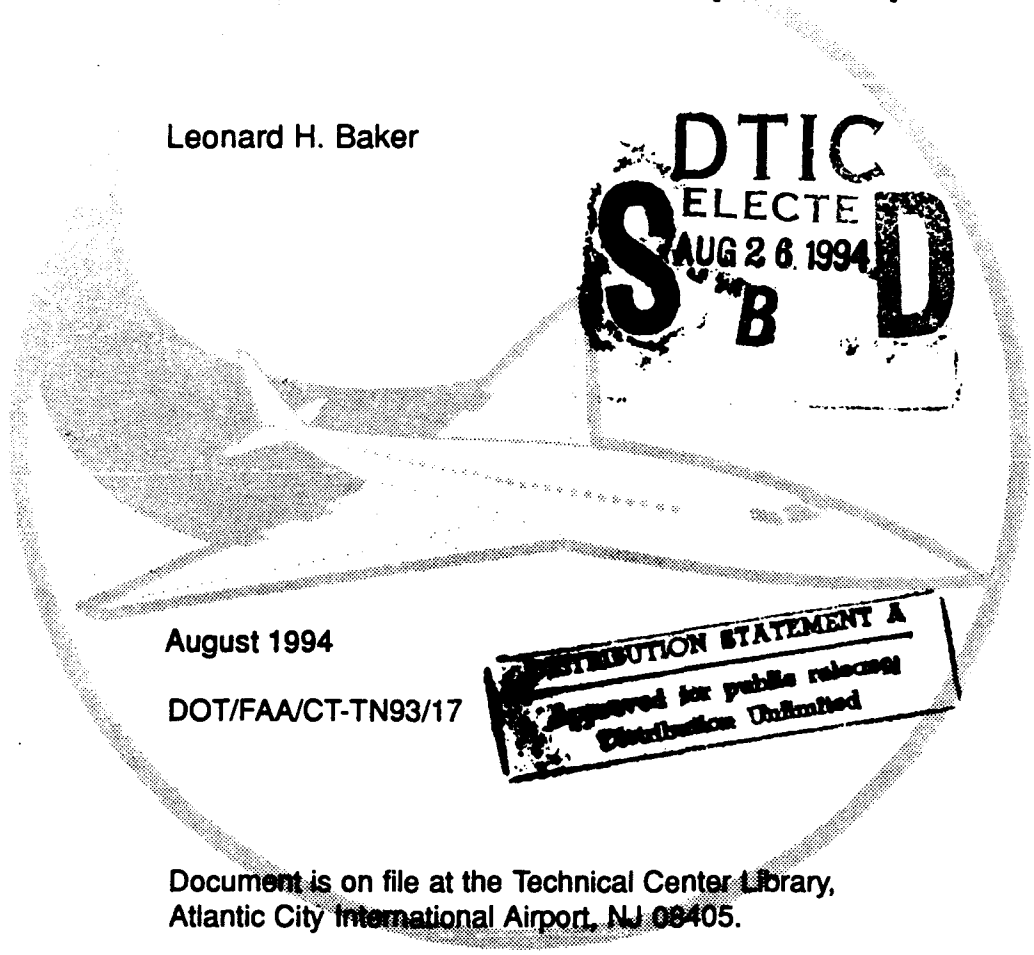
Test and Evaluation Master Plan (TEMP) for Fixed Ground Antenna Radomes (FGAR)

Leonard H. Baker



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16. Abstract

The Federal Aviation Administration (FAA) Fixed Ground Antenna Radome (FGAR) Test and Evaluation Master Plan (TEMP) is prepared by the Program Manager (PM) and Associate Program Manager for Test (APMT). It outlines the Test and Evaluation (T&E) process that will be used to ensure the project meets the requirements of the project specification and the system and subsystem requirements allocated to the project. The FAA TEMP contains FGAR Operational Test and Evaluation (OT&E) test requirements and OT&E schedule durations.

The purpose of the FGAR project is to provide new and larger radomes for en route surveillance radars that require collocated Mode Select Beacon System (Mode S) installations. As a result of the FAA's program to implement Mode S, many existing en route surveillance radar radomes cannot accommodate the additional space required by the new Mode S antennas. The FGARs will provide an environmental enclosure for a variety of single or dual-face monopulse beacon phased array and en route surveillance radar installations. Installations will be comprised of an installation mix ranging from beacon-only-sites (BOS) to collocated beacon and en route surveillance radar sites.

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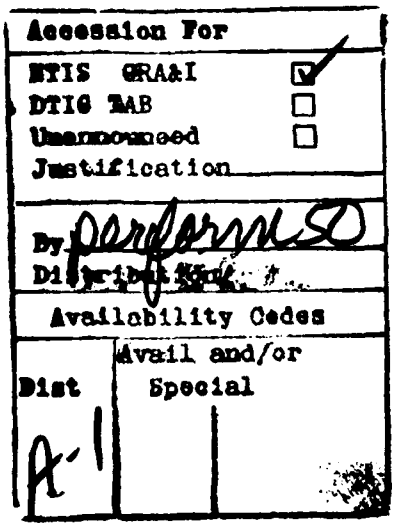
EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) Test and Evaluation Master Plan (TEMP) establishes the basic framework to guide and direct the Fixed Ground Antenna Radome (FGAR) test and evaluation (T&E) program. It addresses the responsibilities of the FGAR contractor and the FAA. The contractor testing responsibilities are addressed through the Development Test and Evaluation (DT&E) and Production Acceptance Test and Evaluation (PAT&E) phases. The FAA testing responsibilities are addressed through the Operational Test and Evaluation (OT&E) Integration, OT&E Operational, and OT&E Shakedown phases.

The FAA TEMP provides details only to the extent necessary to show the rationale for the kind, amount, and schedules of the planned testing. It relates the T&E effort to technical risks; operational issues and concepts; system performance; Reliability, Maintainability, and Availability (RMA); logistics requirements; and key decision points.



1. PURPOSE.

The Federal Aviation Administration (FAA) Fixed Ground Antenna Radome (FGAR) Test and Evaluation Master Plan (TEMP) is the primary document on which related Test and Evaluation (T&E) activity is based. It is intended to be sufficiently detailed to allow FAA personnel associated with the FGAR program to prepare and review lower level test planning documents, prepare for and conduct tests, review test data, and prepare reports. Its purpose is to provide the management and technical information necessary to satisfy the requirements of the FAA mandated T&E process as outlined in Order 1810.4B. In addition, this plan is intended to be used as a management and technical tool which will allow the FAA to monitor the performance of the T&E process, the quality and timeliness of planned tasks, and the overall adequacy of the products rendered during all phases of FGAR testing.

The FGAR is not a National Airspace System (NAS) major system acquisition (MSA). The FGAR contract (DTFA01-93-C-00075) was signed on September 30, 1993. The FGAR specification (FAA-E-2773b) establishes the requirements for performance, design, and acceptance of a state-of-the-art radome. There are no NAS requirements defined in NAS-SS-1000, NAS System Specification, or NAS-DD-1000E, National Airspace System Level I Design Document. This document is prepared in accordance with FAA-STD-024a, Order 1810.4B, and NAS-MD-110 to the extent feasible for testing and evaluating non-MSA equipment.

2. REFERENCE DOCUMENTS.

The documents listed in the following subsections form a part of this FAA TEMP.

2.1 FAA ORDERS.

Order 1810.4B	FAA NAS Test and Evaluation Policy
Order 6300.12	Project Implementation Plan (PIP) Fixed Ground Antenna Radome (FGAR) Including Tower Retrofit Modification

2.2 FAA SPECIFICATIONS.

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

2.3 FAA STANDARDS.

FAA-STD-024a	Preparation of Test and Evaluation Documentation

2.4 NAS DOCUMENTS.

NAS-MD-110	Test and Evaluation (T&E) Terms and Definitions for the National Airspace System

2.5 OTHER FAA DOCUMENTS.

DTFA01-93-C-00075	Fixed Ground Antenna Radome (FGAR) Contract

2.6 DEPARTMENT OF DEFENSE (DOD) DOCUMENTS.

MIL-HDBK-217F	Reliability Prediction of Electronic Equipment
MIL-HDBK-472	Maintainability Prediction
MIL-STD-781D	Reliability Testing for Engineering Development, Qualification, and Production
MIL-STD-785B	Reliability Program for Systems and Equipment Development and Production
MIL-STD-31000	General Specification for Technical Data Packages

3. DESCRIPTION.

This section reviews the aspects of the FGAR necessary for a successful T&E program. Sufficient detail is provided to assure that cognizant T&E personnel will have the knowledge to approach the tasks specified. There is no attempt to provide an exhaustive knowledge of radome or radio frequency (RF) theory and measurement.

3.1 MISSION.

The mission of the FGAR project is to:

a. replace existing radomes on en route surveillance radar/Mode Select Beacon System (Mode S)/Air Traffic Control Radar Beacon System (ATCRBS) towers.

b. install radomes on en route surveillance radar/Mode S/ATCRBS towers not currently covered.

c. replace existing radomes on Beacon Only Site (BOS) [Mode S/ATCRBS] towers.

d. install radomes on BOS [Mode S/ATCRBS] towers not currently covered.

The FGAR will provide environmental protection for a sophisticated L band antenna(s). The radome will be mounted on a fixed ground antenna tower and provide an environmental enclosure for any of a variety of single or dual-faced monopulse phased array beacon and en route surveillance radar antennas. The radomes will be nonmetallic (with the exception of fasteners), oblate spheroid or spherically shaped, and attached at the base to the antenna tower platform.

3.2 EQUIPMENT.

The FGAR supplies optimal protection of the antenna(s) from the outside environment while providing minimal degradation to the electrical performance characteristics of the enclosed antenna(s). There are five types of radomes; they are listed below. No Type IV radomes are being procured. All hardware required for installation: cables and wiring, support equipment, radome mounted/supported equipment, radome mounting ring, spare parts, and the primary power, are part of the FGAR procurement.

The types of radomes are:

a. Type I Radome. This type of radome will provide an environmental enclosure for a collocated L band surveillance radar parabolic reflector and top-mounted dual-faced L band beacon phased array antenna. The radome will be capable of withstanding wind velocities of 150 miles per hour (MPH). They will have an inside diameter of 59 feet at their widest point, and will fit a base ring diameter equal to the present CW-396A radome. The enclosed antennas will rotate at a speed of either 5 or 6 revolutions per minute (RPM).

b. Type II Radome. This type of radome will provide an environmental enclosure for a dual-faced L band beacon phased array antenna consisting of two identical rectangular back-to-back antennas approximately 6 feet high by 27 feet wide, rotating at speeds up to 5 RPM. The radome will be capable of withstanding wind velocities of 150 MPH and will be 35 feet at its widest point. It will fit the standard beacon-only antenna platform without requiring platform modification.

c. Type III Radome. This type of radome will be identical to the Type I in all respects, except that it shall be capable of withstanding wind velocities of 100 MPH maximum.

d. Type V Radome. This type of radome will provide an environmental enclosure for a collocated L band radar reflector and top-mounted dual-faced L band beacon phased array antenna. The radome will be capable of withstanding wind velocities of 150 MPH. They will have an inside diameter of 57.5 feet at their widest point, and will fit a base ring diameter equal to the present Air Route Surveillance Radar (ARSR)-3 [ESSCO Model M57-86-6000] radome.

e. Type VI Radome. This type of radome will be identical to the Type V in all respects, except that it shall be capable of withstanding wind velocities of 100 MPH maximum.

Radome support equipment is defined in FAA-E-2773b.

The FGAR Remote Maintenance Monitoring Subsystem (RMMS) function will monitor environmental functions. The direct interface between the FGAR RMMS demarcation point, and an Environmental Remote Monitoring Subsystem (ERMS) planned for the radar site, will be in the radar equipment room.

3.2.1 Physical Description.

Each radome will be complete and include, but not limited to, the following:

a. Lightning protection assembly
b. Aircraft obstruction light assembly
c. Repair kit and maintenance items
d. Zenith hatch assembly
e. Service hatch
f. Catwalk access hatch
g. Interior safety ladder
h. Interior block and tackle assembly
i. Crown vents, with remote actuation provisions via the ERMS/RMMS interface
j. Snow rope(s)

3.2.2 Key Functions.

The two key functions of FGAR are to protect the en route surveillance radar and/or the Mode S antennas from the outside environment and not degrade their electrical performance characteristics.

3.2.3 Interfaces.

The radome to tower interface is both physical and electrical. It is physically attached to the antenna tower by a radome mounting ring. The radome is electrically interfaced with the radar electrical distribution system, lightning protection system, aircraft obstruction lights, access hatches, RMMS/ERMS, and other devices/units necessary for operation and maintenance of the radome.

3.2.4 Unique Characteristics.

The FGAR has no unique characteristics.

3.3 REQUIRED OPERATIONAL CHARACTERISTICS.

The FGAR will ensure the integrity of the en route surveillance and/or Mode S antennas spatially distributed electromagnetic radiation pattern in the frequency band of 1000-1400 megahertz (MHz). It will maintain electromagnetic wave polarization purity for vertical, horizontal, left, and right circular modes of polarization.

3.4 REQUIRED TECHNICAL CHARACTERISTICS.

The FGAR will provide an environmental enclosure for the en route surveillance radar and/or Mode S antennas. The maximum allowable transmission loss is 0.2 decibels (dB) in the frequency band of 1000-1400 MHz. The radomes are a rigid shell type assembly composed of dielectric panels. The materials used in the construction of the radome will withstand the environmental conditions in such a way that weathering will not preclude its 20-year service life expectancy. The physical facility changes to support and interface each type of radome assembly will be minimized.

The FGARs will replace many existing radomes in use today. This must be accomplished without degrading NAS performance. The effects the FGAR has on antenna patterns, cross-polarization, gain, etc., will be evaluated to determine if any degradation has occurred. This will be accomplished through test and analysis. The radome dielectric material characteristics will be evaluated to determine the effects of weathering.

The ability to minimize transmission losses and maintain structural strength will be included in the overall Operational Test and Evaluation (OT&E) testing.

There are three different physical sizes of FGARs. Depending on their geographical location, the radome will be designed to meet one of two different aerodynamic wind loading requirements.

The FGAR will be used with the following types of antennas:

a. ARSR-1E and -1F

b. ARSR-2

c. ARSR-3

d. FPS AS-1561

e. Mode S En Route (Back-to-Back) Antenna

f. National Aviation Facilities Experimental Center (NAFEC) Dipole Feed (NADIF) Antenna

3.5 T&E ISSUES.

The FGAR T&E issues are those capability issues, either technical or operational, that must be examined before the FGAR's effectiveness can be determined. The development of the concepts for testing these issues will be addressed in lower level test documents. These issues will be of primary importance to the FAA in reaching a decision to deploy the FGAR.

The T&E will be conducted to determine if the move from the present radome, or in some cases no radome, to the FGAR can be accomplished without impacting the end user.

3.5.1 Technical Issues.

The technical issues consist of radome material tests performed by the contractor and the additional analysis which will be required to support the test results.

3.5.1.1 Radome Material Tests.

The key T&E technical issues relating to individual radome material tests are:

a. Electromagnetic test of radome material
b. Hydrophobic surface test
c. High/low temperature effects on the radome material
d. Solar radiation effects on radome material
e. Seam/joint weather penetration test report
f. Hailstone test report
g. Snow/ice adhesion test report
h. Salt/fog effects on radome material
i. Fungus effects on radome material
j. Humidity effects on radome material
k. Altitude effects on composite structures radome material (if applicable)
l. Flammability/combustibility test report
m. Accelerated weathering test report
n. Material properties determination for radome material

3.5.1.2 Additional Analysis Required.

In addition to the tests listed above, the following analysis is required to support these tests:

a. Electromagnetic analysis of the radome/antenna interface
b. Structural analysis of the radome and aerodynamic loading
c. Lightning effects and protection analysis

3.5.2 T&E Integration and Operational Issues.

The integration and operational T&E issues are those that impact the operational effectiveness and suitability of the FGAR.

3.5.2.1 Critical T&E Integration and Operational Issues.

The critical T&E integration and operational effectiveness and suitability issues are:

a. Physical interface between the radome and the antenna tower
b. Electromagnetic performance

    1. Antenna main beam width change
    2. Antenna boresight error (azimuth and elevation)
    3. Antenna sidelobe level error change
    4. Antenna azimuth pointing accuracy

c. RMMS/ERMS FGAR interface
d. Reliability, Maintainability, and Availability (RMA)
e. Contractor conducted training courses

3.5.2.2 Other T&E Integration and Operational Suitability Issues.

Other T&E integration and operational suitability issues are:

a. Electrical interface between the radome and the antenna tower:

   1. Lightning protection
   2. Aircraft obstruction lights
   3. Primary power
   4. Overvoltage load protection

b. Temperature stratification within the radome
c. Snow rope(s) installation
d. Access hatches

3.5.2.3 T&E Operational Interchangeability Issues.

Interchangeability will be demonstrated between radomes of the same type.

4. PROGRAM SUMMARY.

The FGAR program management provides for a division of responsibilities between the various FAA organizations, its support contractors, and the FGAR contractor. The FGAR contractor tasks and responsibilities are delineated in the contract and various agreements. The duties, responsibilities, and authority of various FAA organizations are specified in applicable orders, and other documents, e.g., program directives (PD), memorandum of understanding (MOU), etc., which may be issued. Authority for the expenditure of funds resides with the program manager (PM).

The FGAR T&E program consists of the processes that verify how well the FGAR meets the technical and operational requirements; provides data to assess acquisition, developmental, technical, and operational risks for decision making; verifies performance; and ensures that all critical issues to be evaluated by testing have been adequately considered and resolved.

The FAA Technical Center appointed Associate Program Manager for Test (APMT) has the overall responsibility for testing as delineated in the FAA Order 1810.4B. The FGAR APMT resides in the Secondary Surveillance Systems Division, ACW-100. ACW-100 is responsible for coordinating the T&E efforts vertically from the contractor through all FAA organizations and horizontally between FAA regions, FAA Technical Center, FAA Logistics Center (FAALC), and the FAA Academy. The APMT's role begins after the program is initiated and concludes at the completion of the Operational Readiness Demonstration (ORD) at the Type I, II, and V FGAR First Article sites. (The First Article sites are defined as the first three Type I sites and the first Type II and V sites.) The APMT tracks the program T&E status to the master T&E milestones specified in the PD.

4.1 MANAGEMENT.

The FAA organizations required to support the T&E program and their responsibilities are detailed in Order 1810.4B. This order establishes a Test Policy Review Committee (TPRC) and an FAA Technical Center APMT. The APMT acts as the agent of the PM and manages the T&E program.

The APMT will insure the program is conducted in accordance with the FAA T&E orders. The APMT is responsible for the overall test program, and will prepare inputs for the PM for submission to the Deployment Readiness Review (DRR).

The APMT will develop the test plan and procedures for OT&E Integration testing and OT&E Operational testing. The APMT will review the plans and incorporate the requirements addressed into the program level Verification Requirements Traceability Matrix (VRTM). (See appendix A).

Numerous FGAR T&E documents will be produced and issued by the contractor for review by the FAA. The APMT will coordinate the review process of all Contractor Data Requirement Lists (CDRL) relating to testing. A CDRL review tracking system, identifying critical and informational reviewers, will be generated for the program.

The NAS System Engineering Service (ASE) will be responsible for reviewing changes and updates to the TEMP through the FGAR acquisition phases.

A Quality Reliability Officer (QRO) may be appointed by the Associate Administrator for Contracting and Quality Assurance (ASU-1) to monitor the DT&E and PAT&E testing.

4.2 INTEGRATED SCHEDULE.

The schedules shown in this document are approximations due to the fluid nature of the program at the time of publication of this document. Nevertheless, they are generally sufficient for T&E planning purposes. A fully integrated schedule, showing the T&E program, will be developed by the program office and APMT using Microsoft Project as a tool.

The first site will be at the FAA Technical Center (Elwood ARSR site) and the second at the Northwest Mountain Regions Cascade, Idaho, ARSR site.

Activity summary charts are provided for T&E planning purposes (see figures 4.2-1 through 4.2-3). These charts are used by the APMT for estimating relative level of effort, types of activity, and intensity of workload each T&E organization will be confronted with during the overall T&E program.

The six major test milestones associated with this program are:

a. Contract award
b. Completion of Development Test and Evaluation (DT&E) testing
c. Completion of Contract Acceptance Inspection (CAI)
d. Completion of OT&E Integration testing
e. Completion of OT&E Operational testing
f. Completion of OT&E Shakedown testing

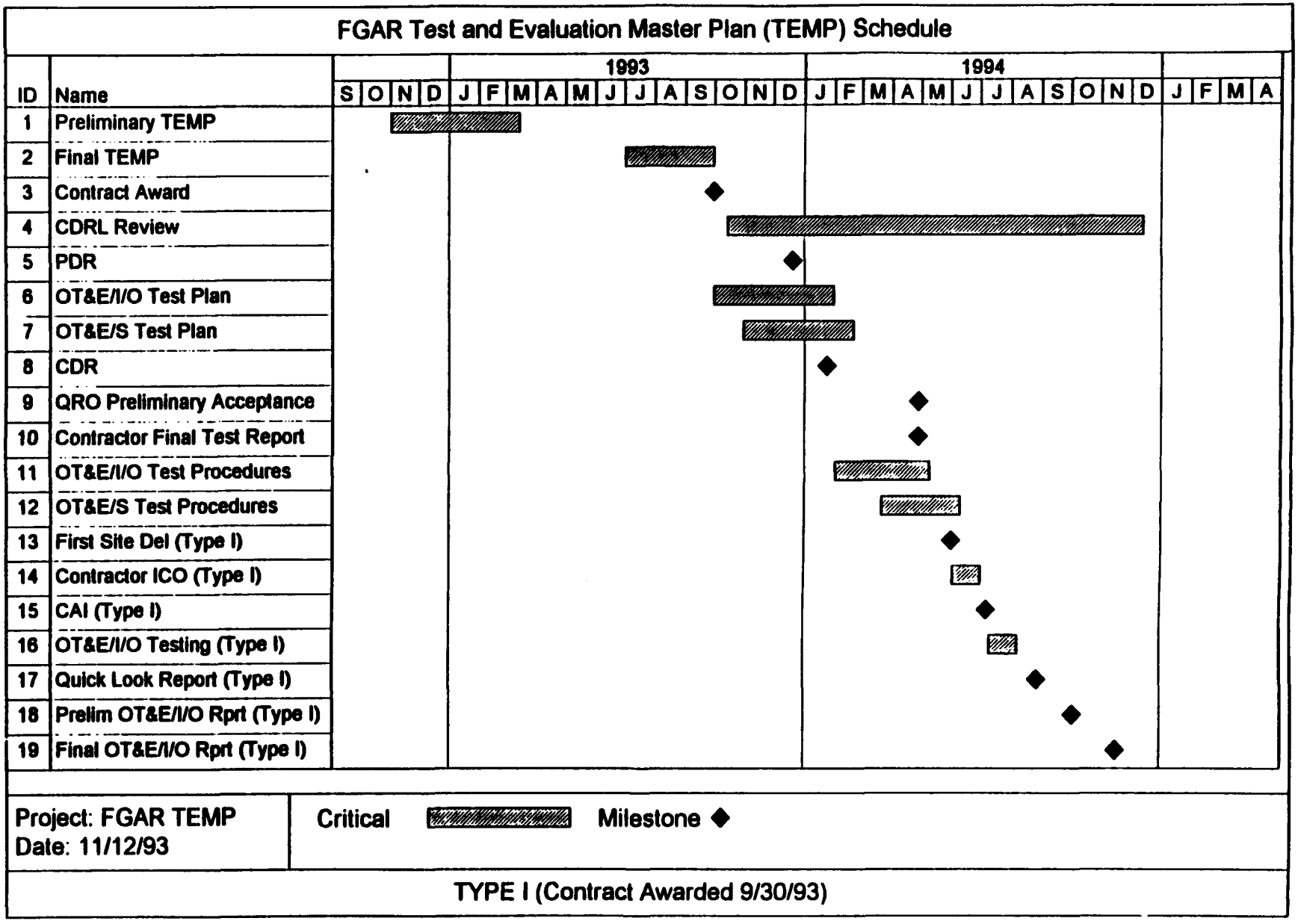


FIGURE 4.2-1. FGAR TEST AND EVALUATION MASTER PLAN SCHEDULE - TYPE I (Sheet 1 of 2)

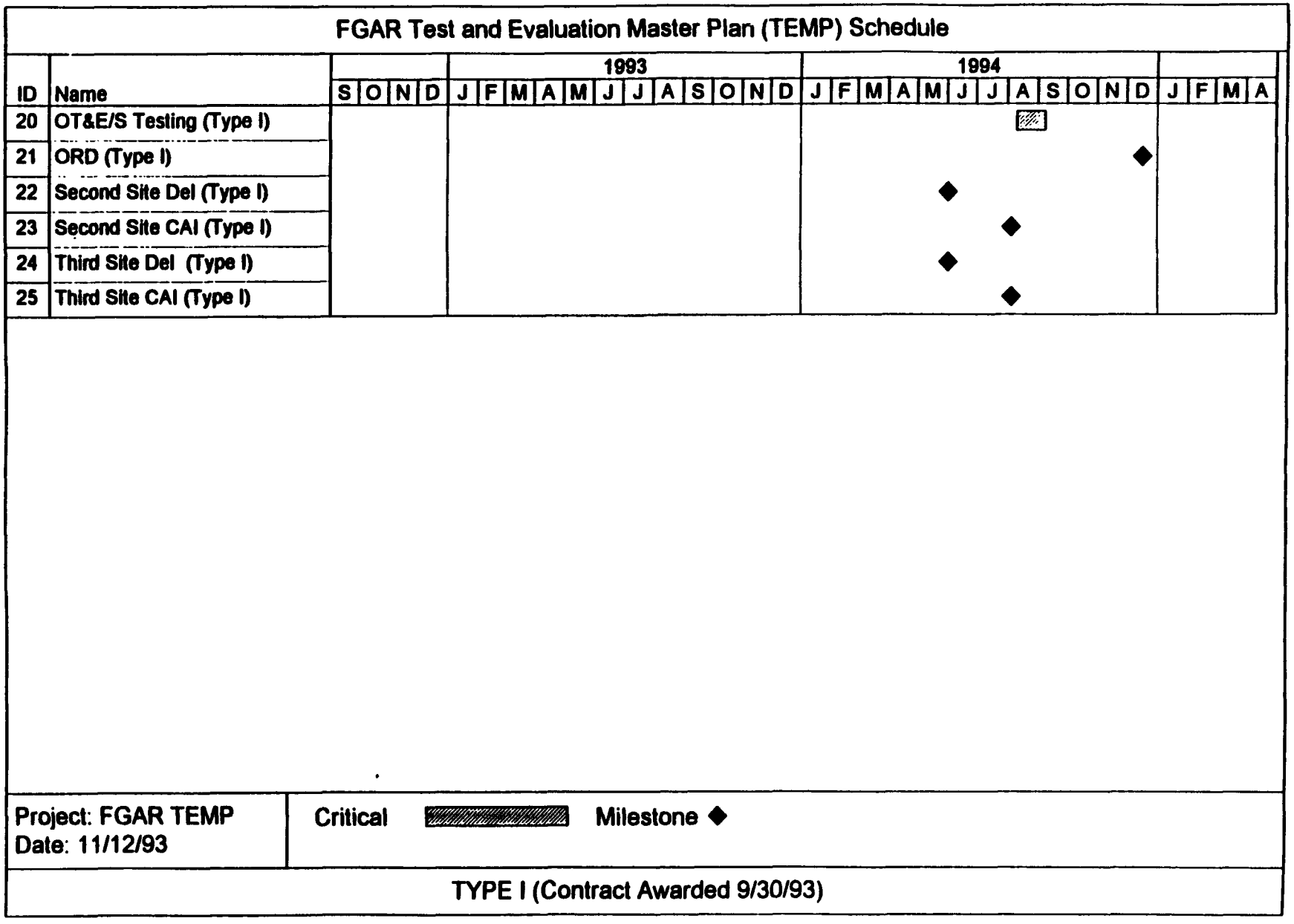


FIGURE 4.2-1. FGAR TEST AND EVALUATION MASTER PLAN SCHEDULE - TYPE I (Sheet 2 of 2)

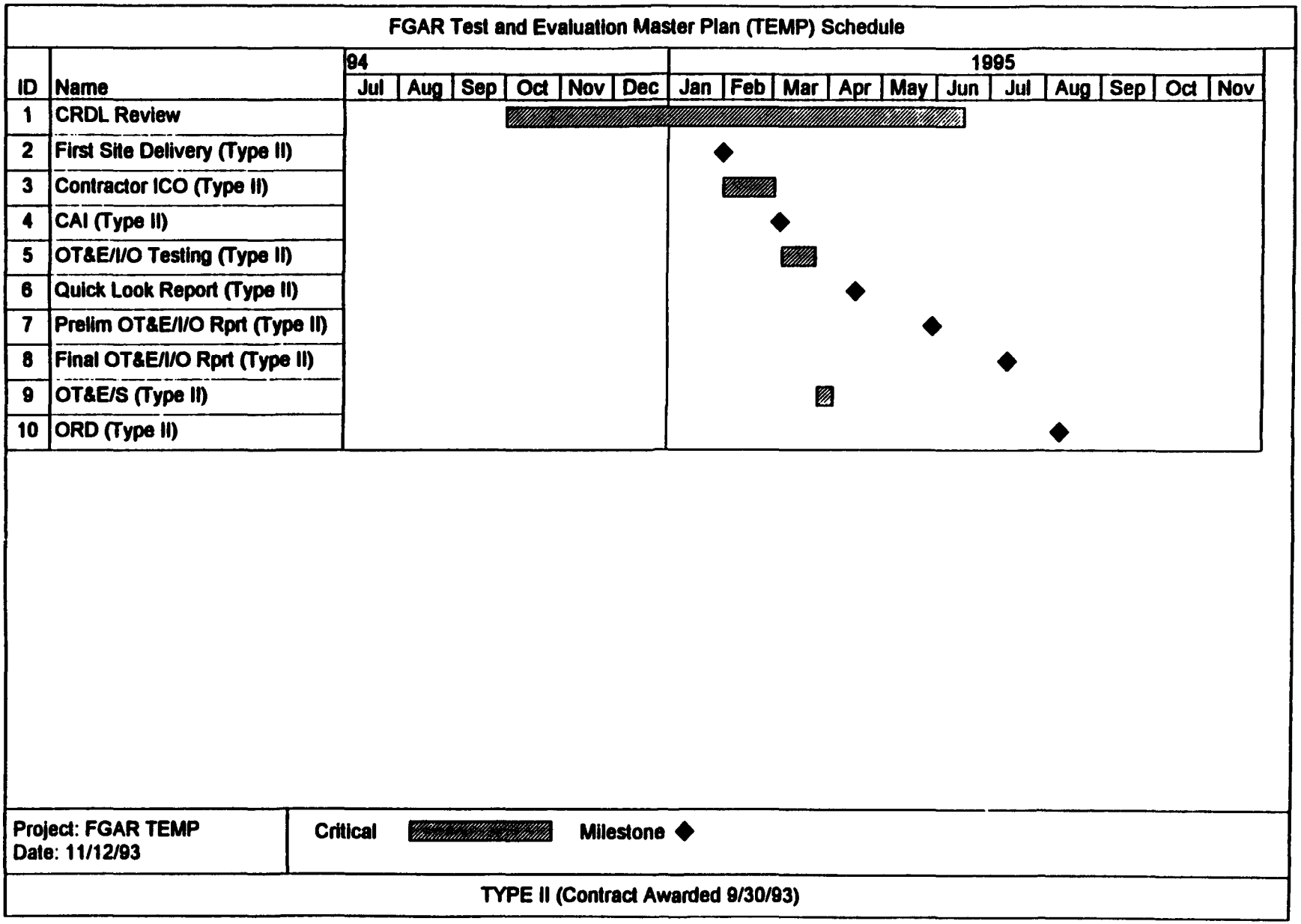


FIGURE 4.2-2. FGAR TEST AND EVALUATION MASTER PLAN SCHEDULE - TYPE II

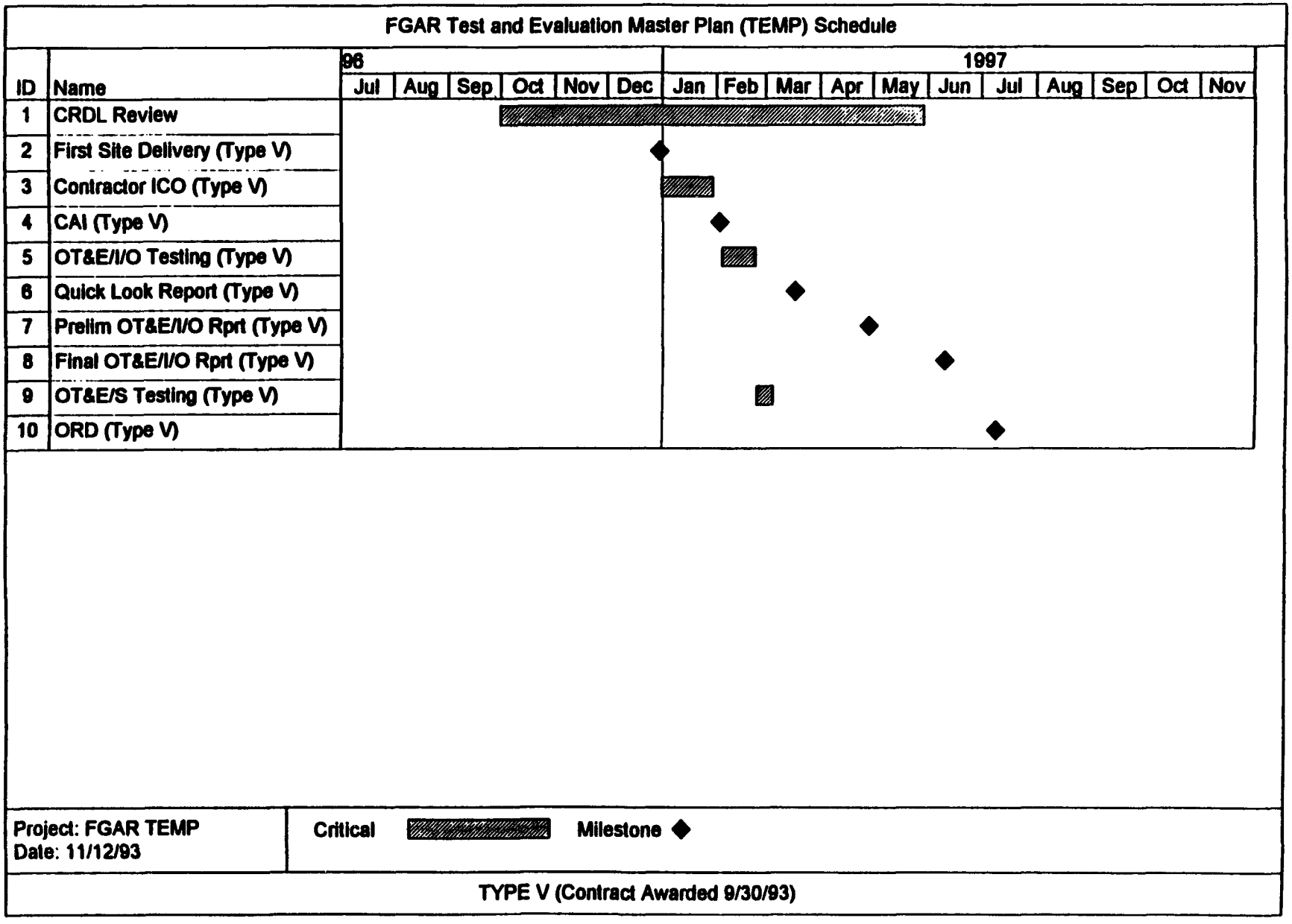


FIGURE 4.2-3. FGAR TEST AND EVALUATION MASTER PLAN SCHEDULE - TYPE V

4.3 TEST PLANS.

The test plans required for T&E of the FGAR project are developed by the organizations delineated below.

4.3.1 FAA TEMP.

The APMT jointly prepares and updates the FAA TEMP in conjunction with the PM. This document will be updated as required.

4.3.2 DT&E and Production Acceptance Test and Evaluation (PAT&E) Test Plans.

The DT&E and PAT&E test plans will be developed by the contractor.

4.3.3 OT&E Integration and OT&E Operational Test Plans.

There will be no stand-alone OT&E Integration test plan. The OT&E Integration and OT&E Operational test plans will be integrated into one document, the OT&E Integration and OT&E Operational test plan. ACW-100 will develop this plan.

4.3.4 OT&E Integration and OT&E Operational Test Procedures.

There will be no stand-alone OT&E Integration test procedures. The OT&E Integration and OT&E Operational test procedures will be integrated into one document, the OT&E Integration and OT&E Operational test procedures. ACW-100 will develop this document.

4.3.5 OT&E Shakedown Test Plan and OT&E Test Procedures.

The OT&E Shakedown test plan and OT&E Shakedown test procedures will be developed by the National Airway System Engineering Division, AOS-200, at the Mike Monroney Aeronautical Center, Oklahoma City, Oklahoma.

4.4 REGRESSION TESTING.

In the event there is a failure during any phase of testing, upon completion of repairs, the failing test together with any required regression testing will be performed again.

a. The contractor test plans will address the types of regression testing required, if a failure occurs during DT&E and PAT&E testing.

b. The OT&E Integration and Operational and OT&E Shakedown test plans will address the types of regression testing required, if a failure occurs during OT&E testing.

4.5 COORDINATION.

The designated FAA Technical On-Site Representative (TOR) will be responsible for coordinating all activities, e.g., shutdowns, etc., with Regional Air Traffic Control (ATC) and Airway Facilities (AF) personnel, and DOD air defense sites.

4.6 TEST REPORTS.

Formal test reports will be prepared at the conclusion of each test phase. The reports will be submitted to the FGAR program office, ANR-400, within 30 days after completion of the tests.

ACW-100 will provide a Quick Look Test Report at the end of OT&E Integration and OT&E Operational testing. AOS-200 will provide a Quick Look Test Report at the end of OT&E Shakedown testing. These reports will be submitted within 15 days after completion of the tests to ACW-1, ANR-400, and AAF-11 for inclusion in the DRR process.

5. DT&E AND PAT&E TESTING.

The FGAR DT&E testing is performed by the contractor. This phase of testing demonstrates compliance with the FGAR specification (FAA-E-2773b) and the Statement of Work (SOW). This testing provides verification of all contract requirements.

The FGAR PAT&E testing is performed by the contractor. This phase of the test program is performed on each delivered item to verify that it conforms to applicable specifications, is free from manufacturing defects, and is substantially identical to the qualified hardware.

5.1 APMT RESPONSIBILITIES.

During DT&E, ACW-100 is responsible for the verification of the test documents developed under this contract. The CDRLs delivered will be reviewed. Document comments will be resolved prior to CDRL acceptance. Testing will be observed to assure the validity of the test. Test reports developed by the contractor will be reviewed for completeness and accuracy.

The APMT will advise the other FAA organizations of the progress of DT&E. Test schedules, plans, procedures, and reports will be made available to assist in planning and conduct of OT&E Integration, OT&E Operational, and OT&E Shakedown testing. This will help eliminate redundant test efforts, provide early detection of problems, and allow the overall test program to remain on schedule and within budgetary limits.

5.2 QRO RESPONSIBILITIES.

The QRO, if assigned, will audit the contractor DT&E and PAT&E testing to determine overall contract conformance to the quality requirements. The QRO may advise the contractor of any test or inspection failures or anomalies.

Upon completion of the DT&E phase, the QRO, if assigned, will monitor and audit the contractor's production tests and inspection process to assure future production items conform to the same standards established during DT&E.

5.3 DT&E AND PAT&E OBJECTIVES.

ACW-100 will verify the contractor tests have successfully shown the FGAR requirements have been met. ACW-100 will certify the contractor's documentation to support the FGAR program, including test reports, then recommend approval by the FAA.

The contractor conducted training courses will be evaluated. This evaluation will be performed in two ways.

a. ACW-100, AOS-200, and FAA Academy instructor personnel will attend and/or monitor the training classes.

b. The ability of field maintenance, AOS-200, and FAALC support personnel to perform maintenance tasks will be evaluated during OT&E Operational and Shakedown testing.

During PAT&E, ACW-100 will monitor, on a limited basis, production tests to confirm subsequent production models conform to the same standards and are similar to the FGAR which passed DT&E testing.

5.4 DT&E AND PAT&E TESTING TO DATE.

ACW-100 has supported the PM in the development of the contract and the SOW. In preparation for DT&E, ACW-100 is preparing to support the preliminary design review (PDR) and critical design review (CDR) by reviewing the requirements.

There has been no DT&E or PAT&E testing performed to date.

5.5 FUTURE DT&E AND PAT&E TESTING.

The following requirements will be addressed during these phases of FGAR testing:

a. Contract requirements
b. Size (internal width and height) of radome
c. Maintenance
d. Contractor support and training
e. Physical interfaces
f. Electrical interfaces
g. Electromagnetic testing
h. Environmental testing
i. Human factors testing
j. RMA testing

5.6 CONTRACTOR TEST AND DEMONSTRATIONS.

The FGAR contractor will perform the following tests and demonstrations:

a. Radome materials tests
b. Type tests
c. Production tests
d. Site acceptance tests (SAT)

5.7 DT&E AND PAT&E EVENTS/SCOPE OF TESTING.

Testing will be conducted using a combination of testing, inspection, analysis, demonstration, and computer simulation to verify the First Article and production FGARs meet the requirements of FAA-E-2773b.

Refer to the contractor FGAR DT&E and PAT&E test plans (to be developed).

5.8 E AND PAT&E TEST ITEMS.

The the FGAR contractor will perform are:

a. Combustibility test
b. Computer simulation
c. Electromagnetic emissions test
d. Electromagnetic performance tests

    1. Azimuth pointing accuracy
    2. Boresight error
    3. Boresight error slope
    4. Cross polarization ratio
    5. Depolarization
    6. Difference pattern null depth error
    7. Hydrophobic loss
    8. Main beam width change
    9. Sidelobe level error change
    10. Transmission loss

e. Environmental test
f. Hail impact test
g. Hydrophobic surface test
h. Ice or snow adhesion test
i. Lightning effects and protection test
j. Maintainability demonstration
k. Physical stability
l. Reliability demonstration
m. Seam/joint test
n. Solar radiation test
o. Transient protection test
p. Water penetration or absorption test
q. Weathering (protective coating) test
r. Wind, snow, and ice loading test

5.9 DT&E AND PAT&E RMA TEST ISSUES.

The majority of the RMA requirements, e.g., the mean time between critical failure (MTBCF) [175,200 hours], will be verified during DT&E testing, utilizing government approved Reliability and Maintainability Program Plans. These contractor developed plans, prepared in accordance with applicable military standards (MIL-STD-781 and -785) and handbooks (MIL-HDBK-217 and -472), describe the methodology, equipment configurations, models, etc., used to derive the reliability, maintainability, and availability predictions for the FGAR and its subsystems.

6. OT&E INTEGRATION TESTING.

The OT&E Integration testing of the FGAR will be limited to testing the:

a. mechanical interface between the FGAR and the existing antenna tower.

b. interface between the FGAR environmental and equipment sensor(s) and the RMMS/ERMS.

The testing will be performed at the first site for Type I, II, and V FGARs. (Additional testing may be performed at the second and third Type I sites [which are considered to be First Articles], if required.)

The mechanical interface between the FGAR and the existing antenna tower is the only critical item.

7. OT&E OPERATIONAL TESTING.

The OT&E Operational testing will be conducted by ACW-100 at the first site for Type I, II, and V FGARs. (Additional testing may be performed at the second and third Type I sites [which are considered to be First Articles], if required.) The OT&E Operational testing is performed to verify the requirements identified in the FAA TEMP VRTM. It verifies the FGAR does not degrade the performance of either the en route surveillance radar or Mode S antennas. In addition, it interfaces physically and electrically with the existing tower structures. The OT&E Operational testing will begin immediately after the contractor completes DT&E testing. The OT&E Operational test program will be structured to take full advantage of earlier DT&E testing.

7.1 OT&E OPERATIONAL TESTING OBJECTIVES.

The objectives of OT&E Operational testing are to:

a. verify the FGAR can replace the present radomes without degrading the electromagnetic performance of the en route surveillance radar and/or the Mode S antennas.

b. verify the FGAR can provide environmental protection for the en route surveillance radar and/or the Mode S antennas, and associated tower platform mounted equipment.

c. determine if there is sufficient personnel access to the radome for inspection and maintenance of the antenna(s) and tower mounted equipment.

d. determine if there is sufficient personnel access from the radome to the tower platform for inspection and maintenance purposes.

e. determine if there is sufficient personnel access from the radome to the aircraft obstruction light assembly and lightning protection system for inspection and maintenance purposes.

f. determine impact of the FGAR on personnel safety.

g. determine if the FGAR mounted RMMS sensors will interface with the RMMS/ERMS.

h. determine if field maintenance, AOS-200, and FAALC support personnel received adequate training, in the contractor and/or FAA Academy conducted classes.

7.2 OT&E OPERATIONAL T&E TO DATE.

There has been no OT&E Operational testing performed to date.

7.3 FUTURE OT&E OPERATIONAL TESTING.

Future OT&E Operational testing will include predelivery and First Article site testing as described below.

7.3.1 Predelivery Testing at FAA Technical Center.

The OT&E Operational testing will commence prior to delivery of the first FGAR. Various electromagnetic measurements will be made at the FAA Technical Center, Elwood ARSR site, with the present radome (an inflatable type) installed. These measurements will form the basis for comparison between the present inflatable radome and the FGAR.

7.3.2 Testing at First Article Sites.

Testing at the First Article Type I, II, and V FGAR sites will be divided into three phases. During all three phases various electromagnetic measurements will be made. Phase 1 will be conducted prior to the removal of the existing radome and the installation by the contractor of any scaffolding, etc., required for its removal. Phase 2 will be conducted after the contractor has removed the current radome, including any work scaffolding, crane boom, etc., required to remove the existing radome. Phase 3 will be conducted after the installation of the FGAR is completed. During all three phases, the same electromagnetic measurements will be made to allow a comparison between the existing radome, with no radome installed, and the FGAR. These tests will be made using an RF interference monitor (RFIM) van and support personnel from ASM-500 and/or one of the FAA regions.

The SOW places the following time constraints on the Phase 2 and Phase 3 testing:

a. Phase 2 - 2 days

b. Phase 3 - 1 day (This phase must be successfully completed prior to final acceptance of the First Article FGARs.)

The results of Phases 1, 2, and 3 testing will be compared to ensure the FGAR does not exceed the allowable errors specified in FAA-E-2773b.

7.4 OT&E OPERATIONAL T&E EVENTS/SCOPE OF TESTING.

a. An RFIM van will be used to measure the antenna main lobe beam width error, boresight error, and sidelobe level error parameters of the antenna(s) as defined in FAA-E-2773b. Other measurements may be made as determined necessary.

1. Prior to the removal of the present radome (if one is present).

2. After removal of the present radome.

3. After the complete installation and checkout of the FGAR by the contractor, but prior to final acceptance by the government.

The RFIM van will be located at three points around the radar site periphery for each phase of testing. Data recordings will be made at each location. At the completion of Phase 3, the results of Phases 2 and 3 will be compared to determine if the allowable errors have been exceeded. In addition, the results of Phases 1 and 3 will be compared to determine if the FGAR has improved or degraded the en route surveillance radar and/or Mode S antenna(s) performance.

In addition, a record of permanent echoes (PE) for both the en route surveillance radar and Mode S will be made during all three phases, for determining the boresight error(s).

b. The ability of the FGAR to provide environmental protection for the antenna(s) will be evaluated utilizing actual, to the maximum extent possible, and simulated weather conditions, e.g., water from high pressure hoses to simulate rain storms, etc.

c. Access to the antenna tower, various FGAR mounted equipment, the outer surface of the radome, and the antenna(s) will be evaluated by having field maintenance and FAALC support personnel perform various preventive and corrective maintenance tasks.

d. Personnel safety will be evaluated to determine if:

1. There is sufficient lighting inside the radome for personnel to safely perform preventive and corrective maintenance on the en route surveillance radar and/or Mode S antenna(s) and other equipment mounted on the tower platform and at the zenith of the FGAR.

2. The interior safety ladder can be used without endangering personnel.

3. The aircraft obstruction lights and lightning protection devices can be serviced safely from the FGAR zenith service hatch.

4. The interior block and tackle assembly can be used safely for installation and removal of antenna sections, servicing of tower platform equipment, etc.

5. Hazardous materials are present in the radome structure.

6. Current-carrying parts are adequately protected to prevent personnel from being injured.

e. The RMMS/ERMS interfaces will be tested by simulating various environmental conditions and equipment failures.

7.5 CRITICAL OT&E OPERATIONAL ITEMS.

The critical OT&E Operational items are those issues which can be tested in the field and which would impact deployment of the FGAR. These issues include:

a. Electromagnetic characteristics of the en route surveillance radar/Mode S antenna(s) are not altered, including:

1. Main beam width change of ±0.05° maximum.

2. Boresight error of 0.0085° root-mean-square (RMS) and 0.0255° maximum.

3. Sidelobe level error change of ±1 dB, using a sidelobe that is 25 dB below the main lobe for all frontal and back lobes.

4. Azimuth pointing accuracy of the Mode S antenna is not degraded by the material and/or method of construction of the FGAR.

b. RMMS/ERMS FGAR electrical (signal) interface.

c. Maintainability and availability will be tested using FAA field maintenance, AOS-200, and FAALC support personnel performing various maintenance tasks.

7.6 OTHER OT&E OPERATIONAL ITEMS.

In addition, the following characteristics will be tested in the field to determine their operational effectiveness and suitability:

a. Lightning protection system integration into the antenna tower/radar site lightning protection system.

b. Verification that maintenance can be performed on the:

1. Aircraft obstruction light assembly

2. Lightning protection system

c. FGAR primary power distribution system integration into the antenna tower/radar site primary power distribution system.

d. Over voltage load protection provisions for the FGAR and the FGAR/antenna tower interface.

e. Temperature differences at different levels in the FGAR are within tolerance.

f. Snow removal rope(s) is installed and can be used to sweep the outer surface of the FGAR.

g. Access hatches are readily accessible and provide easy egress to/from the FGAR.

8. OT&E SHAKEDOWN TESTING.

The FGAR OT&E Shakedown tests will be developed and conducted by AOS-200 at the First Article Type I, II, and V FGAR sites. (Additional testing may be performed at the second and third Type I sites [which are considered to be First Articles], if required.) The OT&E Shakedown is independent testing conducted by AOS-200 to verify and validate the OT&E Integration and OT&E Operational testing. The inputs to this test phase and the results will be made available to the field as an aid in site shakedown testing.

8.1 OT&E SHAKEDOWN OBJECTIVES.

The objectives of shakedown T&E are to:

a. determine if field maintenance, AOS-200, and FAALC support personnel have received adequate training.

b. determine if all documentation is available, complete, adequate, etc.

c. determine if the FAALC can support the FGAR program, i.e., do they have spare parts, repair kits, etc.

d. determine if the FGAR is maintainable by field maintenance, AOS-200, and FAALC support personnel.

8.2 OT&E SHAKEDOWN TO DATE.

There has been no OT&E Shakedown testing performed to date.

8.3 FUTURE OT&E SHAKEDOWN TESTING.

The OT&E Shakedown testing will commence following the completion of CAI and OT&E Integration and OT&E Operational testing of the First Article Type I, II, and V FGARs.

The OT&E Shakedown will be conducted through a series of tests performed by field maintenance and FAALC support personnel. These tests will be used to determine if field maintenance, AOS-200, and FAALC support personnel; and the FAALC are ready to support the FGAR program.

The following must be completed before OT&E Shakedown can commence.

a. CAI,

b. OT&E Integration and OT&E Operational testing,

c. All spare parts, repair kits, documentation, etc., are available on-site,

d. Field maintenance, AOS-200, and FAALC support personnel have been trained.

8.4 OT&E SHAKEDOWN EVENTS/SCOPE OF TESTING.

a. Documentation

Utilizing the technical instruction (TI) manuals and other contractor supplied documentation normally available, field maintenance, AOS-200, and FAALC support personnel will perform preventive and corrective maintenance on the FGAR, to determine:

1. If the documentation is:

(a) Complete - Topics are adequately covered and explained. The manual contents reflect the current equipment.

(b) Readable - Procedures and descriptions are written in an easy-to-understand manner.

(c) Correct/Accurate - Standards, schedules, tolerances, and procedures are correct.

(d) Revisable - Manuals and other documents follow standard update procedures and can be adequately maintained.

(e) Organized - Documents are logically organized and easy to use.

(f) Durable - Documents are well bound, durable, and easy to handle (not too large, etc.).

2. If the documentation has been supplied in sufficient quantity.

3. Additional copies are available, if required.

4. If the training materials are complete, accurate, etc., enough to allow the FAA Academy to train field maintenance, AOS-200, and FAALC support personnel.

5. If the draft maintenance handbook and/or changes to existing handbooks complete, accurate, etc.

b. Training

The training schedule will be reviewed to ensure an adequate number of trained personnel will be available to maintain the FGAR and perform first and second level support. Training will be evaluated throughout OT&E Shakedown testing by observing trained personnel performing their tasks. The training will be evaluated against the following test issues:

1. Scheduling - A sufficient number of trained personnel are available to perform first and second (AOS-200) level, and FAALC preventive and corrective maintenance.

2. Timeliness - The training was provided without an excessive lapse between the training and the use/maintenance of the FGAR and its associated equipment.

3. Hands-On - Sufficient hands-on and repetition was provided to ensure competence.

4. Effectiveness - Training is sufficient to provide adequate performance in maintaining the FGAR and its associated equipment.

c. Maintainability

Maintainability will be verified by having field maintenance, AOS-200, and FAALC support personnel perform preventive and corrective maintenance on the FGAR and its associated equipment. The following items will be evaluated during the performance of the maintenance:

1. Layout - Equipment design allows ready and safe access to controls, access ports, etc., for all users.

2. Training - Field maintenance, AOS-200, and FAALC support personnel are adequately trained.

3. Alarms/Alerts - Alarms are adequate to attract attention, but not necessarily disruptive. Status lights are highly visible and easily understood, without being disruptive.

4. Procedures - Maintenance procedures are:

(a) Effective - The procedures are well thought out and easy to follow.

(b) Workable - Following the procedures will result in the desired results.

(c) Timely - The procedures are available when required.

(d) Compatible - Existing procedures are not adversely affected.

(e) Universality - The FGAR and its associated equipment will adapt well to all locations. All site specific variations are addressed and tested, as required.

d. Logistical Support

Logistical support will be evaluated to determine if the FAALC can support the FGAR program. This will be accomplished by:

1. Field maintenance personnel ordering spare parts, exchange and repair (E&R) parts, tools, support equipment, repair kits, etc., from the FAALC.

2. Verifying the FAALC has a complete inventory of spare parts, subassemblies, etc.; tools; support equipment; repair kits; etc.; on-hand to support the FGAR program.

3. The FAALC has trained support personnel available to provide field support for the FGAR program, when required.

4. Ensuring spare parts, subassemblies, etc., are compatible.

5. Ensuring turn-around time on E&R and repair and return (R&R) parts, subassemblies, etc., is adequate so operations will not be impaired.

6. Ensuring spare parts, subassemblies, etc.; repair kits; etc.; can be obtained in a reasonable time.

7. Specialized tools and test equipment are available.

8.5 CRITICAL OT&E SHAKEDOWN ITEMS.

There are no critical items associated with the conduct of OT&E Shakedown testing.

9. CRITICAL RESOURCE SUMMARY.

9.1 TEST ARTICLES.

The items required to adequately support FAA Technical Center and/or First Article testing consist of the following:

a. TI manuals and related documentation.

b. Test equipment normally available at or available to an operational en route surveillance radar and/or Mode S facility, e.g., digital voltmeter (DVM), etc.

c. RFIM van with specialized test equipment (currently calibrated against known standards) to measure RF propagation loss, power, etc.

d. Tank truck with the capability of dispensing water under high pressure through hoses, e.g., fire department pumper truck.

9.2 SPECIAL SUPPORT REQUIREMENTS.

The special support requirements for the FAA Technical Center or First Article tests consist of the following:

a. Trained field maintenance personnel

b. Trained AOS-200 personnel

c. Trained FAALC support personnel

d. Trained ASM-500 and/or FAA regional personnel to operate the RFIM van (see paragraph 9.1.c).

10. ABBREVIATIONS AND ACRONYMS.

AF	Airway Facilities
APMT	Associate Program Manager for Test
ARSR	Air Route Surveillance Radar
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
BOS	Beacon Only Site
CAI	Contract Acceptance Inspection
CDR	Critical Design Review
CDRL	Contractor Data Requirements List
dB	Decibel
DEL	Delivery
DOD	Department of Defense
DRR	Deployment Readiness Review
DT&E	Development Test and Evaluation
DVM	Digital Voltmeter
E&R	Exchange and Repair
ERMS	Environmental Remote Monitoring Subsystem
FAA	Federal Aviation Administration
FAALC	Federal Aviation Administration Logistics Center
FGAR	Fixed Ground Antenna Radome
ICO	Installation and Checkout
MHz	Megahertz
MODE S	Mode Select Beacon System
MOU	Memorandum of Understanding
MPH	Miles per Hour
MSA	Major System Acquisition
MTBCF	Mean Time Between Critical Failure
NADIF	National Aviation Facilities Experimental Center Dipole Feed
NAFEC	National Aviation Facilities Experimental Center
NAS	National Airspace System
ORD	Operational Readiness Demonstration
OT&E	Operational Test and Evaluation
PAT&E	Production Acceptance Test and Evaluation
PD	Program Directive

PDR	Preliminary Design Review
PE	Permanent Echo
PIP	Project Implementation Plan
PM	Program Manager
PRELIM	Preliminary
QRO	Quality Reliability Officer
R&R	Repair and Return
RF	Radio Frequency
RFIM	Radio Frequency Interference Monitor
RFP	Request for Proposal
RMA	Reliability, Maintainability, and Availability
RMMS	Remote Maintenance Monitoring Subsystem
RMS	Root Mean Square
RPM	Revolutions per Minute
RPRT	Report
SAT	Site Acceptance Test
SOW	Statement of Work
T&E	Test and Evaluation
TEMP	Test and Evaluation Master Plan
TI	Technical Instruction
TOR	Technical On-Site Representative
TPRC	Test Policy Review Committee
VRTM	Verification Requirements Traceability Matrix

APPENDIX A

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.1.1		Program Organization, Planning, and Reporting	I	I		
3.1.1.2		Program Reviews	I	I		
3.1.1.3		Reporting Progress Status	I	I		
3.1.2		Configuration Management (CM)	I	I		
3.1.2.1		Configuration Management Plan	I			
3.1.2.2		Subcontractor/Vendor Control	I	I		
3.1.2.3		Configuration Identification	I	I		
3.1.2.3.1		Composition of System Baseline	I	I		
3.1.2.3.1.1		Allocated Baseline	I			
3.1.2.3.1.2		Product Baseline	I	I		
3.1.2.4		Configuration Item Development Records (CIDR)	I	I		
3.1.2.5		Baseline Management & Review Support	I	I		
3.1.2.5.1		Specification Change Maintenance	I	I		
3.1.2.5.2		Baseline Change Control	I	I		

LEGEND: A = Analysis; D = Demonstration; I = Inspection; T = Test

SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.1.2.6		Radome Interface Control	I	I		
3.1.2.7		Configuration Status Accounting	I	I		
3.1.2.8		Configuration Audits	I	I		
3.1.3		Data Management	I	I		
3.1.3.1		Integration of Contractor's Data Management Effort	I	I		
3.1.3.2		Data Control & Status Accounting	I	I		
3.1.3.3		Controls Over Subcontractor Data	I	I		
3.1.3.4		Drawings and Technical Memoranda	I	I		
3.1.5		Production Management & Planning	I	I		
3.1.5.1		Production Readiness Review	I			
3.2		System Engineering	I			

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.2.2.1.1		Hardware Production Specifications and Data	A/I			
3.2.2.1.2		Interchange Documentation	A/I			
3.2.2.1.3	3.4.3	Technical Instruction Books (2773b - Instruction Books)	I			A/I
3.2.3		Design Reviews	I			
3.2.3.1		Technical Interchange Meetings	I	I		
3.2.4.1	3.2.3	Reliability Program (2773b - Reliability Requirements/Apportionment)	I			
3.2.4.2		Parts Control Program	I			
3.2.5.1	3.2.4	Maintainability Program (2773b - Maintainability)	A/I			A/I
3.2.6	3.3.2	Electromagnetic Interference and Susceptibility (2773b - Electromagnetic Radiation)	A/T		I	
3.2.7	3.3.7	Human Factors (2773b - Human Engineering)	A/I	I	D/I	D/I
3.2.7.1		Human Factors Assessment	I	I		

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.2.8	3.3.6	System Safety (2773b - Safety)	I	I	I	I
3.2.8.1		Task 100	A/D		D	
3.2.8.2		Task 101	I			
3.2.8.3		Task 103	I			
3.2.8.4		Task 210	I			
3.2.8.5		Task 211	I			
3.3		Equipment Design and Production	I	I	I	
3.3.1		Radome, Type I	I	I	I	
3.3.2		Radome, Type II	I	I	I	
3.3.5		Radome, Type V	I	I	I	

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.4.2.1		Contractor's Master Test Plan	I			
3.4.2.2	3.4.6.1	Test Plans (2773b - Test Plans)	I	I		
3.4.2.3	3.4.6.1.1	Test Procedures (2773b - Test Procedures)	I	I		
3.4.2.4	3.4.6.2	Test Evaluation Reports (2773b - Test Reports)	I	I		
3.4.3		Test Performance	T	T		
3.4.4		First Article Testing (First Article is defined as the first three Type I FGARs and the first Type II, III, V, and VI FGARs.)	T	T		
3.4.4.1		Government T&E of First Article			D/I/T	

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.4.4.1.4		Locations of the First Article Testing	I			
3.4.5		Field Testing at FAA Sites	T	T	D/I/T	
3.5		Turnkey Installation	D	D	I	
3.5.1		Inspection & Acceptance Testing	T	T	D/I	
3.5.2		Contract Acceptance Inspection (CAI)	I	I	I	
3.5.3		Clean-Up			I	
3.5.4.1		Tower Preparation Required for Type II Radomes	I	I	I	
3.5.4.2		Tower Preparation for Type I, III, V, and VI Radomes	I	I	I	
3.5.5		Turnkey Documentation	I			
3.5.5.1		"Red-Lined" Installation Drawings	I	I		I
3.5.5.2		Final As-Built Drawings				I

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.5.6.1		Equipment	I	I	I	
3.5.6.7		Turnkey Quality Assurance	I	I		
3.6	3.5	National Air Space Integrated Logistics Support (NAILS) [2773b - Logistics]	I	I		
3.6.1	3.5.7	NAILS (2773b - Supply Support)	I	I		
3.6.1.1		NAILS Program Management	I	I		
3.6.1.1.1		NAILS Management Team (NAILSMT)	I	I		

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.6.1.1.2		Integrated Support Plan (ISP) Development	I			
3.6.1.2		Logistics Support Analysis (LSA) Plan Requirements	I			
3.6.1.2.1		LSA Task 102, LSA Plan	I			
3.6.1.2.1.1		LSA Candidate Selection Procedures and Criteria	I			
3.6.1.2.2		LSA Task 103, Program and Design Review (Subtask 103.2.3 & 103.2.4 only)	I			
3.6.1.2.3		LSA Task 301, Functional Requirements Identification (Subtask 301.2.4, 301.2.4.1, & 301.2.4.3 only)	I			
3.6.1.2.4		LSA Task 303, Evaluation of Alternatives and Tradeoff Analysis (Subtask 303.2.7 only)	I			
3.6.1.2.5		LSA Task 401, Task Analysis (Subtask 401.2.1, 401.2.8, & 401.2.11 only)	I			
3.6.1.2.6		LSA Record (LSAR)	I			

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.6.1.2.7		LSA Control Number Assignment	I			
3.6.1.2.8		LSAR Data Review	I			
3.6.2.1	3.4.5.1	Maintenance Plan (2773b - Maintainability Program Plan)	I			
3.6.2.2	3.4.5.2	Depot Maintenance Study (2773b - Detailed Maintenance Concept and Plan)	I			
3.6.2.3		Lowest Replaceable Unit (LRU) Repair/Rebuild Data Requirements	I			
3.6.3.1.1		NAILSMT Integrated Logistics Support (ILS) Guidance/Planning Conference	I			
3.6.3.1.1.1		LSA/Provisioning Conference	I			
3.6.3.1.2		Provisioning Conference	I			
3.6.3.2		Cataloging	I			
3.6.3.3		Spare Parts - Peculiar	I			

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.6.3.4		Spare Parts Common (Contractor is Sole Source)	I			
3.6.3.5		Design Change Notice	I			
3.6.3.6		Installation Materials List	I			
3.6.3.7		On-Site Spare Parts List	I		I	I
3.7		Support Equipment Identification	I			I
3.8		Training	I			
3.8.1		Contractor Training Personnel	I			
3.8.2		Maintenance Course Requirements	I			
3.8.2.1		Course Development	I			
3.8.2.2		Course Development Documentation	I			
3.8.2.3		Student Prerequisites	I			
3.8.2.4		Conduct of Training Courses	I			D
3.8.2.5		Supplementary Course Material	I			I
3.8.2.8		Student Reports	I			
3.8.2.9		Field Maintenance Course Outcomes	D			D

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.8.2.10		Depot Maintenance Course Outcomes	D			D
3.9		Quality Assurance	A/I	A/I		
3.10.1.1		Support Equipment for FAA Deport Storage	I	I		
3.10.1.2		Support Equipment for Site	I	I		
3.10.2		Package Requirements for System Equipment	I	I		

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
3.10.3.1		Site Stocks	I	I	I	
3.10.3.2		Depot Stocks (Preservation/ Packaging)	I	I		I
3.10.4		Depot Stocks (Packaging)	I	I		I
3.10.5		Marking	I	I		I
3.10.6		Storage FAA Depot	I	I		I
3.10.7		Disposal	I	I	I	
3.11		Data and Documentation	I			
3.12.1		Technical Services	D	D		
3.12.1.1		Periodic Maintenance	D	D		
3.12.1.2		Corrective Maintenance	D	D		
3.13		Interim Contract Support	D	D		

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SOW Reference Paragraph Number	FAA-E-2773b Reference Paragraph Number	Requirement to be Verified	Verification Level & Method			
			DT&E	PAT&E	OT&E /I/O	OT&E/S
	3.1.2	Interface Definition	I		I	
	3.1.2.1	Physical Interface	I		I	
	3.1.2.2	Electrical Interface	I/T		D	D
	3.1.2.2.1	Primary Power	T		I/T	I/T
	3.1.2.2.2	Load Protection	T	T	T	
	3.1.2.2.3	Remote Maintenance Monitoring System		T	I/T	I/T
	3.1.3	Major Component List		I	I	
	3.2.1	Performance Requirements	A/I		T	
	3.2.1.1	Electrical Performance Requirements	A/T		T	
	3.2.1.1.1	Antenna Main Lobe Beam Width Error	A/T		T	
	3.2.1.1.2	Boresight Error	A/T		T	
	3.2.1.1.3	Boresight Error Slope	A/T			
	3.2.1.1.4	Difference Pattern Null Depth Error	A/T			
	3.2.1.1.5	Sidelobe Level Error	A/T		T	

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			DT&E	PAT&E	OT&E /I/O	OT&E/S
	3.2.1.1.6	Cross Polarization Ratio	A/T			
	3.2.1.1.7	Depolarization	A/T			
	3.2.1.1.8	Transmission Loss	A/T	T		
	3.2.1.1.9	Hydrophobic Loss	A			
	3.2.1.2.1	Thermal Temperature Gradients	A/T		T	
	3.2.1.2.2	Solar Radiation	A/T			
	3.2.1.2.3	Water Penetration and Hail Impact	A/T			
	3.2.1.2.4	Hydrophobic Surface	A/T			
	3.2.1.2.5	Ice or Snow Adhesion	A/T			
	3.2.1.2.6	Lightning Protection	A/T	I	D	
	3.2.1.2.7	Aircraft Obstruction Lights	I/T	I	D	D
	3.2.1.2.10	Remote Maintenance Monitoring	T	I	T	T
	3.2.1.2.11	Transient Protection	A/T		T	
	3.2.1.2.12	Snow Rope	I	I	I	

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			DT&E	PAT&E	OT&E /I/O	OT&E/S
	3.2.2	Physical Characteristics	A			
	3.2.2.1	Protective Coating	A/I	I	I	
	3.2.2.2	Aerodynamic Loading	A			
	3.2.2.3	Weight Loading	A			
	3.2.2.5	External Color	A/I	I	I	
	3.2.3.2	Radome Reliability	A/I/T			
	3.2.3.3	Reliability Prediction	A/I			
	3.2.3.4	Reliability Data Base	A/I			
	3.2.4.1	Maintainability Predictions	A/I			
	3.2.4.2	Maintainability Data Base	A/I			
	3.2.6	Transportability	A/I	I		
	3.3.1.1	Weathering and Hydrophobicity	A/T			
	3.3.1.2	Temperature Stability	A/T			
	3.3.1.3	Flammability & Combustibility	A/T			
	3.3.1.4	Ultraviolet Light	A/T			
	3.3.1.5	Physical Stability	A/I			

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			DT&E	PAT&E	OT&E /I/O	OT&E/S
	3.3.1.6	Tensile Strength	A/T			
	3.3.3	Nameplates or Product Markings	I	I	I	
	3.3.4	Workmanship	I	I	I	
	3.3.5	Interchangeability	A/I		I	
	3.3.8	Hardware	A/I		I	
	3.3.9	Radome Structure Design	A			
	3.3.10	Grounding Requirements	A/I/T		I/T	
	3.4.4	Reliability Program Plan	I			
	3.4.4.1	Reliability Status Reports	I	I		
	3.4.5.3	Maintainability Status Reports	I	I		
	3.4.6.2.1	Failure Recording and Reporting	I	I		
	3.4.7	Installation Plan and Report	I			I
	3.4.7.1	Installation Report	I		I	I
	3.4.8	Drawings	I		I	I

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			DT&E	PAT&E	OT&E /I/O	OT&E/S
	3.5.1	Maintenance Action Frequency	A/D		D	D
	3.5.1.1	Restoration			D	D
	3.5.2	Radome Crown Access	A/I		D	D
	3.5.3	Service Life	A/D			
	3.5.4	Radome Shell Maintenance Actions	D		D	D
	3.5.5	Radome Erection			D	
	3.5.6	Radome Shell Repair Kits	A/T	I	I	I
	3.7.1	Lightning Protection	A/I/T	I	I/T	
	3.7.2	Aircraft Obstruction Lights	A/D/I		D	D
	3.7.3	Zenith Hatch Assembly	A/D	D	D	D
	3.7.4	Snow Rope	A		D	D
	3.7.5	Catwalk Access Hatch	A	I	D	D

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