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Fixed Ground Antenna Radome (FGAR) Type V/VI Operational Test and Evaluation (OT&E) Operational Test Final Report

Leonard H. Baker

May 1996

DOT/FAA/CT-TN96/18

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16. Abstract

This report documents the Operational Test and Evaluation (OT&E) Operational testing performed on the Type V/VI, Fixed Ground Antenna Radome (FGAR) First Article. The Type V/VI FGAR replaces the original radome at Air Route Surveillance Radar (ARSR) - 3 sites.

This testing was performed on the Federal Aviation Administration's (FAA) Southern Region's Newport, Mississippi (MS) ARSR-3 En Route Radar Facility (QNM). The testing was limited to electromagnetic performance characteristics evaluation.

Electromagnetic performance data was collected by the Memphis Air Route Traffic Control Center (ARTCC) [ZME], the only ARTCC which receives Newport ARSR-3 En Route Radar Facility (QNM) data. The testing showed no degradation of the antenna electromagnetic patterns. The testing demonstrated that the FGAR meets the Operational Suitability and Operational Effectiveness requirement of the FAA.

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Electromagnetic performance testing was accomplished by collecting data at the Memphis Air Route Traffic Control Center (ARTCC) [ZME]. The Technical Support Staff (TSS) at the Memphis ARTCC (ZME) analyzed the data using their Quick Analysis of Radar Sites (QARS); Range, Azimuth, Radar Reinforced Evaluator (RARRE); Beacon False Target Analysis (BFTA); and Common Digitizer Data Reduction (COMDIG) programs; which are run on the ARTCC HOST Computer System (HCS). The testing showed the electromagnetic performance of the primary (ARSR-3) and secondary (Air Traffic Control Radar Beacon System [ATCRBS]) radars, following the FGAR installation, remained relatively unchanged.

In conclusion, OT&E testing determined that the Type V/VI FGAR meets the Operational Suitability and Operational Effectiveness requirements of the Federal Aviation Administration (FAA). The Type V/VI FGAR is ready to be integrated into the National Airspace System (NAS).

1. INTRODUCTION.

1.1 PURPOSE.

The purpose of this report is to provide the results of the Operational Test and Evaluation (OT&E) Operational testing performed on the First Article Type V/VI, Fixed Ground Antenna Radome (FGAR), installed at the Newport, Attala County, Mississippi (MS), Air Route Surveillance Radar (ARSR)-3 En Route Radar Facility (QNM).

1.2 SCOPE.

OT&E Operational testing was limited to electromagnetic performance evaluation. The Memphis Air Route Traffic Control Center (ARTCC) [ZME] collected Newport ARSR-3 En Route Radar Facility (QNM) data using their HOST Computer System (HCS). Data were collected with the original radome installed and again after installation of the FGAR. They then analyzed the data, using their HCS and analysis programs available at the Memphis ARTCC (ZME).

2. REFERENCE DOCUMENTS.

2.1 FEDERAL AVIATION ADMINISTRATION (FAA) ORDERS.

Order 6100.1C	Maintenance of NAS En Route Stage A - Air Traffic Control System

2.2 FAA SPECIFICATIONS.

FAA-E-2773b	Fixed Ground Antenna Radome (Mode S Compatible)

2.3 OTHER FAA DOCUMENTS.

FAA-4306B-8H	User's Manual - Common Digitizer Data Reduction (COMDIG) Program
FAA-4306F-3H	User's Manual - Common Digitizer Record (CD RECORD) Program
FAA-4306M-6H	User's Manual - Range, Azimuth, Radar Reinforced Evaluator (RARRE) Program
FAA-4306N-7H	User's Manual - Quick Analysis of Radar Sites (QARS) Program
FAA-4306P-9H	User's Manual - Beacon False Target Analysis (BFTA) Program
DOT/FAA/CT-TN93/17	Test and Evaluation Master Plan (TEMP) for Fixed Ground Antenna Radome (FGAR)
DOT/FAA/CT-TN95/23	Fixed Ground Antenna Radome (FGAR) Type I/III OT&E Integration and OT&E Operational Final Test Report
DOT/FAA/CT-TN96/9	Fixed Ground Antenna Radome (FGAR) Type II Operational Test and Evaluation (OT&E) Operational Test (Rockville Beacon Only Site [BOS]) Final Report

DOT/FAA/CT-TN95/69	Operational Test and Evaluation (OT&E) Operational Test Plan for Type V/VI Fixed Ground Antenna Radome (FGAR)
DOT/FAA/CT-TN96/1	Operational Test and Evaluation (OT&E) Operational Test Procedures for Type V/VI Fixed Ground Antenna Radome (FGAR)

2.4 FAA FIELD TEST REPORTS.

Manager, Airway Facilities System Management Office, Memphis, Tennessee, "Newport, (QNM) ARSR-3 Fixed Ground Antenna Radome Evaluation." Report prepared for Associate Program Manager for Test (APMT), ACT-310B, Undated.

3. SYSTEM DESCRIPTION.

3.1 MISSION REVIEW.

The FAA program to implement the En Route Mode Select Beacon System (Mode S) resulted in a requirement to replace the existing radomes at en route radar and BOS facilities. The existing radomes are not physically large enough to accommodate the En Route Mode S back-to-back phased array antennas. The FGAR supplies optimal protection of the antennas from the outside environment while providing minimal degradation of the electromagnetic performance characteristics of the enclosed antennas.

3.2 TEST SYSTEM CONFIGURATION.

The Type V/VI FGAR provides an optimal environmental enclosure for the ARSR-3 antenna. The Type V radome is capable of withstanding wind velocities of 150 miles per hour (MPH) and the Type VI velocities of 100 MPH. However, the manufacturer, Electronic Space Systems Corporation (ESSCO), is supplying all Type V FGARs. The Type V/VI FGAR has an inside diameter of 57.5 feet at its widest point, and will fit a base-ring diameter equal to the present ARSR-3 radome.

The radome is supplied as a complete assembly, which includes:

a. Lightning Protection Subsystem (LPS).

b. Zenith Service and Catwalk Access Hatches.

c. Aircraft Obstruction Light (AOL) assembly.

d. Devices to monitor the state of the AOLs and the access hatches condition (open/closed).

3.3 INTERFACES.

The Type V/VI FGAR interfaces both mechanically and electrically with the National Airspace System (NAS). A block diagram of the interfaces are shown in figure 3.3-1.

3.3.1 Mechanical.

The Type V/VI FGAR interfaces mechanically with the existing antenna tower base-ring.

3.3.2 Electrical.

The Type V/VI FGAR interfaces electrically with the antenna tower/facility:

a. Electrical system.

b. LPS.

c. Remote Maintenance Monitoring System (RMMS)/Environmental Remote Monitoring Subsystem (ERMS).

3.3.3 Interface Testing.

There was no OT&E Integration testing performed on the Type V/VI FGAR. The FGAR electrical interfaces were thoroughly tested during Type I/III FGAR OT&E Integration and Operational testing. The Type V/VI FGAR interfaces were, however, tested during on-site acceptance testing as following:

a. Mechanical.

The mechanical interface between the Type V/VI FGAR and the existing antenna tower base-ring was verified.

b. Electrical.

1. The interface between the FGAR and the facility electrical system was verified.

2. The interface between the FGAR and the antenna tower LPS was tested.

3. The interface between the FGAR and the RMMS/ERMS could not be tested, since the ERMS has not been developed. The FGAR side of the interface, however, was tested.

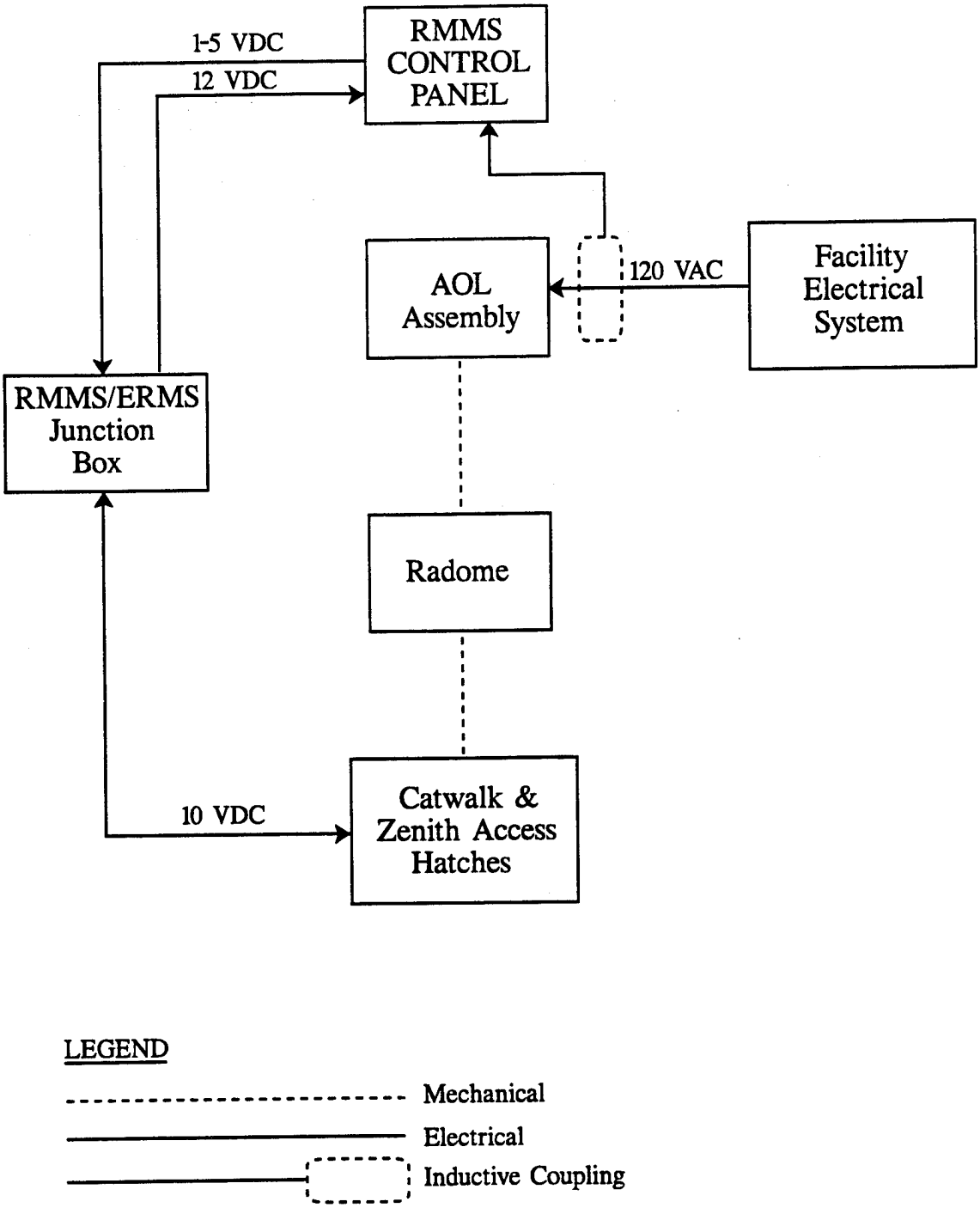


FIGURE 3.3-1 TYPE V/VI FGAR INTERFACES BLOCK DIAGRAM

4. TEST AND EVALUATION PROGRAM.

4.1 TEST SCHEDULE AND LOCATIONS.

a. Test Schedule.

Testing was performed during the periods:

1. With the original radome installed - February 12 to March 10, 1996.

2. With the FGAR installed - March 17 to April 5, 1996.

b. Test Locations.

1. Memphis ARTCC (ZME).
2. Newport ARSR-3 En Route Radar Facility (QNM).

4.2 TEST PARTICIPANTS.

The test participants included personnel from different organizations. Appendix A contains a list of the individual test participants. The organizations and personnel participating in the testing were:

a. Memphis ARTCC (ZME) Technical Support Staff (TSS) engineers.
b. Newport ARSR-3 En Route Radar Facility (QNM) technicians.
c. Raytheon/ACT-310B engineers.

4.3 TEST AND SPECIALIZED EQUIPMENT.

The following Government Furnished Equipment (GFE) and software were used to perform the tests:

a. Memphis ARTCC (ZME) HCS and the QARS, RARRE, BFTA, COMDIG, and CD RECORD programs.

b. Newport ARSR-3 En Route Radar Facility (QNM) ARSR-3 and Air Traffic Control Radar Beacon Interrogator (ATCBI)-5 systems.

The Newport ARSR-3 En Route Radar Facility (QNM) and the Memphis (ZME) ARTCC were commissioned and certified operational facilities during the test periods.

5. TEST AND EVALUATION DESCRIPTION.

The Memphis ARTCC (ZME) collects data from all radar facilities supplying data to it and analyzes these data using their HCS and the QARS program. The QARS program output data are used to determine if the radar data is usable for Air Traffic Control (ATC). In addition, Memphis ARTCC (ZME) TSS engineers have specialized programs available to analyze specific primary (ARSR-3) radar and beacon (Air Traffic Control Radar Beacon System [ATCRBS]) problems (see appendix B).

The Newport ARSR-3 En Route Radar Facility (QNM) presently supplies data to the Memphis ARTCC (ZME) only, but is scheduled to supply data to the Houston ARTCC (ZHU) in the future. The Memphis ARTCC (ZME) TSS engineers supported OT&E Operational testing by forwarding the daily QARS Summary output data, for a period of time with the original radome installed and again after the FGAR was installed, to the FAA Technical Center for analysis. The TSS engineers also ran the specialized RARRE, BFTA, and COMDIG programs on the Newport ARSR-3 En Route Radar Facility (QNM) data.

5.1 QARS PROGRAM TEST.

5.1.1 Test Objectives.

The objective was to determine if there were any difference(s) in the performance characteristics of the ARSR-3 and beacon (ATCRBS) radars data being received by the Memphis ARTCC (ZME) after the FGAR was installed.

5.1.2 Test Criteria.

The ARSR-3 and beacon (ATCRBS) radars performance characteristics measured at the Memphis ARTCC (ZME), by the QARS program, are not degraded by the FGAR.

5.1.3 Test Description.

The Memphis ARTCC (ZME) ran the QARS program on their HCS using ARSR-3 and beacon (ATCRBS) data from the Newport ARSR-3 En Route Radar Facility (QNM).

The critical issue is: Does the FGAR degrade the electromagnetic performance of the ARSR-3 or beacon (ATCRBS) radars?

5.1.4 Data Collection and Analysis Method.

The Memphis ARTCC (ZME) collected data only during periods when the Newport ARSR-3 En Route Radar Facility (QNM) was operating as a commissioned and certified facility. This data was collected with the original radome installed and again after the FGAR was installed.

5.1.5 Results and Discussion.

The electromagnetic performance parameters measured by the Memphis ARTCC (ZME) QARS data, after the FGAR was installed, showed only a slight variation from those measured with the original radome installed. The electromagnetic performance data averages with the original radome as compared to the FGAR were:

NOTE

The Blip/Scan Ratio (BLIP/SCAN) is equivalent to the Probability of Detection (PD).

a. Beacon (ATCRBS) Parameters.

1. Blip/Scan Ratio (BLIP/SCAN) increased slightly (0.1 percent).

2. Mode 3/A Reliability (MODE 3/A REL) did not change.

3. Mode 3/A Validity (MODE 3/A VAL) increased slightly (0.1 percent).

4. Mode C Reliability (MODE C REL) increased slightly (0.1 percent).

5. Mode C Validity (MODE C VAL) increased slightly (0.2 percent).

b. Search Radar (ARSR-3) Parameters.

1. Logarithmic Normal/Normal (LOG/NML) Blip/Scan (BLIP/SCAN) Ratio increased slightly (0.5 percent).

2. Moving Target Indicator (MTI) Blip/Scan (BLIP/SCAN) Ratio decreased slightly (0.7 percent).

With the original radome installed, the QARS data showed: (1) one beacon Azimuth Deviation (AZ DEV) out of tolerance (>2.0 Azimuth Change Pulses [ACP]), and (2) two search radar (ARSR-3) MTI Blip/Scan Ratio's (BLIP/SCAN) out of tolerance (<85 percent). After the installation of the FGAR there were no out of tolerance conditions recorded. All of the other parameters measured by the QARS program were within the established national standards as defined in Order 6100.1C, Maintenance of NAS En Route Stage A - Air Traffic Control System.

The average beacon Blip/Scan Ratio (BLIP/SCAN), Mode 3/A Reliability (MODE 3/A REL), Mode 3/A Validity (MODE 3/A VAL), Mode C Reliability (MODE C REL), Mode C Validity (MODE C VAL), search LOG/NML Blip/Scan Ratio (BLIP/SCAN), and search MTI Blip/Scan Ratio (BLIP/SCAN) are shown in tables 5.1.5-1 through 5.1.5-7. The Memphis ARTCC (ZME) QARS data is shown in appendix C. The average beacon Blip/Scan Ratio (BLIP/SCAN), Mode 3/A Validity (MODE 3/A VAL), and Mode C Validity (MODE C VAL) are shown graphically in appendix C.

TABLE 5.1.5-1. BEACON BLIP/SCAN RATIO

Fail Criteria <96%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	99.2	99.3

TABLE 5.1.5-2. MODE 3/A RELIABILITY

Fail Criteria <98%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	99.8	99.8

TABLE 5.1.5-3. MODE 3/A VALIDITY

Fail Criteria <98%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	99.4	99.5

TABLE 5.1.5-4. MODE C RELIABILITY

Fail Criteria <98%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	99.4	99.5

TABLE 5.1.5-5. MODE C VALIDITY

Fail Criteria <97%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	99.1	99.3

TABLE 5.1.5-6. SEARCH LOG/NML BLIP/SCAN RATIO

Fail Criteria <85%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	95.6	96.1

TABLE 5.1.5-7. SEARCH MTI BLIP/SCAN RATIO

Fail Criteria <85%	Original Radome %	FGAR %
Memphis ARTCC (ZME)	96.6	95.9

5.2 BFTA PROGRAM TEST.

5.2.1 Test Objectives.

The objective was to determine if there were any differences in the number and/or types of beacon false targets, i.e., splits, ring-around (RAR), reflections (REF), etc., in the Newport ARSR-3 En Route Radar Facility (QNM) beacon (ATCRBS) data received by the Memphis ARTCC (ZME), after the FGAR was installed.

5.2.2 Test Criteria.

The number and/or types of beacon false targets contained in the Newport ARSR-3 En Route Radar Facility (QNM) beacon (ATCRBS) data received by the Memphis ARTCC (ZME) did not increase, after installation of the FGAR.

5.2.3 Test Description.

The test was divided into two phases:

a. Phase 1 - With the original radome installed.

b. Phase 2 - After installation of the FGAR was completed and the contractor had completed the:

1. First Article Design Qualification Test (DQT).
2. Site Acceptance Test (SAT).
3. Contractor Acceptance Test (CAI).

During both phases, Memphis ARTCC (ZME) TSS engineers ran the BFTA program using Newport ARSR-3 En Route Radar Facility (QNM) beacon (ATCRBS) data.

5.2.4 Data Collection and Analysis Method.

The BFTA program was run on beacon (ATCRBS) data collected with the original radome installed and again after the FGAR was installed. These data were then compared by the TSS engineers to determine if there were any changes in the number and/or types of beacon false targets.

5.2.5 Results and Discussion.

The beacon false target rate, after the FGAR was installed, was 0.01 percent. The majority of the beacon false targets were caused by range splits (RNG-SPLIT) with occasional azimuth splits (AZ-SPLIT). The number of ring-around (RAR), reflection (REF), and pulse repetition frequency (PRF) interference (PRF INTERF) errors was negligible.

5.3 COMDIG PROGRAM TEST.

5.3.1 Test Objectives.

The objective was to determine if there was any change in the position of the ARSR-3 radar permanent echoes (PE) and/or beacon "parrot," in the Newport ARSR-3 En Route Radar Facility (QNM) data received by the Memphis ARTCC (ZME), after the FGAR was installed.

5.3.2 Test Criteria.

There was no change in the position of the Newport ARSR-3 En Route Radar Facility (QNM) search (ARSR-3) radar PEs and/or beacon "parrot" in the data received by the Memphis ARTCC (ZME), after the FGAR was installed.

5.3.3 Test Description.

The test was divided into two phases:

a. Phase 1 - With the original radome installed.

b. Phase 2 - After installation of the FGAR was completed and the contractor had completed the:

1. First Article DQT.
2. SAT.
3. CAI.

During both phases, Memphis ARTCC (ZME) TSS engineers ran the COMDIG program using Newport ARSR-3 En Route Radar Facility (QNM) search (ARSR-3) and beacon (ATCRBS) radar data.

5.3.4 Data Collection and Analysis Method.

The COMDIG program was run on ARSR-3 and beacon (ATCRBS) data collected with the original radome installed and again after the FGAR was installed. These data were then compared by the TSS engineers to determine if there was any change in the position of the ARSR-3 radar PE's or beacon "parrot."

The search (ARSR-3) video collimation (COLL) data were not recorded by the Memphis ARTCC (ZME).

5.3.5 Results and Discussion.

The COMDIG program showed that the beacon "parrot," after the FGAR was installed, did not vary in range and remained within the prescribed 2 ACP tolerance.

5.4 RARRE PROGRAM TEST.

5.4.1 Test Objectives.

The objective was to determine if there were any differences in the overall radar reenforcement percentage, altitude coverage, and/or range coverage in the Newport ARSR-3 En Route Radar Facility (QNM) search (ARSR-3) and beacon (ATCRBS) radar data being received by the Memphis ARTCC (ZME), after the FGAR was installed.

5.4.2 Test Criteria.

The radar reenforcement percentage, altitude coverage, and range coverage did not decrease, after installation of the FGAR.

5.4.3 Test Description.

The test was divided into two phases:

a. Phase 1 - With the original radome installed.

b. Phase 2 - After installation of the FGAR was completed and the contractor had completed the:

1. First Article DQT.
2. SAT.
3. CAI.

During both phases, Memphis ARTCC (ZME) TSS engineers ran the RARRE program using Newport ARSR-3 En Route Radar Facility (QNM) search (ARSR-3) and beacon (ATCRBS) radar data.

5.4.4 Data Collection and Analysis Method.

The RARRE program was run on ARSR-3 and beacon (ATCRBS) data collected with the original radome installed and again after the FGAR was installed. These data were then compared by the TSS engineers to determine if there were any changes in the overall radar reinforcement percentages, altitude coverage, and/or range coverage.

5.4.5 Results and Discussion.

The RARRE program showed a radar reinforcement rate of 92 percent, after the FGAR was installed.

6. CONCLUSIONS.

The electromagnetic performance characteristics of the ARSR-3 and beacon (ATCRBS) radars were relatively unchanged by installation of the FGAR. The Memphis ARTCC (ZME) were "very pleased with the performance of the Newport ARSR-3 with the FGAR."

7. RECOMMENDATIONS.

The results of OT&E Operational testing uncovered no major problems with the Type V/VI FGAR. The FGAR meets the Operational Suitability and Operational Effectiveness requirements of the FAA. It is recommended that the Type V/VI FGAR be integrated into the NAS.

8. ACRONYMS AND ABBREVIATIONS.

°	Degree
>	Greater Than
<	Less Than
%	Percent(age)
±	Plus/Minus
ACP	Azimuth Change Pulse(s)
AOL	Aircraft Obstruction Light(s)
APMT	Associate Program Manager for Test
ARSR	Air Route Surveillance Radar
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCBI	Air Traffic Control Beacon Interrogator
ATCRBS	Air Traffic Control Radar Beacon System
AZ	Azimuth (QARS program)
BCN	Beacon (QARS program)
BFTA	Beacon False Target Analysis (a computer program)
BLIP	Blip/Scan Ratio (QARS program)
BOS	Beacon Only Site
CAI	Contractor Acceptance Inspection
CD	Common Digitizer
CD RECORD	Common Digitizer Record (a computer program)
COLL	Collimation (COMDIG program)
COMDIG	Common Digitizer Data Reduction (a computer program)
DEV	Deviation (QARS program)
DQT	Design Qualification Test
DRG	Data Receiver Group
ERMS	Environmental Remote Monitoring Subsystem
ESSCO	Electronic Space Systems Corporation (company name)
FAA	Federal Aviation Administration
FGAR	Fixed Ground Antenna Radome

GFE	Government Furnished Equipment
HCS	HOST Computer System
HOST	Air Traffic Control HOST Computer System (not an acronym)
LOG/NML	Logarithmic Normal/Normal (QARS program)
LPS	Lightning Protection Subsystem
MPH	Miles per Hour
Mode S	Mode Select Beacon System
MS	Mississippi
MTI	Moving Target Indicator (QARS program)
NAS	National Airspace System
NM	Nautical Mile(s)
NML	Normal (QARS program)
OT&E	Operational Test and Evaluation
PCT	Percent (QARS program)
PD	Probability of Detection
PE	Permanent Echo (QARS program)
PRF	Pulse Repetition Frequency
PRF INTERF	Pulse Repetition Frequency Interference (BFTA program)
QARS	Quick Analysis of Radar Sites (a computer program)
QNM	Newport ARSR-3 En Route Radar Facility (identifier)
RAR	Ring-Around (QARS program)
RARRE	Range, Azimuth, Radar Reinforced Evaluator (a computer program)
RDAS-SS	Radar Data Acquisition Subsystem System Specialist
REF	Reflection(s) [QARS program]
REINFOR	Reinforced (QARS program)
REL	Reliability (QARS program)
RF	Radio Frequency
RMMS	Remote Maintenance Monitoring System
RNG	Range (QARS program)
SAT	Site Acceptance Test
SCAN	Blip/Scan Ratio (QARS program)

SCH/BCN	Search/Beacon (QARS program)
SCH-REINFOR	Search-Reinforced (QARS program)
TEMP	Test and Evaluation Master Plan
TSS	Technical Support Staff
VAL	Validity (QARS program)
VAC	Volts Alternating Current
VDC	Volts Direct Current
ZER	Code Zero(s) [QARS program]
ZHU	Houston Air Route Traffic Control Center (identifier)
ZME	Memphis Air Route Traffic Control Center (identifier)

APPENDIX A

TEST PARTICIPANTS

TEST PARTICIPANTS

The personnel, their title, and organization, who participated in the testing are listed below.

1. FAA Technical Center.

   Harold G. Sedgwick, FGAR Test Director, Senior Engineer, Raytheon/ACT-310B

2. Memphis ARTCC (ZME).

   Robert Anders, Radar Data Acquisition Subsystem System Specialist (RDAS-SS)

3. Newport ARSR-3 En Route Radar Facility (QNM).

   William O. Brantley, Electronic Technician

   Sherrod T. Ratcliff, Electronic Technician

   William E. Rivers, Electronic Technician

APPENDIX B

DATA ANALYSIS PROGRAMS

DATA ANALYSIS PROGRAMS

The programs used to analyze the electromagnetic performance data of the primary (ARSR-3) and secondary (ATCRBS) radars are described below:

1. Beacon False Target Analysis (BFTA) Program - The BFTA program is used to investigate and evaluate the false target problem in the NAS automated ATCRBS radar system. The BFTA program is run on the HCS.

   a. Pulse Repetition Frequency Interference (PRF INTERF) - If pulse repetition frequency interference is detected, the azimuth of the detected interference and the cyclic pattern of the interference relative to the time intervals is outputted.

   b. Reflections (REF) - The physical location of the six most prominent reflecting surfaces which are causing false targets are outputted, with the most severe reflecting surfaces first. The range is in whole and tenths of miles. The azimuth is in degrees by 2° sectors.

   c. Ring-Around (RAR) - The TOTAL OCCURRENCES is the number of beacon (ATCRBS) targets exhibiting ring-around. The RING-AROUND RATE is the percentage of beacon (ATCRBS) targets analyzed which exhibit ring-around.

2. Common Digitizer Data Reduction (COMDIG) Program - The COMDIG program extracts selected types of data from a Common Digitizer (CD) Record (CD RECORD) program tape containing various mixtures of the six different CD message types received at the HCS and prints the data in prescribed formats. The COMDIG program is run on the HCS.

3. Common Digitizer Record (CD RECORD) Program - The CD RECORD program provides the capability to record on magnetic tape CD data, as received over the Data Receiver Group (DRG)/HCS interface. The CD RECORD program is run on the HCS.

4. Quick Analysis of Radar Sites (QARS) Program - The QARS program provides confirmation of an ARTCCs CD interface and operational status. The data can be either real time or a CD RECORD format tape. The QARS program is run on the HCS.

   The QARS program is divided into two sections: (1) Radar System Interface Verification, and (2) Radar Data Analysis Summary routine which analyzes the beacon tracks. The following are the applicable Radar Data Analysis Summary parameters:

   a. Beacon (BCN) Parameters.

      1. Scan - Total number of antenna revolutions for the period of time the beacon (ATCRBS) return was tracked.

      2. Blip/Scan - The ratio of the number of times a target was detected (BLIP) to the number of times it could have been detected (SCAN), expressed as a percentage.

      3. Radar Reinforced (SCH-REINFOR) - The ratio of the number of beacon messages with the reinforced bit set to the total number of beacon messages received, expressed as a percentage.

4. Beacon Split.

   (a) Azimuth Split (AZ-SPLIT) - One beacon target providing two beacon messages with the same discrete code within one scan interval which are in the same range cell, and azimuth separation is equal of less than 45 Azimuth Change Pulses (ACP).

   (b) Range Split (RNG-SPLIT) - One beacon target providing two beacon messages with the same discrete code within one scan interval which are in adjacent range cells, and azimuth separation is equal to or less than 30 ACPs.

5. False Beacon (FALSE-BCN).

   (a) Ring-Around (RAR) - A ring-around condition is caused by the smaller side lobes of radio frequency (RF) energy radiated from the beacon antenna that are strong enough to interrogate a beacon transponder at close range almost continuously, while the antenna is rotating through a good portion of its entire scan.

   (b) Reflections (REF) - Reflections are caused by large flat surfaces, such as buildings and fences near the ground antenna. These surfaces reflect the interrogations and reply signals causing the ground antenna to receive aircraft replies not only when looking directly toward the aircraft, but when looking toward the reflectors. The result is a false target that remains in the system for a period of time that is dependent on the size and location of the reflecting surface.

   (c) Code Zeros (ZER) - The code zero percentage (ZER) is a ratio of the number of beacon targets with code zeros to the number of beacon targets with the correct code. Only code zero targets in the clear are counted. Code zero targets that are associated with splits, reflections (REF), or ring-around (RAR) are not counted as a part of the total code zeros.

6. Code Reliability.

   (a) Mode 3/A Reliability (MODE 3/A REL) - The Mode 3/A reliability percentage is the ratio of the number of beacon returns with the correct code present in each reply to the total number of beacon returns tracked.

   (b) Mode 3/A Validity (MODE 3/A VAL) - The Mode 3/A validity bit is set in the CD when two successive replies, in response to the same mode, from the same aircraft, are identical. The percentage reported is the ratio of declared beacon returns, to the total number of beacon returns tracked.

   (c) Mode C Reliability (MODE C REL) - The Mode C reliability percentage is the ratio of the total number of beacon returns, with a reported altitude within ±800 feet of the last reliable altitude, to the total number of Mode C returns tracked.

(d) Mode C Validity (MODE C VAL) - The Mode C validity is confirmed and reported by the CD in the same manner described for Mode 3/A validity (MODE 3/A VAL). The percentage reported is the ratio of Mode C validated beacon messages to the total number of beacon messages received.

(e) Mode C Scans - Total number of antenna revolutions for the period of time a Mode C beacon return was tracked.

7. Deviation.

(a) Range Deviation (RNG DEV) - The mean difference of the predicted versus actual position of the track. The absolute difference is accumulated and then divided by the number of returns for the track. The value depicts the range in eighths of a nautical mile (NM).

(b) Azimuth Deviation (AZ DEV) - The mean difference of the predicted versus actual position of the track. The absolute difference is accumulated and then divided by the number of returns for the track. The value depicts the azimuth in ACPs.

b. Logarithmic/Normal (LOG/NML) Video Parameters.

1. Scans - The number of antenna scans listed for LOG/NML search (ARSR-3) video is not a subtotal of the BCN video scans and varies according to the target range and altitude. When the track altitude/range is beyond the search or beacon radars theoretical line of sight the performance parameters are not calculated for the search radar.

2. Blip/Scan - The ratio of the number of times a target was detected (BLIP) to the number of times it could have been detected (SCAN), expressed as a percentage. The search (ARSR-3) BLIP/SCAN figures include miscollimated search returns that are within 1/4 mile in range and 15 ACPs of the beacon return.

3. Azimuth Split (AZ-SPLIT) - A search (ARSR-3) split is declared when two search targets meet either of the following criteria:

(a) The beacon target is reinforced and another search (ARSR-3) target is detected in the same range cell, and the azimuth separation is equal to or less than twice the sliding window size.

(b) The beacon target is not radar reinforced and two search (ARSR-3) targets are detected in the same range cell with an azimuth separation equal to or less than the sliding window size.

4. Range Split (RNG-SPLIT) - A search (ARSR-3) split is declared when two search targets meet either of the following criteria:

(a) The beacon target is reinforced and another search (ARSR-3) target is detected in adjacent range cells, and azimuth separation is equal to less than the sliding window.

(b) The beacon target is not radar reinforced and two search (ARSR-3) targets are found in adjacent range cells, and azimuth separation is equal to or less than the sliding window size.

c. Moving Target Indicator (MTI) Video Parameters.

1. Scans - The number of antenna scans listed for MTI search (ARSR-3) video is not a subtotal of the BCN video scans and varies according to the target range and altitude. When the track altitude/range is beyond the search or beacon radars theoretical line of sight the performance parameters are not calculated for the search radar.

2. Blip/Scan - The ratio of the number of times a target was detected (BLIP) to the number of times it could have been detected (SCAN), expressed as a percentage. The search (ARSR-3) BLIP/SCAN figures include miscollimated search returns that are within 1/4 mile in range and 15 ACPs of the beacon return.

3. Azimuth Split (AZ-SPLIT) - A search (ARSR-3) split is declared when two search targets meet either of the following criteria:

(a) The beacon target is reinforced and another search (ARSR-3) target is detected in the same range cell, and the azimuth separation is equal to or less than twice the sliding window size.

(b) The beacon target is not radar reinforced and two search (ARSR-3) targets are detected in the same range cell with an azimuth separation equal to or less than the sliding window size.

4. Range Split (RNG-SPLIT) - A search (ARSR-3) split is declared when two search targets meet either of the following criteria:

(a) The beacon target is reinforced and another search (ARSR-3) target is detected in adjacent range cells, and azimuth separation is equal to less than the sliding window.

(b) The beacon target is not radar reinforced and two search (ARSR-3) targets are found in adjacent range cells, and azimuth separation is equal to or less than the sliding window size.

d. Permanent Echo (PE) Verification.

1. Range Error (RNG ERROR) - The mean error between the reported and the adapted position of the PE in whole and eights of an NM.

2. Azimuth Error (AZ ERROR) - The mean error between the reported and the adapted position of the PE in whole and tenths of ACPs.

3. Percent Reliability (PCT REL) - Calculated from 50 scans initiated by receipt of the first PE that compares to the adapted value.

e. Total Tracks - The number of tracks for the site.

f. Search/Beacon (SCH/BCN) Channel - The search (ARSR-3) and beacon (ATCRBS) radar channel supplying data.

5. Range, Azimuth, Radar Reinforced Evaluator (RARRE) Program - The RARRE program provides the capability to retrieve, sort, and print target information pertaining to all Mode 3/A beacon equipped aircraft detected by any number of radar sites. The data are received from a CD RECORD format tape. The RARRE program is run on the HCS.

APPENDIX C

QARS DATA

AND

HISTOGRAMS

QARS DATA AND HISTOGRAMS

The Newport ARSR-3 En Route Radar Facility (QNM) QARS data and histograms are presented as follows:

1. Pages C-2, C-3, and C-4, with the original radome installed.
2. Pages C-5 and C-6, with the FGAR installed.
3. Page C-7, QARS beacon data histograms.

MEMPHIS ARTCC (ZME) QARS DATA FOR
NEWPORT ARSR-3 (QNM) WITH ORIGINAL RADOME

DATE		2/12/96	2/13/96	2/14/96	2/15/96	2/16/96	2/17/96	2/18/96	2/19/96	2/20/96	2/21/96	2/22/96
	FAIL CRITERIA											
BEACON												
Scans		13706	21781	20142	22923	20456	17842	9914	13125	17009	20761	21341
Blip/Scan	<96%	99.5	99.0	99.4	99.1	99.2	99.4	99.5	99.4	99.1	99.0	99.1
Sch-Reinfor	<85%	89.1	89.2	91.3	90.6	95.9	94.0	95.5	89.4	90.8	95.1	91.9
Az-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Ring-Around	>.5%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Reflections	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Code Zeroes	>.5%	.0	.0	.0	.0	.0	0	0	0	0	.0	.0
Mode 3/A Rel	<98%	99.7	99.8	99.8	99.8	99.8	99.9	99.9	99.9	99.6	99.8	99.8
Mode 3/A Val	<98%	99.5	99.5	99.5	99.6	99.5	99.7	99.6	99.8	99.2	99.4	99.6
Mode C Rel	<98%	99.1	99.1	99.2	99.5	99.1	99.7	99.6	99.8	99.2	99.3	99.5
Mode C Val	<97%	98.9	98.9	98.9	99.3	98.9	99.5	99.5	99.7	98.7	98.9	99.1
Mode C Scans		13608	21465	19952	22636	20161	17475	9862	13049	16820	20491	21084
Rng Dev	>0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Az Dev	>2.0	1.96	1.97	1.91	1.84	1.91	1.84	1.76	1.79	1.95	1.93	1.94
LOG/NML												
Scans		11058	17597	14362	17039	15166	12511	7518	11034	13149	15157	16350
Blip/Scan	<85%	89.5	90.7	92.0	91.8	95.2	94.1	95.7	90.4	89.9	94.5	90.7
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MTI												
Scans		2648	4184	5780	5884	5292	5331	2396	2091	3860	5624	4991
Blip/Scan	<85%	86.5	80.8*	88.8	86.0	96.4	92.9	94.5	82.6*	92.6	96.1	94.4
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PE VERIFICATION												
#4 Rng Error	>0/1	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0
#4 Az Error	>2.0	-0.6	-0.6	-0.2	+0.3	+0.1	+0.8	-0.0	+0.9	+0.3	+0.3	+0.5
#4 Pct Rel	<90%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.0	100.0	100.0	98.0
TOTAL TRACKS		**131**	**174**	**158**	**187**	**179**	**157**	**136**	**128**	**192**	**172**	**164**
SCH/BCN CHANNEL		**A/B**	**B/B**	**B/B**	**B/A**	**A/A**	**B/A**	**B/A**	**B/A**	**B/A**	**B/B**	**A/B**

MEMPHIS ARTCC (ZME) QARS DATA FOR NEWPORT ARSR-3 (QNM) WITH ORIGINAL RADOME (Continued)

DATE		2/23/96	2/24/96	2/25/96	2/26/96	2/27/96	2/28/96	2/29/96	3/1/96	3/2/96	3/3/96	3/4/96
	FAIL CRITERIA											
BEACON												
Scans		19779	12873	22208	15540	15908	21531	15935	29810	18648	15558	12797
Blip/Scan	<96%	99.0	99.4	98.9	98.5	98.9	99.3	99.3	99.2	99.5	99.6	99.6
Sch-Reinfor	<85%	95.6	96.0	94.4	91.1	94.9	95.0	96.3	95.5	96.1	96.8	96.2
Az-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Ring-Around	>.5%	.0	.2	.0	.0	.0	.0	.0	.0	.0	.1	.0
Reflections	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Code Zeroes	>.5%	.0	.0	.0	.0	0	0	0	0	.0	.0	.0
Mode 3/A Rel	<98%	99.8	99.7	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8
Mode 3/A Val	<98%	99.5	99.5	99.6	99.5	99.3	99.5	99.6	99.4	99.6	99.5	99.6
Mode C Rel	<98%	99.4	99.6	99.6	99.3	99.1	99.4	99.5	99.4	99.6	99.6	99.4
Mode C Val	<97%	99.1	99.4	99.5	99.0	98.8	99.1	99.2	99.1	99.4	99.4	99.2
Mode C Scans		19530	12806	21950	15296	15714	21317	15809	29552	18559	15495	12720
Rng Dev	>0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Az Dev	>2.0	1.93	1.86	1.91	1.96	1.93	1.93	1.95	1.92	1.89	1.89	1.95
LOG/NML												
Scans		15038	9772	17499	11499	12308	16998	12364	23523	14552	12248	10109
Blip/Scan	<85%	95.7	96.4	93.8	89.9	94.1	94.5	96.1	95.3	95.9	97.2	96.2
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MTI												
Scans		4741	3101	4709	4041	3600	4533	3571	6287	4096	3310	2688
Blip/Scan	<85%	94.1	94.0	94.8	91.7	96.6	96.1	96.5	95.6	96.4	95.3	95.9
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PE VERIFICATION												
#4 Rng Error	>0/1	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0
#4 Az Error	>2.0	+0.4	+0.4	+0.4	+0.4	-0.0	-0.4	-0.5	-0.8	-0.6	-0.4	-0.3
#4 Pct Rel	<90%	100.0	100.0	98.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL TRACKS		**158**	**106**	**155**	**117**	**129**	**180**	**127**	**213**	**132**	**129**	**117**
SCH/BCN CHANNEL		**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**

MEMPHIS ARTCC (ZME) QARS DATA FOR NEWPORT ARSR-3 (QNM) WITH ORIGINAL RADOME (Continued)

DATE		3/5/96	3/6/96	3/7/96	3/8/96	3/9/96	3/10/96
	FAIL CRITERIA	#					
BEACON							
Scans		11530	20516	18059	17067	12300	22792
Blip/Scan	<96%	99.0	99.0	99.2	99.0	99.4	99.5
Sch-Reinfor	<85%	94.7	94.6	96.5	96.7	96.6	96.6
Az-Split	>.1%	.0	.0	.0	.0	.0	.0
Rng-Split	>.1%	.0	.0	.0	.0	.1	.0
Ring-Around	>.5%	.0	.0	.0	.0	.0	.0
Reflections	>.2%	.0	.0	.0	.0	.0	.0
Code Zeroes	>.5%	.0	.0	.0	0	0	0
Mode 3/A Rel	<98%	99.8	99.8	99.8	99.7	99.8	99.7
Mode 3/A Val	<98%	99.6	99.5	99.1	99.3	99.5	99.4
Mode C Rel	<98%	99.5	99.3	99.5	99.3	99.5	99.5
Mode C Val	<97%	99.3	99.0	99.1	98.9	99.1	99.2
Mode C Scans		11379	20336	17911	16854	12230	22677
Rng Dev	>0/1	0/0	0/0	0/0	0/0	0/0	0/0
Az Dev	>2.0	2.01*	1.98	1.83	1.84	1.66	1.66
LOG/NML							
Scans		9370	17003	15254	12719	10223	18920
Blip/Scan	<85%	93.8	93.9	96.3	96.4	96.5	96.4
Az-Split	>.2%	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0
MTI							
Scans		2160	3640	2805	4348	2077	3872
Blip/Scan	<85%	96.4	96.3	97.3	96.7	95.9	97.2
Az-Split	>.2%	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0
PE VERIFICATION							
#4 Rng Error	>0/1	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0
#4 Az Error	>2.0	+0.2	+1.5	+0.5	-1.0	-0.6	-0.7
#4 Pct Rel	<90%	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL TRACKS		**114**	**160**	**137**	**149**	**108**	**161**
SCH/BCN CHANNEL		**A/B**	**A/A**	**A/A**	**A/A**	**A/A**	**B/A**

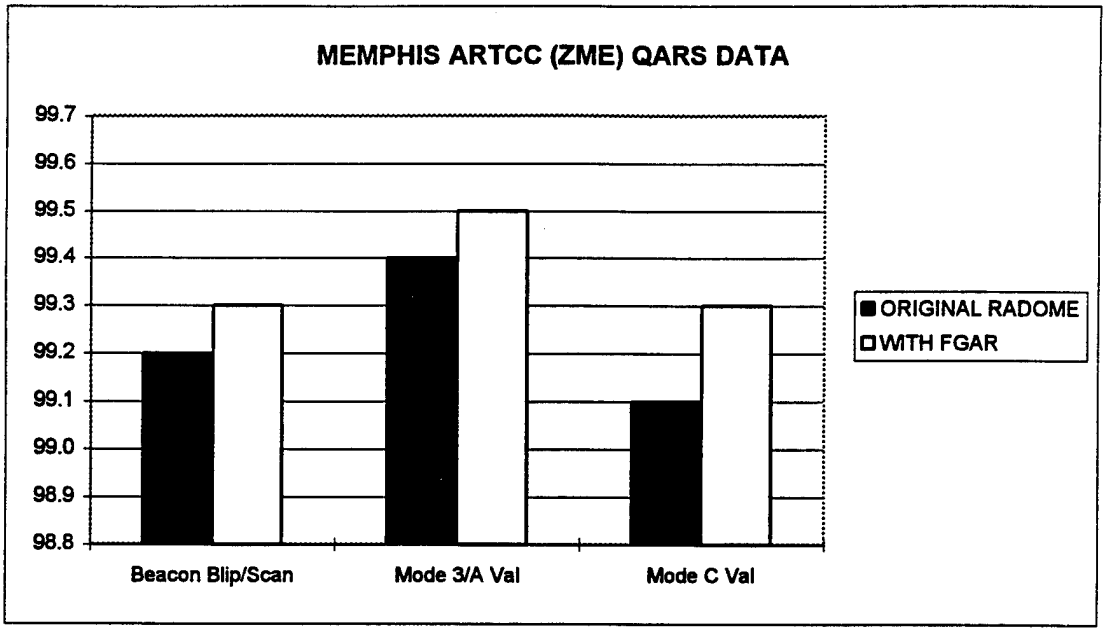
LEGEND
* OUT OF TOLERANCE
HEAVY RAINS

MEMPHIS ARTCC QARS DATA FOR NEWPORT ARSR-3 (QNM) WITH FGAR

DATE		3/17/96	3/18/96	3/19/96	3/20/96	3/21/96	3/22/96	3/23/96	3/24/96	3/25/96	3/26/96
	FAIL CRITERIA										
BEACON											
Scans		9208	10421	27739	28737	27149	23993	12743	9203	9567	8300
Blip/Scan	<96%	99.4	98.9	99.1	99.3	99.1	99.1	99.6	98.5	98.7	99.1
Sch-Reinfor	<85%	94.5	87.6	96.3	96.1	96.6	96.6	95.9	95.7	93.4	95.5
Az-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Ring-Around	>.5%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Reflections	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Code Zeroes	>.5%	.0	.0	.0	0	0	0	0	.0	.0	.0
Mode 3/A Rel	<98%	99.9	99.8	99.8	99.8	99.8	99.7	99.7	99.9	99.8	99.9
Mode 3/A Val	<98%	99.7	99.6	99.4	99.5	99.4	99.2	99.4	99.7	99.6	99.7
Mode C Rel	<98%	99.7	99.3	99.4	99.5	99.1	99.3	99.6	99.7	99.3	99.5
Mode C Val	<97%	99.5	99.1	99.2	99.1	98.7	98.9	99.3	99.5	99.1	99.3
Mode C Scans		9148	10283	27345	28476	26799	23766	12698	9063	9432	8225
Rng Dev	>0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Az Dev	>2.0	1.82	1.90	1.79	1.82	1.81	1.87	1.87	1.86	1.97	1.86
LOG/NML											
Scans		7152	9267	21098	21689	20864	18526	9811	6716	6685	6946
Blip/Scan	<85%	94.1	86.3	96.0	96.0	96.7	96.5	96.7	94.9	93.1	95.8
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MTI											
Scans		2056	1145	6641	7045	6285	5467	2932	2487	2882	1354
Blip/Scan	<85%	94.6	95.0	96.4	96.2	95.4	96.1	92.7	96.3	92.6	92.4
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PE VERIFICATION											
#4 Rng Error	>0/1	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0
#4 Az Error	>2.0	-0.9	-1.6	-1.8	-1.6	-0.9	-0.6	-0.4	-0.3	-0.6	-0.3
#4 Pct Rel	<90%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TOTAL TRACKS		**86**	**111**	**214**	**206**	**216**	**197**	**101**	**77**	**87**	**78**
SCH/BCN CHANNEL		**B/A**	**B/A**	**B/A**	**B/A**	**A/A**	**A/A**	**A/B**	**A/B**	**A/B**	**A/B**

MEMPHIS ARTCC QARS DATA FOR NEWPORT ARSR-3 (QNM) WITH FGAR (Continued)

DATE		3/27/96	3/28/96	3/29/96	3/30/96	3/31/96	4/1/96	4/2/96	4/3/96	4/4/96	4/5/96
	FAIL CRITERIA										
BEACON											
Scans		21635	27948	26572	12965	12225	15886	13434	17022	15982	16339
Blip/Scan	<96%	99.3	99.3	99.4	99.2	99.3	99.4	99.4	99.4	99.0	99.4
Sch-Reinfor	<85%	96.6	96.7	96.8	93.4	97.3	97.0	97.2	96.0	96.5	94.6
Az-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>.1%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Ring-Around	>.5%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Reflections	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Code Zeroes	>.5%	0	0	0	0	0	0	0	0	0	0
Mode 3/A Rel	<98%	99.8	99.8	99.8	99.7	99.9	99.8	99.6	99.8	99.6	99.8
Mode 3/A Val	<98%	99.6	99.5	99.5	99.4	99.9	99.6	99.5	99.5	99.4	99.4
Mode C Rel	<98%	99.6	99.5	99.4	99.5	99.8	99.6	99.5	99.5	99.3	99.6
Mode C Val	<97%	99.4	99.3	99.2	99.1	99.7	99.4	99.1	99.2	98.9	99.3
Mode C Scans		21477	27741	26372	12866	12147	15782	13352	16908	15769	16206
Rng Dev	>0/1	0/0	0/0	0/0	0/0	0/0	0/1	0/1	0/1	0/1	0/1
Az Dev	>2.0	1.83	1.85	1.86	1.85	1.89	1.85	1.89	1.89	1.90	1.89
LOG/NML											
Scans		16885	21988	19832	11261	9876	11717	10160	12996	13045	13601
Blip/Scan	<85%	96.2	96.4	97.2	93.0	97.3	96.7	97.3	96.6	96.4	94.3
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MTI											
Scans		4750	5960	6740	1704	2349	4159	3274	4026	2937	2738
Blip/Scan	<85%	97.0	97.1	95.3	95.3	96.6	97.3	96.3	93.2	95.6	95.7
Az-Split	>.2%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Rng-Split	>3%	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PE VERIFICATION											
#4 Rng Error	>0/1	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0	+0/0
#4 Az Error	>2.0	-0.3	-0.5	-0.2	-0.3	-0.6	-0.6	-0.5	-0.3	-0.5	-0.7
#4 Pct Rel	<90%	100.0	100.0	100.0	98.0	100.0	100.0	98.0	100.0	100.0	100.0
TOTAL TRACKS		**158**	**200**	**217**	**113**	**96**	**124**	**122**	**151**	**151**	**148**
SCH/BCN CHANNEL		**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**	**A/B**


MEMPHIS ARTCC (ZME) QARS DATA
99.7
99.6
99.5
99.4
99.3
99.2
99.1
99.0
98.9
98.8
Beacon Blip/Scan
Mode 3/A Val
Mode C Val
ORIGINAL RADOME
WITH FGAR

APPENDIX D

REPORT

NEWPORT, MS (QNM) ARSR-3
FIXED GROUND ANTENNA RADOME
EVALUATION

MEMPHIS ARTCC (ZME)

Memorandum

Department of
Transportation

**Federal Aviation
Administration**

Subject: Newport, MS (QNM) ARSR-3 Fixed Ground Antenna Radome Evaluation

Date:

From: Manager, Airway Facilities Systems Management Office
Memphis, Tennessee

Reply to: Anders
901-368-8318

To: Associate Program Manager for Test, ACT-310B

The first Type V/VI Fixed Ground Antenna Radome (FGAR) was installed at the Newport, MS ARSR-3 Enroute Radar Facility during March 13th to the 15th, 1996. At your request the Memphis ARTCC compared Newport's performance before and after the radome replacement to check on any impact to the electromagnetic performance characteristics of the primary and secondary radars. The evaluation showed that Newport's performance did not change with the installation of the FGAR.

Data collection was done with all combinations of primary and secondary channels. The Range, Azimuth, Radar Reinforcement Evaluator (RARRE) program produced a radar reinforcement rate of 92 percent. The Beacon False Target Analysis (BFTA) program showed the site operating with a false target rate of .01. In most cases the site did not have any ringaround targets, reflectors, or PRF interference. Of the false targets most were range splits with an occasional azimuth split. The Common Digitizer Data Reduction (COMDIG) program showed that the range of the parrot never deviated while the azimuth stayed within the 2 ACP tolerance limit required.

The Memphis SMO is very pleased with the performance of the Newport ARSR-3 with the FGAR.

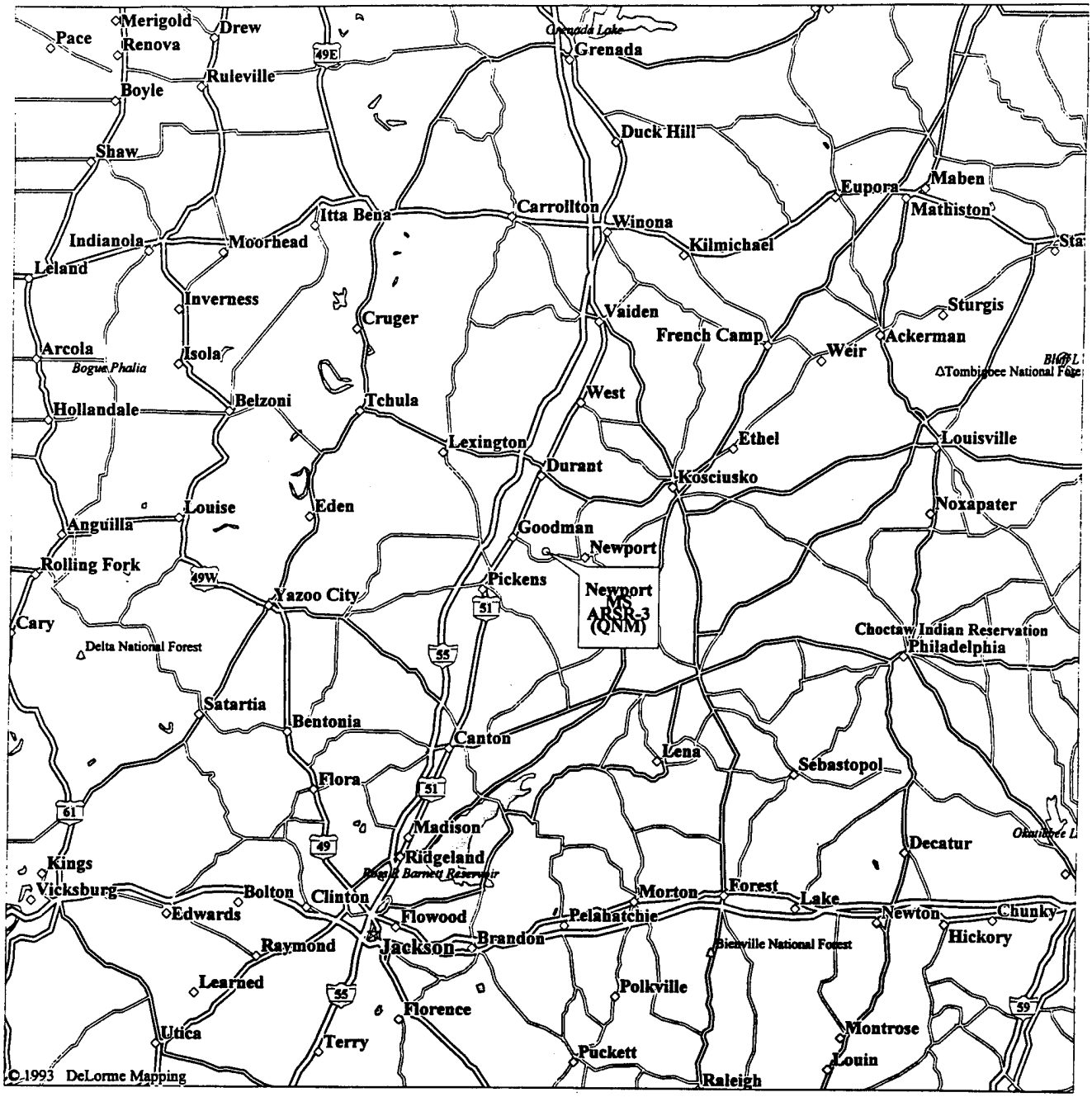
If you require additional information, please contact Robert L. Anders, Technical Support Staff, at (901) 368-8318.

FOR James E Lemmond
Percell Duckett

APPENDIX E

LOCATION MAPS

NEWPORT ARSR-3
EN ROUTE RADAR FACILITY (QNM)



LEGEND

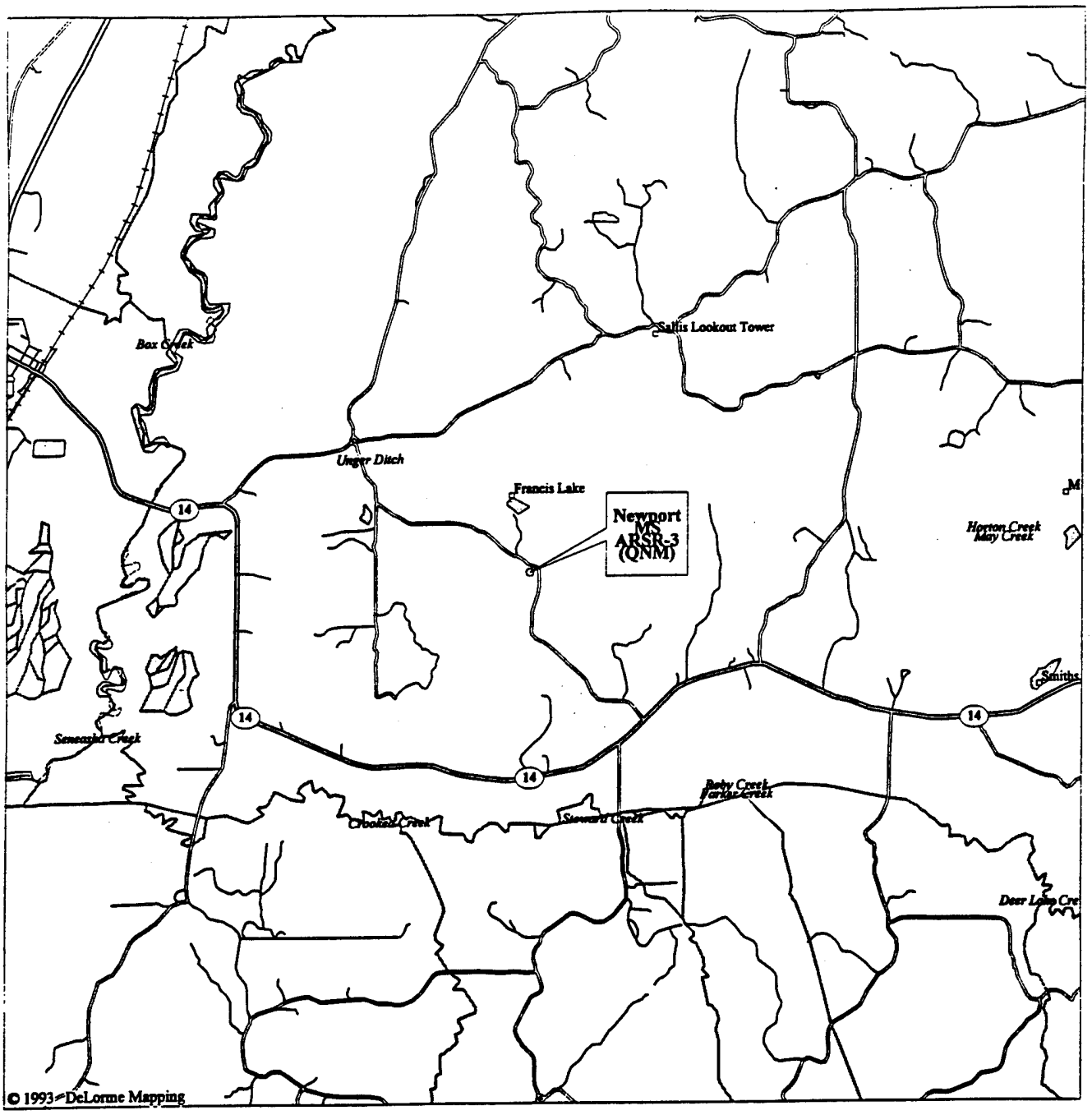
- Population Center
- Town, Small City
- Park
- Interstate, Turnpike
- US Highway
- Major Street/Road
- State Route
- Interstate Highway
- US Highway
- Open Water

Scale 1:1,000,000 (at center)

20 Miles

20 KM

Mag 9.00
Sun Mar 24 20:31:21 1996



LEGEND

- Population Center
- State Route
- Geo Feature
- County Boundary
- Street, Road
- Major Street/Road
- State Route
- US Highway
- Railroad
- River
- Open Water
- Intermittent River
- Utility (powerline)

Scale 1:62,500 (at center)

1 Miles

2 KM

Mag 13.00
Sun Mar 24 20:29:16 1996