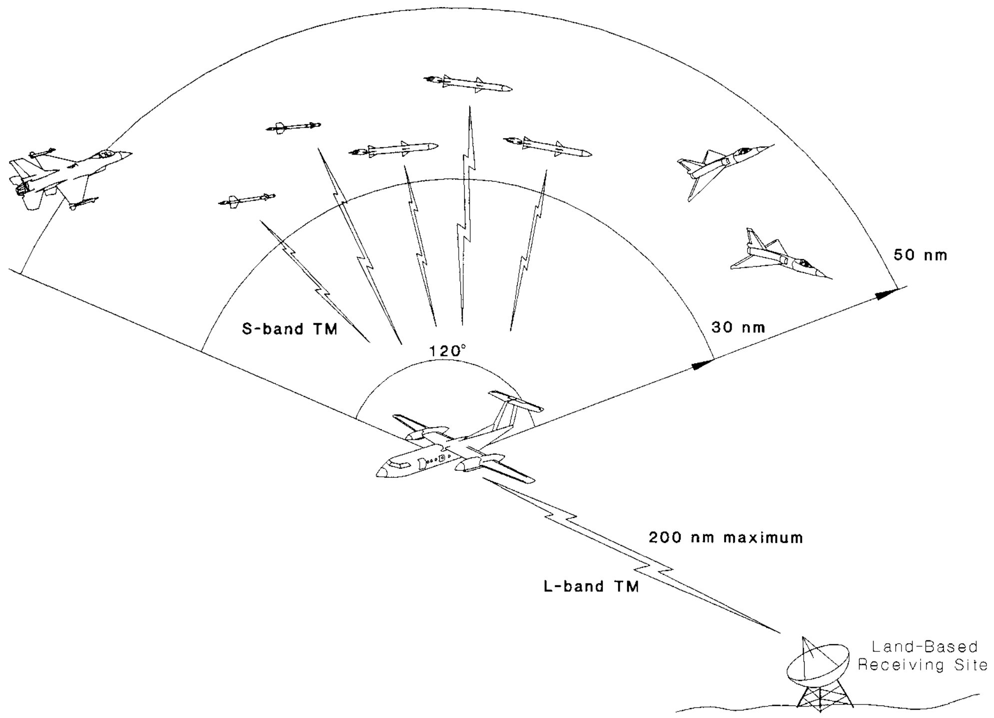

Fig. 3 Telemetry relay.

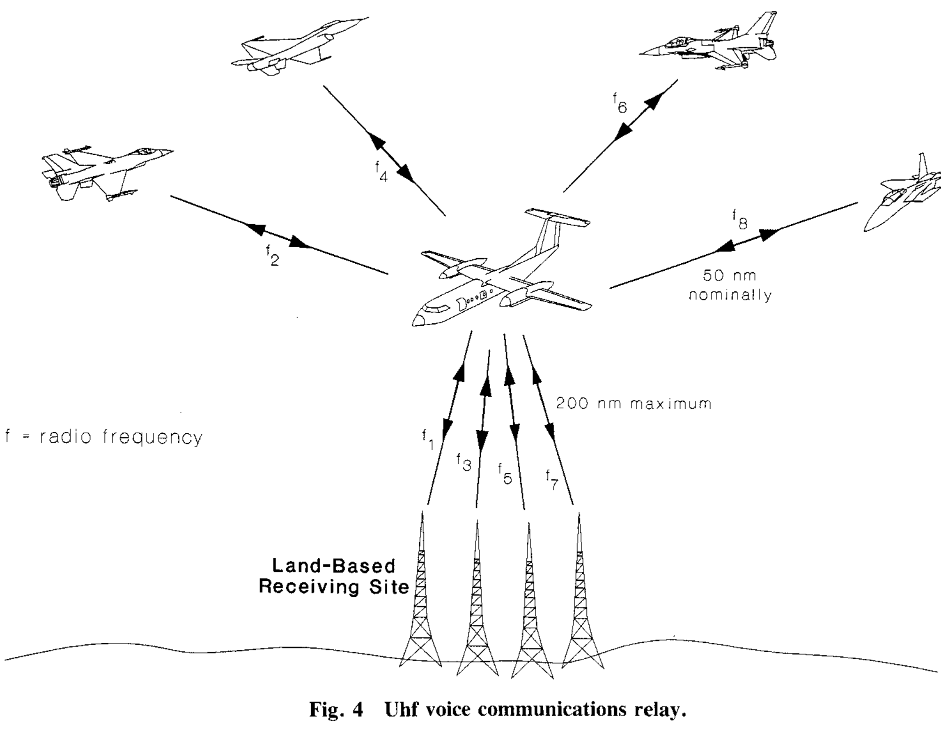

Fig. 4 Uhf voice communications relay.

(GHz), with a pulse resolution factor of 395 Hz. It was pitch and roll stabilized to 15 deg and provided 360-deg coverage for approximately 50 nm from the E-9A's position. The sea surveillance radar was designed to detect a 1-m^2 target within a radius of at least 20 nm. Optimum radar performance was at E-9A altitudes of approximately 1000–3000 feet MSL. The radar sea surveillance system (including hf data downlink) was used to locate an area of the Gulf of Mexico clear of surface vessels for missile firings. The radar operator on board the E-9A manually tagged or numbered boat radar returns on the sea surveillance radar display. Up to 100 tagged boat positions were then downlinked on one of five separate hf channels on the hf data downlink for real time display at the range control facility (RCF). Safety personnel on the ground used this boat position information to determine a clear area to conduct AA missile firings. For moving boats, the operator had to manually move the tagged positions to reflect current boat positions.

During testing and all WSEP missions, the E-9A conducted premission sea surveillance of the planned operating areas over the Gulf of Mexico to find a region clear of surface vessels in which to conduct the AA missile firing (Fig. 5).

Tagged positions of boats on or near the planned operating area were downlinked by the hf data link for computer display at the Gulf Range drone control relay facility. The E-9A typically conducted the sea surveillance from altitudes of 1000–7000-ft MSL. Although designed to survey a 100- by 100-nm area in under 1 hr, the E-9A normally focused on a shoot area 40-nm wide by 70-nm long.

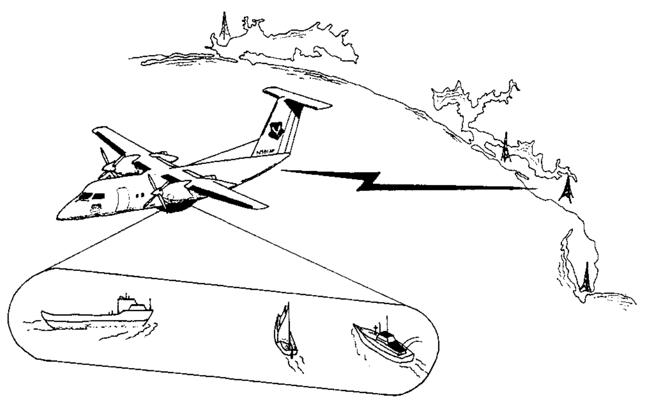

Fig. 5 Sea surveillance.

The hf ground receiving station was part of the E-9A radar sea surveillance subsystem. The station consisted of an antenna and hf receiver located at the range support facility (RSF) in building 1801, Tyndall AFB, the communications links from the RSF to the prototype RCF in building 1277, and a time diversity modem located at the RCF. The time diversity modem compared received data on the five hf channels sent out by the E-9A. Three channels had to have valid data for sea surveillance data to be displayed. If the data were not valid, boat position update did not occur. The E-9A transmitted updated data every 60 s for approximately 20 s. Boat position was also called out verbally over uhf radio by the E-9A radar operator, giving range and bearing to Wetstone (air weapons controllers responsible for WSEP) control. Wetstone safety officers then traced boat positions on a radar scope to establish the shoot box.

Drone control relay and tracking was performed by the Gulf Range drone relay network. The E-9A was equipped with an onboard DLS. The E-9A could replace one of three Gulf Range relay aircraft required for complete network coverage. Normally, when performing this control relay function, the E-9A could not perform other functions due to relay geometry requirements.

The drone control relay mission director positioned the E-9A as required to support the two additional airborne drone control relay aircraft. These aircraft also provided relay of drone control commands and responses, flight termination commands, and flight termination status. Time-space-position information was also relayed between low-level drones and the land-based Gulf Range drone control relay facility (Fig. 6).

A major component used for diagnostic support of the four E-9A aircraft subsystems was the GSV. This van was backed up to the aft section of the E-9A to connect to the aircraft electronic systems. It had an on-board internal power distribution system for powering its air conditioning, lighting, and test equipment. The van test equipment checked out the telemetry subsystems by generating telemetry test signals that were internally sent to the E-9A's receiving system.

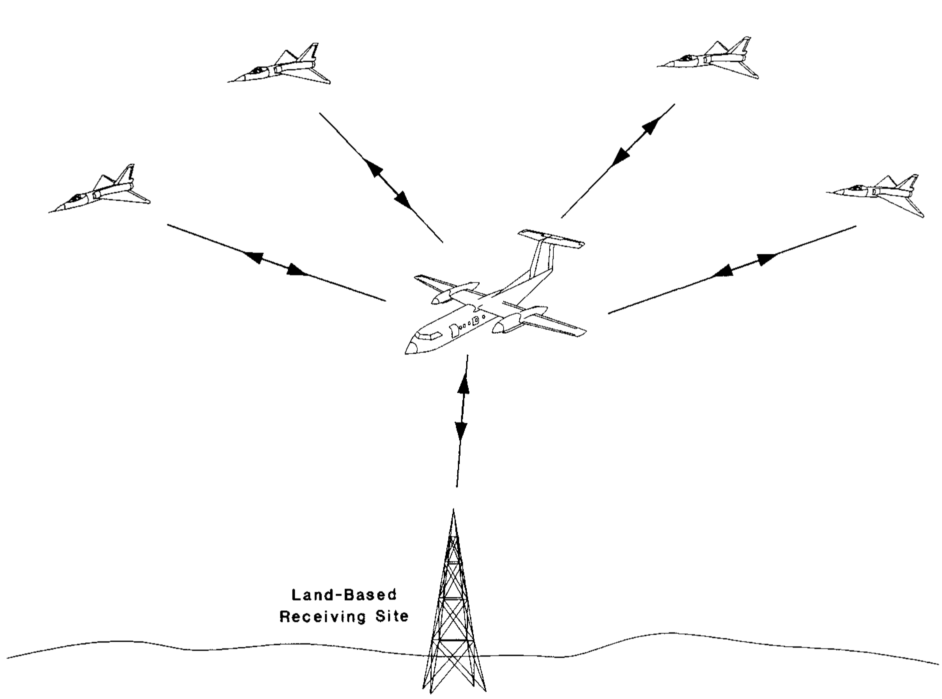

Fig. 6 Drone control relay and tracking.

The resulting signal at the E-9A transmitter was sent to the van where it was compared, in real time, to the original test signals.[3] The van also tested E-9A radio relays by checking power levels and the actual frequency of transmission. This test did not use E-9A receive/transmit antennas; the power was shunted into a nontransmitting resistor, or a dummy load. The ground support van is shown testing the E-9A instrumentation in Fig. 7.

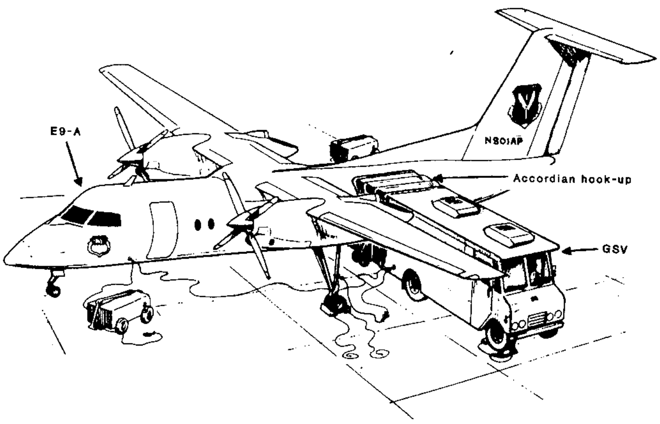

Fig. 7 GSV testing E-9A subsystems.

Telemetry Relay Testing

The capability of the E-9A to receive and relay telemetry was assessed during standard WSEP and advanced medium range air-to-air missile (AMRAAM) missions and dedicated multipath/shielding telemetry flights.

WSEP Telemetry Method

The E-9A performed premission sea surveillance to establish a shoot box for each mission. The shoot box varied from 20 to 100 nm from Tyndall AFB. When possible, the E-9A was positioned south of the shoot box to simulate OTH missions. This placed the E-9A at least 70 nm from Tyndall AFB. The E-9A's altitude during telemetry relay varied from 8000 to 25,000 ft MSL, averaging 15,000 feet MSL. The standard WSEP mission consisted of three–five missile launches, with various mixes of AIM-7F, AIM-7M, AIM-9L, and AIM-9M missiles. Additionally, AMRAAM live-fire missions were accomplished during testing.

AMRAAM Telemetry Multipath/Shielding Method

The purpose of these missions was to collect E-9A data on F-15 and F-16 AMRAAM multipath interference during telemetry reception, and to look at shielding effects from F-15 and F-16 aircraft captive-carrying an AMRAAM missile telemetry source. The quality of data retransmission from various distances from Tyndall AFB was also examined. Separate missions were required for the F-15 and the F-16.

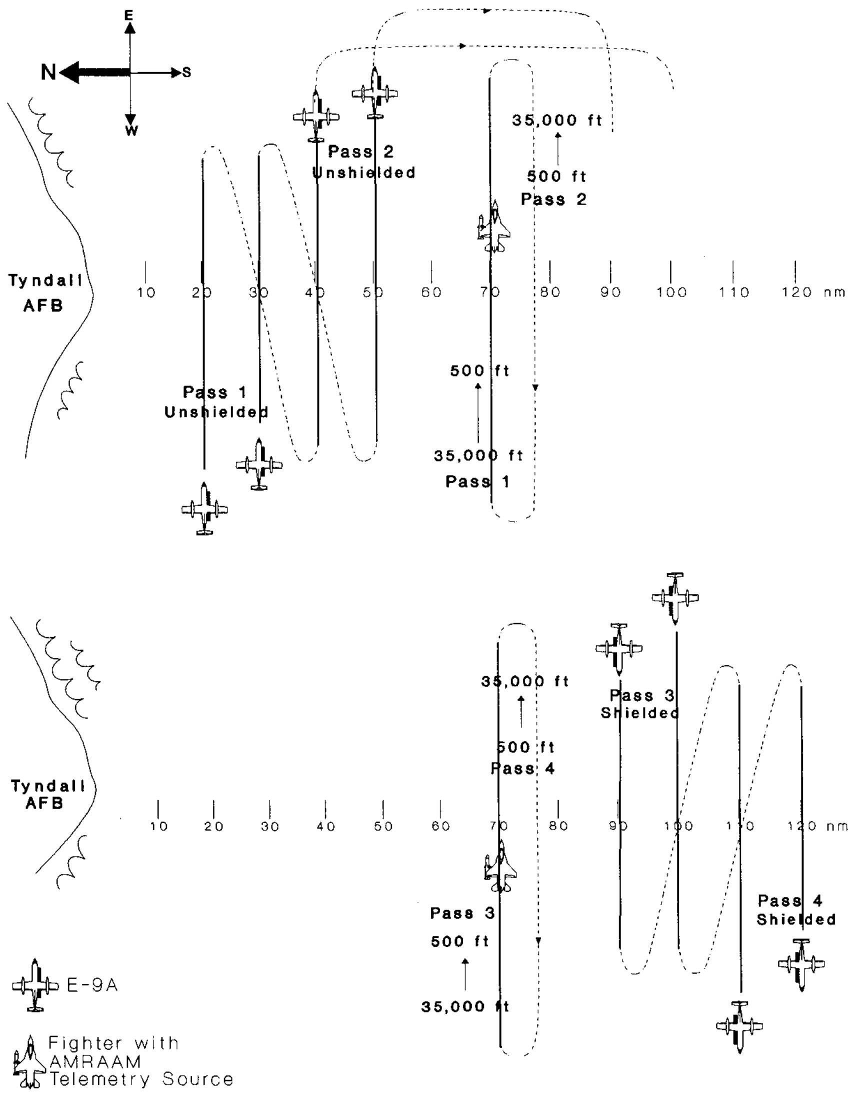

Fig. 8 E-9A/AMRAAM multipath/shielding test.

The E-9A, using its phased array antenna elements, had the capability to polarize telemetry receiving beams to minimize multipath interference. Both E-9As had their five telemetry beams configured before the mission with the receiving system in three different polarizations. Normal E-9A telemetry antenna reception was oriented slant left and slant right combined. It was electronically aligned 45-deg left and right of vertical. The E-9A telemetry antenna was designed to automatically select the received signal with the greatest strength. Data were also collected with the antenna polarized both vertically and horizontally. All data received were recorded on board the E-9As for postmission evaluation. These data were also reradiated through transmitters to ground receiving stations.

For telemetry testing, one fighter made multiple W-to-E passes by the two E-9As, which were flying in a loose formation. The fighter's under-wing-mounted AMRAAM telemetry source was kept within the elevation beamwidth of the E-9A's phased array antenna during the pass. The E-9As rolled 2–6-deg right wing up in the direction of the AMRAAM telemetry source twice during each pass to look at the effects of the E-9A roll on the telemetry antenna. The E-9As flew level in pitch attitude, at approximately 150 kt. E-9A altitude was 15,000 ft for all passes. The no. 1 E-9A led the no. 2 E-9A by approximately 10 nm for each pass (Fig. 8). During passes 1 and 2, the missile telemetry source was not shielded by the fighter fuselage. On passes 3 and 4, the fighter fuselage shielded the missile telemetry source from the E-9A.

Telemetry Results and Conclusions

The QOT&E on E-9A telemetry reception and relay was started and then delayed until the end of overall testing because of numerous changes and refinements to the telemetry system. The 84 TS requested a configuration freeze in order to complete the testing. This was done and the remaining missions were accomplished with a mix of AIM-7, AIM-9, and AMRAAM telemetry data sources. Initial results were not satisfactory as missile data were very noisy and had numerous dropouts. Much of these data were unusable by missile analysts. Some data were usable if telemetry dropouts did not occur during critical phases of missile flight.

The most critical phases of missile telemetry were just after launch and at target intercept because of scoring. If noise or dropouts occurred during these phases of flight, the data were unusable. AMRAAM had even more stringent data requirements. Dropouts of more than $\frac{1}{2}$ ms could mask critical fusing and terminal phase signals necessary for missile analysis.

The USAF and the E-9A prime contractor brought in consultants to help improve poor E-9A telemetry reception. Along with the test team members, they determined that one cause of excess noise and dropouts was incorrect software coefficients which steer the phased array telemetry antenna to track an accelerating missile. These coefficients, alpha and beta, govern extrapolation of future position based on present velocity and position. In addition, changes were made to the telemetry recording format, telemetry filters, bit synchronizers, receivers, and telemetry antenna software. Once all the changes were implemented, data were collected on non-QOT&E missions which revealed an improvement in data quality. However, the telemetry system was not consistent in delivering acceptable telemetry, so further refinement of the telemetry system was recommended.

Another recommendation from testing was that the E-9A be modified to ensure timing data were always available. On two test missions, telemetry data were unusable because the E-9A atomic clock system used for timing references failed. There is a backup, less precise, satellite clock on board the E-9A which would make data usable in the event of atomic clock failures. QOT&E recommended that the satellite clock timing be patched to the telemetry recorder on the E-9A to preclude future clock failures.

Ultrahigh Frequency Radio Relay Testing

The capability of the E-9A to relay uhf voice communications was assessed during all types of test missions.

Ultrahigh Frequency Radio Relay Test Method

On missions where the uhf radio relay link was needed, E-9A AA and air-to-ground (AG) radio relays were turned on. Wetstone control broadcasted on an AG frequency and this transmission was relayed through the E-9A to WSEP shooters or support aircraft on an AA frequency. Communication evaluation was accomplished on board the E-9A by an 84 TS flight test engineer, as well as by users on both ends of the relay: Wetstone control and airborne WSEP aircraft. Relay distances were typically 30–40 nm from the AA link, and 70 nm for the AG link.

Ultrahigh Frequency Radio Relay Results and Conclusions

Three problem areas were uncovered during radio relay testing. The first problem was that during initial missions several receiver/transmitters and multicouplers burned out. The radio relay AG antenna is located on the lower fuselage centerline, only 6-ft aft of the antenna for the pilot's uhf no. 2 radio (Fig. 9). The blade antenna for the E-9A pilot's uhf no. 2 radio is a low gain antenna, whereas, the dipole antenna for the radio relay is a high gain antenna. During early testing, a frequency assigned for radio relay was sometimes assigned for use by E-9A pilots for a mission frequency. When this happened, if the E-9A pilots used the lower antenna uhf no. 2 radio for the same frequency in use with the radio relay, they broadcasted 10 W of power directly into the radio relay antenna tuned to the same frequency. Conversely, when the radio relay transmitted, it saturated the pilot's lower antenna uhf no. 2 radio with 30 W of power 6-ft away. Once this cause of numerous radio failures was discovered, the E-9A pilots refrained from using a radio relay frequency for uhf no. 2 radio communication. Pilot transmissions using the uhf no. 1 radio (using the upper antenna) did not seem to cause problems because of the fuselage shielding the relay antenna mounted on the aircraft bottom.

A second radio relay problem which may have contributed to premature failure in the radio relay system was inadequate separation between radio relay frequencies. Two multicouplers were used to time-share two antennas with eight radios. The specification on the multicoupler required separation of 6 MHz between all radio relay frequencies. It also required 10 MHz between any adjacent AA, and 10 MHz between AG radio relay frequencies. Initially, frequencies for WSEP use were only 2–3 MHz apart. This may have caused failures in the multicouplers which interconnect the eight radios into two antennas. Wetstone Control, responsible for uhf communication frequency allocation during WSEP missions, resolved the problem by establishing three distinct groupings of

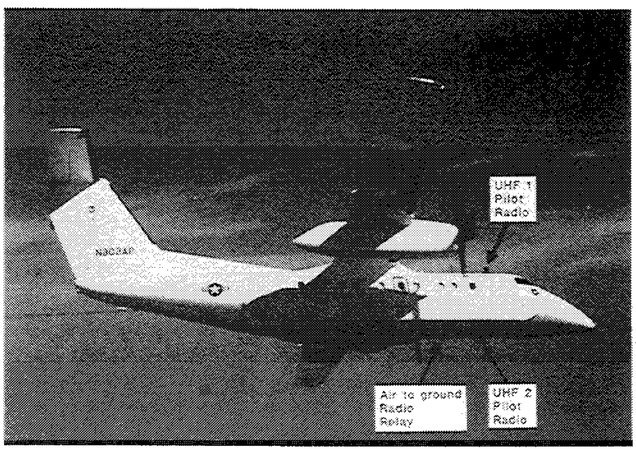

Fig. 9 Pilot and radio relay antenna locations.

frequencies which were named "gold," "silver," and "bronze." These frequency groupings were separated from each other enough to ensure radio relay transmission and reception multicoupler safety.

A third radio relay problem uncovered during the QOT&E was that the radio relays seemed to chatter on a certain frequency. The radio relay would break squelch frequently and cause transmissions to become noisy and unusable. It was discovered, after several missions, that the frequency used for relay (271.2 MHz) was very close to the Tyndall AFB Automated Terminal Information System (ATIS) frequency of 271.8 MHz. The ATIS continuous recording transmission bled over to the relay frequency enough to interfere with the squelch level setting on the radio relay. The solution to this problem was to discontinue use of the 271.2-MHz radio relay frequency.

After these three problem areas of radio relay use were resolved, the radio relays functioned well and were used when frequencies were available throughout the remainder of testing. The radios were rated operationally effective and transmissions were both loud and clear when relayed through the E-9A.

Since antenna location imposes an operational restriction, QOT&E recommended that the E-9A pilot's checklist and the E-9A technical order data be modified to include a warning to avoid using any frequency assigned for the mission as a radio relay frequency. If this cannot be avoided, the pilots should use only the upper antenna uhf no. 1 radio when using the same frequency assigned to a radio relay.

Sea Surveillance Testing

The capability of the E-9A to acquire and relay boat position data by hf transmission to the RCF was assessed during all types of test missions.

Sea Surveillance Methods

Four types of sea surveillance testing were run to characterize system effectiveness.

Type I sea surveillance testing used Mitsubishi drone relay aircraft MU-IIs, a slower flying aircraft than a fighter, to visually establish an absolute baseline on what boats were actually on the Gulf of Mexico during testing. The E-9A flew around the perimeter of Tyndall airspace, as shown in Fig. 10, at 3000 ft MSL and was followed by a row of three MU-IIs. Three observers on each MU-II scanned for boats with the naked eye and with binoculars.

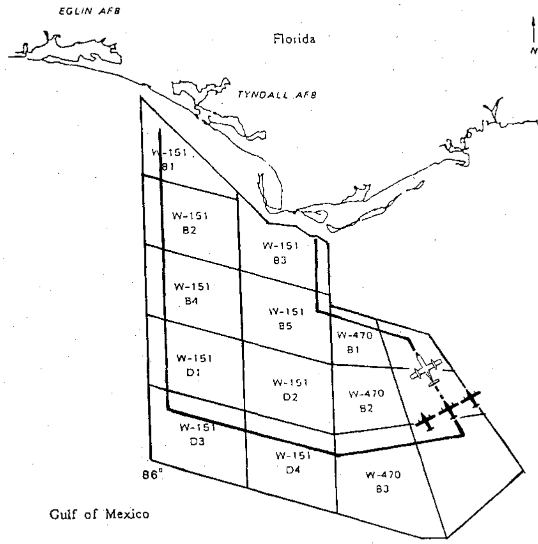

Fig. 10 E-9A/MU-II boat patrol.

During the track described above, the E-9A relayed boat positions to the Gulf Range drone control relay facility by hf data link. The E-9A tagged only contacts which were within 20 nm of either side of its path. The MU-IIs followed the E-9A and reported any contacts they observed visually to the Gulf Range drone control relay facility for correlation with the E-9A contacts. When the line of MU-IIs swept past a contact but did not find the contact, the MU-II closest to the unseen contact was vectored to it by a Wetstone controller at the Gulf Range drone control facility. This established whether the contact was real or false. The remaining MU-IIs continued on course, slowing slightly until rejoined by the Gulf Range drone control relay-vectored MU-II, which sped up to catch the other two MU-IIs.

Type II sea surveillance testing was added to evaluate degraded, high-altitude radar performance of the E-9A during WSEP operations. Normally, the E-9A performed sea surveillance directly over an intended shoot box at design altitude of 1000–4000 ft MSL. It then moved approximately 25–30 nm to the side of the shoot box and climbed to approximately 10,000–20,000 ft MSL. From this position, the E-9A relayed telemetry and still provided sea surveillance, even though the radar was not as effective at these altitudes. The E-9A followed this profile during these two hi/low sea surveillance test missions (Fig. 11).

Type III sea surveillance testing established E-9A radar positioning contact accuracy. On the Gulf of Mexico air combat maneuvering instrumentation range, instrumentation tower platform positions were well known. The E-9A radar tagged tower positions and downlinked them as contacts by the hf relay. The downlinked positions were compared to known, surveyed tower positions.

Type IV sea surveillance testing focused on the E-9A's hf boat relay data link. During this test, the E-9A flew the boundaries of normal WSEP airspace and relayed boat position information. This test determined if, and where, any data dropouts occurred around the WSEP ranges. In addition to type I through type IV sea surveillance testing, the sea surveillance radar was evaluated on every WSEP mission during QOT&E. All testing addressed two classes of sea con-

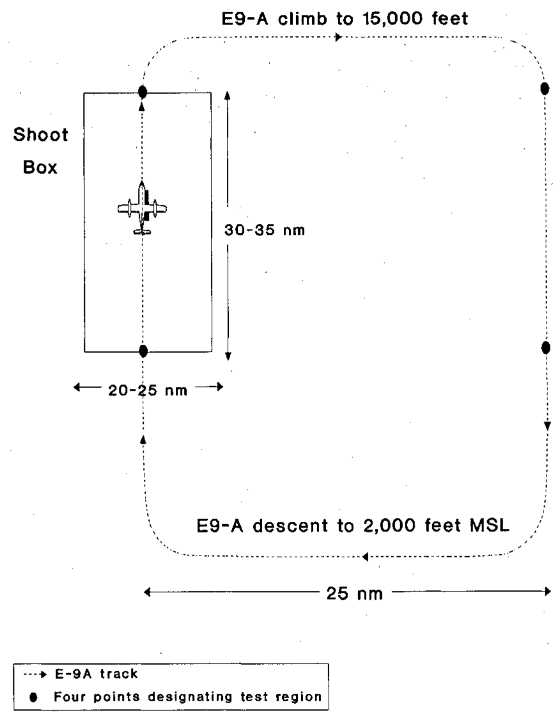

Fig. 11 Hi/low sea surveillance.

ditions: calm-to-medium seas and medium-to-rough seas. Very rough seas were not tested because WSEP operations requiring the E-9A are very limited during severe weather due to drone recovery limitations.

Sea Surveillance Results and Conclusions

On every WSEP mission and many AMRAAM missions, the E-9A was used to provide range patrol to help establish a shoot box. Shooter aircraft overflying the shoot box were asked to look for any contacts the E-9A missed; none were reported. Over 900 boats were found by the E-9A during testing. However, on one test mission the radar operator missed a contact which was found visually by the E-9A copilot using binoculars. Radar operator vigilance may have been an issue because the contact was quickly found after the newly trained radar operator was advised of the boat's general location. Also, the E-9A was at 7000 ft, well above optimum radar search altitude.

Evaluation of the sea surveillance radar's ability to detect boats on the Gulf of Mexico was accomplished during type I testing flights, which used MU-IIs to look for boats and during WSEP QOT&E missions. During these flights, the E-9A found all the boats on the Gulf of Mexico within its scanning range. It did not identify any extraneous contacts, such as floating debris or wreckage, as a boat.

The E-9A identified buoys as contacts; however, this was not a detriment to operational use because buoy positions were well known. One buoy, which was close to numerous shoot boxes, required E-9A overflight on each mission. This was because the E-9A could not determine from radar alone whether a small boat was docked to the buoy.

During the type II hi/low testing, the E-9A had more difficulty establishing and maintaining contact with boats when it was higher than the optimum sea surveillance altitude of approximately 1000 ft. When forced to conduct range patrol from a nonoptimum radar altitude of around 15,000 MSL, the E-9A missed up to 15% of the contacts during medium seas. The E-9A missed even more contacts when flying at higher altitudes during calm seas. With numerous small boats out on the Gulf during very calm seas, 30% were missed when the E-9As were patrolling from 15,000 ft. Since normal operating plans required periodic low altitude E-9A resweep of a shoot box, any contacts missed from altitude should be detected during resweep. At these higher altitudes, the E-9A was capable of updating at least 70–85% of the contacts it detected while down low. Without the E-9A, this information would not be available to Wetstone range safety controllers for determining boat movement between shoot box sweeps. With a long loiter time of at least 4.5 h and its very effective sea surveillance radar, the E-9A accomplished range patrol more efficiently than a fighter aircraft.

The E-9A radar, coupled to the navigational system, was accurate to within 0.3–0.5 nm of an actual surveyed air combat maneuvering instrumentation tower position on one type III mission and 0.2 nm on a second mission. This is operationally acceptable in terms of intended E-9A use; the E-9A locates boats and Wetstone control places a 5-nm circle around the boat to keep the shoot box away from the boat.

The hf boat position data link was rated not effective numerous times throughout QOT&E. Various problems caused the signal to be intermittent and very noisy at the ground station. On one mission lasting 1.4 h, only 5 min of hf data were received at the ground station. Initial testing problems were traced to a faulty power amplifier antenna and coupler in the hf antena connection. However, on days with lightning storms or when the hf frequencies were noisy, the relay was still not effective in getting the data to the RCF.

The E-9A experienced more clutter on the radar display during medium-to-rough seas than during calmer seas. This was due to the radar energy being reflected back to the E-9A by cresting waves. The E-9A radar operator's task difficulty increased during rough seas because of additional image clutter. However, during rough seas, there were fewer small boats. With fewer boats overall, any remaining large contacts (boats) were detected in spite of increased clutter. Also, during severe weather, the E-9A sea surveillance radar was degraded by thunderstorms obscuring the shoot area. Since WSEP operations usually weather-cancel in these conditions, this was not a major concern.

Two sea surveillance recommendations were made as a result of the QOT&E. One was to examine the employment concept of the E-9A when it provided range patrol information from high altitude. Also, QOT&E recommended looking at options to increase reliability and quality of hf boat position relay signals.

Gulf Range Drone Control Upgrade System

The capability of the E-9A to support Gulf Range drone control relay operations was assessed on drone control missions and during WSEP missions.

Drone Control Relay Method

The E-9A was equipped with a Gulf Range drone control relay DLS and was dedicated to flying a normal Gulf Range drone control relay mission profile. Because of geometry requirements, the E-9A could not normally accomplish any other mission when effecting drone control relay. The Wetstone controller positioned the E-9A and the other DLS-equipped MU-IIs, which were part of a quadrangle, for drone control. The E-9A was positioned so that it could effectively replace one of the three DLS-equipped aircraft without upsetting the required geometry. The Gulf Range drone control relay mission director verified that the three DLS aircraft were operating properly. He then electronically replaced one of the DLS-equipped aircraft with the E-9A in the Gulf Range drone control relay network. He noted any changes in drone control relay time-space-positioning information, command and control data, and mission effectiveness in general, due to selecting the E-9A DLS to replace one of the other DLS-equipped aircraft. The drone remote control pilot commanded several drone maneuvers, such as barrel rolls, turns, etc., while the observer pilot flying in the drone noted the response. These observer pilot assessments were also used to evaluate Gulf Range drone control relay control differences between use of the MU-IIs and the E-9A.

Drone Control Relay Results and Conclusions

The E-9A was used in a Gulf Range drone control relay quadrant in three missions, and during these missions no change in data was seen between the E-9A DLS and MU-II DLS. Quality of data at the Gulf Range drone control relay facility handled through the E-9A was as good as that seen when using the MU-IIs. Pilots who flew on board the QF-100 and QF-106 drones used during the testing detected no difference between E-9A control and MU-II control. The E-9A DLS was often turned on to provide positioning information for Tyndall controllers. It functioned well as a beacon in addition to relaying drone commands. No recommendations were made to improve the drone control relay system, as it functioned well throughout the QOT&E.

Summary

The E-9A has been shown to be an effective aircraft for providing Gulf Range users with radar sea surveillance, telemetry relay, uhf frequency radio relay, and Gulf Range drone control relay. The sea surveillance radar when used at its design altitude is highly effective in locating boats. The E-9A can provide continuous, effective sea surveillance patrol for over 4.5 h. The uhf radio relay, the telemetry relay (with ongoing refinement), and drone control relay subsystems will enable future missile firings to be conducted far from land-based support sites. Even with these successful subsystems, numerous system and operational problems were discovered during operational testing. Most problems have already been resolved by training, employment, and engineering fixes to make the E-9A even more effective in accomplishing its mission.

References

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