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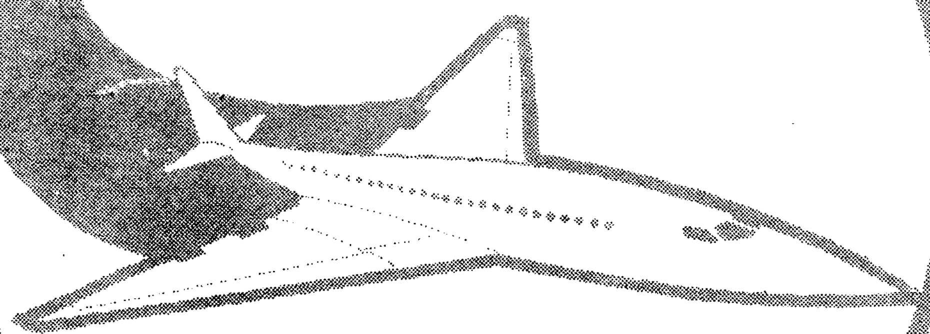
Terminal Doppler Weather Radar (TDWR) Build 5 Test and Evaluation Master Plan (TEMP)

Elizabeth Turcich



May 1994

DOT/FAA/CT-TN94/2

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16. Abstract

This document presents the Terminal Doppler Weather Radar (TDWR), Build 5 enhancement, Test and Evaluation Master Plan (TEMP). This Build 5 TEMP identifies Operational Test and Evaluation (OT&E) objectives, responsibilities, resources, schedules, and critical test issues. The Build 5 enhancement consists of a Build 5A which provides connectivity to the Low Level Wind Shear Alert System (LLWAS) II, and a Build 5B which provides connectivity to an LLWAS III. Build 5A displays LLWAS II wind data along with TDWR hazardous weather data on TDWR Geographic Situation Displays (GSD) and Ribbon Display Terminals (RDT). Build 5B provides additional capabilities such as having a Microburst Shear Integration Algorithm (MSIA), TDWR/LLWAS III Integration Algorithm, 15-day archiving and TDWR, LLWAS II and LLWAS III data integration.

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EXECUTIVE SUMMARY

This document presents the Terminal Doppler Weather Radar (TDWR), Build 5 enhancement, Test and Evaluation Master Plan (TEMP). This Build 5 TEMP identifies Operational Test and Evaluation (OT&E) objectives, responsibilities, resources, schedules, and critical test issues. The Build 5 enhancement consists of a Build 5A which provides connectivity to the Low Level Wind Shear Alert System (LLWAS) II, and a Build 5B which provides connectivity to an LLWAS III. Build 5A displays LLWAS II wind data along with TDWR hazardous weather data on TDWR Geographic Situation Displays (GSD) and Ribbon Display Terminals (RDT). Build 5B provides additional capabilities such as having a Microburst Shear Integration Algorithm (MSIA), TDWR/LLWAS III Integration Algorithm, 15-day archiving; and, integration of LLWAS II, TDWR and LLWAS III data.

Build 5A OT&E is planned to start at Memphis, TN, during January 1994. Build 5B OT&E is planned during the September to November 1994, timeframe at Denver, CO, which will be the first installed site. The majority of the weather testing will be conducted at Orlando, FL, during April 1995. Desired weather phenomena typically does not occur in the fall at either Denver or Orlando.

A test risk exists regarding the LLWAS prime development contractor's ability to complete the LLWAS III to TDWR interface software to support the test schedule provided at appendix A.

1. INTRODUCTION.

This Test and Evaluation Master Plan (TEMP) provides test direction for the implementation and acceptance of the Terminal Doppler Weather Radar (TDWR) Build 5 enhancement. The TDWR Build 5 enhancement integrates Low Level Wind Shear Alert System (LLWAS) II and LLWAS III data with TDWR data.

Throughout the document the term LLWAS III is used. Within the LLWAS community, LLWAS III is called the LLWAS Network Expansion (NE) system.

The development contractor will develop a Contractor's Master Test Plan (CMTP) Build 5 Addendum which will execute the development contractor's test responsibilities.

This Build 5 TEMP follows the FAA-STD-024a format and includes FAA Order 1810.4B policy requirements.

1.1 PURPOSE.

The purpose of this TEMP is to ensure comprehensive testing is conducted through the identification of organizational responsibilities, presentation of test methodology, and identification of test requirements. The Operational Test and Evaluation (OT&E) must ensure that Build 5A and Build 5B effectively interface to LLWAS systems without degrading the existing baselined system.

1.2 SCOPE.

This TEMP provides for the comprehensive testing of the Build 5 enhancement to ensure it satisfies user and National Airspace System (NAS) requirements. It describes the Test and Evaluation (T&E) processes for ensuring this enhancement project meets applicable project specification (FAA-E-2806/1) and system/subsystem requirements allocated in NAS-SS-1000, Volumes I, III, and V. Federal Aviation Administration (FAA) organizational responsibilities, requirements, and test methodologies are provided. A Verification Requirements Traceability Matrix (VRTM) which integrates physical, functional, operational effectiveness, and NAS operational suitability requirements is included at appendix B.

2. REFERENCE DOCUMENTS.

The following specifications, standards, and other documents were used in the development of this TEMP.

2.1 FAA DOCUMENTS.

2.1.1 FAA Specifications.

NAS-SS-100	NAS System Specification, Volume I, Functional and Performance Requirements for the National Airspace System General, October 1992.
NAS-SS-1000	NAS System Specification, Volume III, Functional and Performance Requirements for the Ground-to-Air Element, February 1993.
NAS-SS-1000	NAS System Specification, Volume V, Functional and Performance Requirements for the National Airspace System Maintenance and Operations Support Element, October 1992.
FAA-E-2806/1	Specification Terminal Doppler Weather Radar, November 12, 1992, w/SCN 1, January 2, 1993.

2.1.2 FAA Standards.

FAA-STD-024a	Preparation of Test and Evaluation Plans and Test Procedures, August 17, 1987.

2.1.3 Other FAA Publications.

NAS-MD-790	Interface Control Document (ICD), Maintenance Processor Subsystems (MPS) to Remote Monitoring Subsystems (RMSs) and Remote Monitoring Subsystem Concentrators (RMSCs), June 10, 1986.
NAS-MD-793	Remote Maintenance Monitoring System Functional Requirements for the Remote Monitoring Subsystem (RMS), February 28, 1986.
FAA ORDER 1810.4B	FAA NAS Test and Evaluation Policy, October 22, 1992.
NAS-MD-110	Test and Evaluation (T&E) Terms and Definitions for the National Air Space System, March 27, 1987
OT&E Test Report	Final Report for the Air Traffic Control Evaluation of the Prototype Terminal Doppler Weather Radar System, MCO, Orlando, Florida, September 1992.
OT&E Quick Look	Terminal Doppler Weather Radar, Operation Test and Evaluation (OT&E) Integration and OT&E Operational Tests/Retests, Quick Look Report, September 21, 1993.

OT&E Quick Look	Terminal Doppler Weather Radar (TDWR) Operational Test and Evaluation Integration and Operational Quick Look Report, November 12, 1992.
OT&E Quick Look	Look Terminal Doppler Weather Radar (TDWR) RMS/MPS OT&E/Integration Regression Test Quick Look Results, dated June 30, 1993.
Shakedown Report	Evaluation Report Shakedown Evaluation Report, January 19, 1993.
Shakedown Quick Look Report	Terminal Doppler Weather Radar (TDWR) Shakedown Regression Test Quick Look Report, May 13, 1993.

2.2 OTHER STANDARDS.

ANSI X3.41-1974	American National Standard Code for Information Interchange.
ANSI X3.4-1977	American National Standard Code for Information Interchange.
EIA-RS-232c	Interface between Data Terminal Equipment and Data Communications Equipment and Data Communications Equipment Employing Serial Binary Data Interchange, August 1969.
ANSI X3.64-1979	Additional Controls for Use with ASCII.
ANSI X3.66-1979	American National Standard for Advanced Data Communications Control Procedures (ADCCP), January 1979.
EIA-530	High Speed 25-Position Interface Data Terminal Equipment and Data Circuits, April 1986.

2.3 MILITARY STANDARDS.

MIL-STD-470B	Maintainability Program Requirements (for System and Equipments), May 30, 1989.

2.4 DEVELOPMENT CONTRACTOR'S DOCUMENTATION.

D001-BLD5-2	Contractor's Master Test Plan (CMTP) Build 5 Addendum, January 12, 1993.
B022-Bld5-1A	Build 5 Software Requirements Specification Radar Product Generation (RPG) Software, (CSCI-2) CGG551591, Revision A, November 19, 1992.
B022-Bld5-2B	Build 5 Software Requirements Specification Remote Monitoring Subsystem CSCI-3, CGG551592, Revision B, June 30, 1993.
B022-Bld5-3B	Build 5 Software Requirements Specification Display Computer Software, CSCI-4, CGG551594, Revision B, June 24, 1993.

3. SYSTEM DESCRIPTION.

3.1 OVERVIEW.

The TDWR is a C-band pencil beam doppler radar with a narrow beam width (0.5°), high sensitivity, which is optimized for detection of hazardous weather in the airport terminal area.

The system has two operational modes and one maintenance mode. The operational modes consist of a monitor mode and a hazardous weather mode. In the monitor mode, the TDWR performs 360° scans which minimize pedestal wear. The TDWR enters the hazardous weather mode and performs sector scans over the airport terminal area when predefined weather conditions are detected. The maintenance mode is manually selected to modify operational parameters, perform diagnostics, and perform routine maintenance.

The TDWR system is composed of four functional areas; Radar Data Acquisition (RDA), Radar Product Generation (RPG), Remote Monitoring Subsystem (RMS), and Display Functional Unit (DFU). The RDA performs weather detection, clutter handling, and primitive processing. The RPG performs weather product generation, RDA scan control, external user output generation, and archiving. Archived data will consist of TDWR/LLWAS II and/or TDWR/LLWAS III, Geographic Situation Display (GSD)/Ribbon Display Terminal (RDT) blanking, and programmable alarm timeouts. The RMS performs system monitoring, fault isolation, and alarm reporting. The DFU provides interim display and control.

The TDWR will interface to LLWAS II system (Build 5A), LLWAS III system (Build 5B), or both systems simultaneously. Build 5A displays LLWAS II wind data along with TDWR hazardous weather data on the TDWR GSD and RDT. The LLWAS II system consists of six anemometers, a computer, and alphanumeric displays for reporting airport winds and Wind Shear alarms. Build 5B accomplishes the following:

a. Interfaces the TDWR RPG and GSD to the LLWAS II and/or III systems,
b. Integrates TDWR and LLWAS III Wind Shear alarms,
c. Enhances TDWR microburst product alarm generation,
d. Provides for 15 days of archive data at the GSD,
e. Performs RDT and GSD blanking,
f. Provides RDT and GSD audible alarm timeouts.

The TDWR and LLWAS III Wind Shear alarm integration is accomplished using Government Furnished Information (GFI) TDWR/LLWAS III algorithm. Microburst alarms are enhanced with a GFI Microburst Shear Integration Algorithm (MSIA).

The LLWAS III system consists of 10 to 29 anemometers, a computer, and uses the TDWRs, RDTs, and GSDs to display alphanumeric wind and Wind Shear data.

A failure of either the DFU/LLWAS link or TDWR will result in a string of 9s displayed for all LLWAS centerfield winds and a blanking of threshold winds. This same scenario occurs if the RPG to LLWAS and DFU to LLWAS links fail. A string of 9s are displayed for individual LLWAS sensor failures.

3.2 MISSION.

The TDWR mission is to provide the timely detection and reporting of hazardous Wind Shear phenomena in and near the terminal approach and departure zones of an airport. A secondary function is to predict wind shifts and detection of other hazardous weather.

At airports where the TDWR will be located with an LLWAS III, Build 5B will combine the two systems into a single Wind Shear detection system. An algorithm takes alphanumeric runway alert messages generated by each subsystem and joins them into integrated alert messages. The MSIA and TDWR/LLWAS III alert integration algorithms accomplishes two important functions:

a. Maintains the probability of detection for hazardous events while reducing the number of false alerts and microburst overwarnings,

b. Increases the accuracy of loss/gain Wind Shear estimates.

At airports where the TDWR will be located with a LLWAS II, the LLWAS II will provide the TDWR with Center Field Winds (CFW) and sector winds (no Wind Shear information).

Until the Tower Computer Control Complex (TCCC) becomes available, integrated TDWR and LLWAS data will be presented on TDWR alphanumeric and graphic displays.

3.3 MESSAGE PROCESSING.

Message processing and product display is dependent on the operational status of the respective interfaced TDWR and LLWAS system(s). The following identifies data source and message output which will be of concern to test personnel:

a. TDWR Alphanumeric Microburst Alarm Messages are generated from TDWR weather data once per minute (minimum). This is an update rate required by NAS-SS-1000, Volume I, paragraph 3.2.1.2.5.2.9, which states, "The TDWR shall provide weather data to specialists that is no older than 1 minute."

b. LLWAS III Alphanumeric Microburst Alarm Messages are generated by the LLWAS III and transmitted to the TDWR.

c. Integrated Alphanumeric Microburst Alarm Messages are generated each time LLWAS III data is received.

d. Threshold winds (runway arrival and departure end winds) are generated by the LLWAS III and transmitted to the TDWR. The LLWAS II provides wind data detected by each of its sensors to the TDWR which can be mapped to airport runways and then displayed as threshold winds for that runway.

e. CFW information is generated by either the LLWAS II or LLWAS III and is then transmitted to the TDWR.

f. TDWR Alphanumeric Gust Front Alarm Messages are generated from TDWR weather data.

g. LLWAS III Alphanumeric Gust Front Alarm Messages are generated by the LLWAS III and transmitted to the TDWR.

h. Integrated Alphanumeric Gust Front Alarm Messages are generated each time LLWAS III data is received.

i. Graphic Microburst Products are generated only from TDWR data. Area Noted for Attention (ARENAs) will be highlighted in the event of an LLWAS-only detected microburst.

j. Graphic Gust Front Products are generated only from TDWR data. ARENAs will be highlighted in the event of an LLWAS-only detected gust front.

3.4 BUILD 5 FUNCTIONALITY.

The following provides an understanding of Build 5 functions and their respective responsibility:

a. RPG Build 5A function provides the following:

1. LLWAS II Data Transfer,
2. LLWAS II Threshold and CFW processing,
3. LLWAS II message element formatting.

b. RPG Build 5B function provides the following:

1. LLWAS III Data Transfer,
2. LLWAS III Threshold and CFW processing,
3. LLWAS II message element formatting,
4. TDWR/LLWAS III Integration Algorithm processing,
5. Integrated Microburst/Gust Front alarm condition detection,
6. Alarm graphic/alphanumeric message formatting,
7. Non-MSIA losses and MSIA rounding,
8. Message forwarding to the TCCC.

c. RMS Build 5A and Build 5B functions provide the following:

1. Performance Monitoring capability,
2. Maintenance Data Terminal (MDT) screens and menus display changes,
3. Adaptation data changes.

The Build 5A RMS function also provides for definition changes to the ARENA. An ARENA identifies geographical location(s), on or near an airport, where winds could affect users. Wind Shear events are reported on DFUs if the events meet criteria and occur within these areas. Note: Events are shown on the GSD regardless of whether they occur within ARENAs.

d. SUN-IPX Build 5 function does the following:

1. Displays weather products and alert messages,
2. Interfaces with the RPG,
3. Interfaces with both LLWAS II and LLWAS III,
4. Displays ARENAs,
5. Displays from DFU selected runways,
6. Displays Build 5B integrated weather alert messages,
7. Allows setting of programmable alarm timeouts,
8. Provides backup interface with LLWAS II and/or III,
9. Provides 15-day archive capability.

NOTE: SUN-IPX is a SUN workstation model.

e. Display Build 5A function does the following:

1. Provides format for threshold winds,
2. Provides display for LLWAS II data,
3. Provides LLWAS II link backup.

f. Display Build 5B function does the following:

1. Displays integrated weather alert messages,
2. Displays LLWAS III data; e.g., CFW, threshold winds, alarm messages,
3. Displays LLWAS II data,
4. Provides LLWAS II and LLWAS III link(s) backup,
5. Provides 15-day archive,
6. Provides programmable alarm timeouts.

3.5 BUILD 5 SYSTEM INTERFACES.

NAS-SS-1000 specification identified TDWR Build 5 interfaces are described in this section.

3.5.1 TDWR-LLWAS II (Six Sensor).

A 1200-baud (Bd) communications interface will exist between the TDWR and the LLWAS II. Figure 3.5.1-1 presents the TDWR/LLWAS II interface.

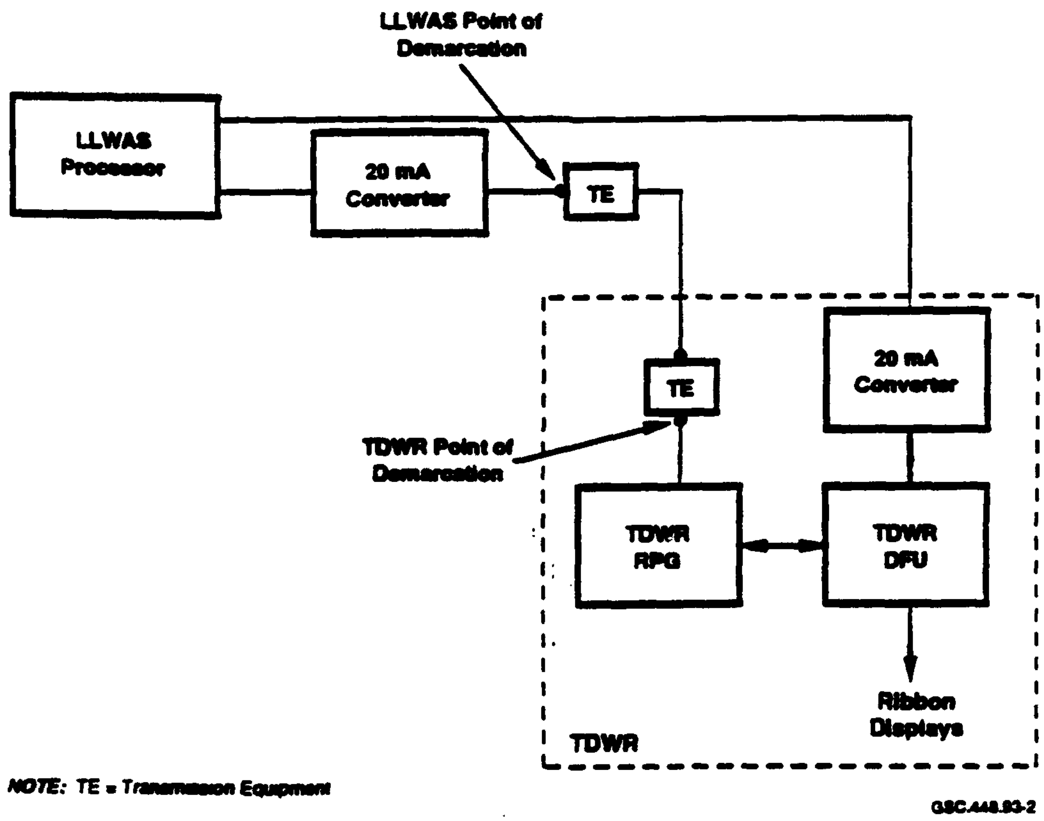


FIGURE 3.5.1-1. TDWR/LLWAS II INTERFACE DEPICTION

3.5.2 TDWR-LLWAS III (Network Expansion System).

A 9600-Bd communications interface will exist between the TDWR and the LLWAS III. Figure 3.5.2-1 presents the TDWR/LLWAS III interface.

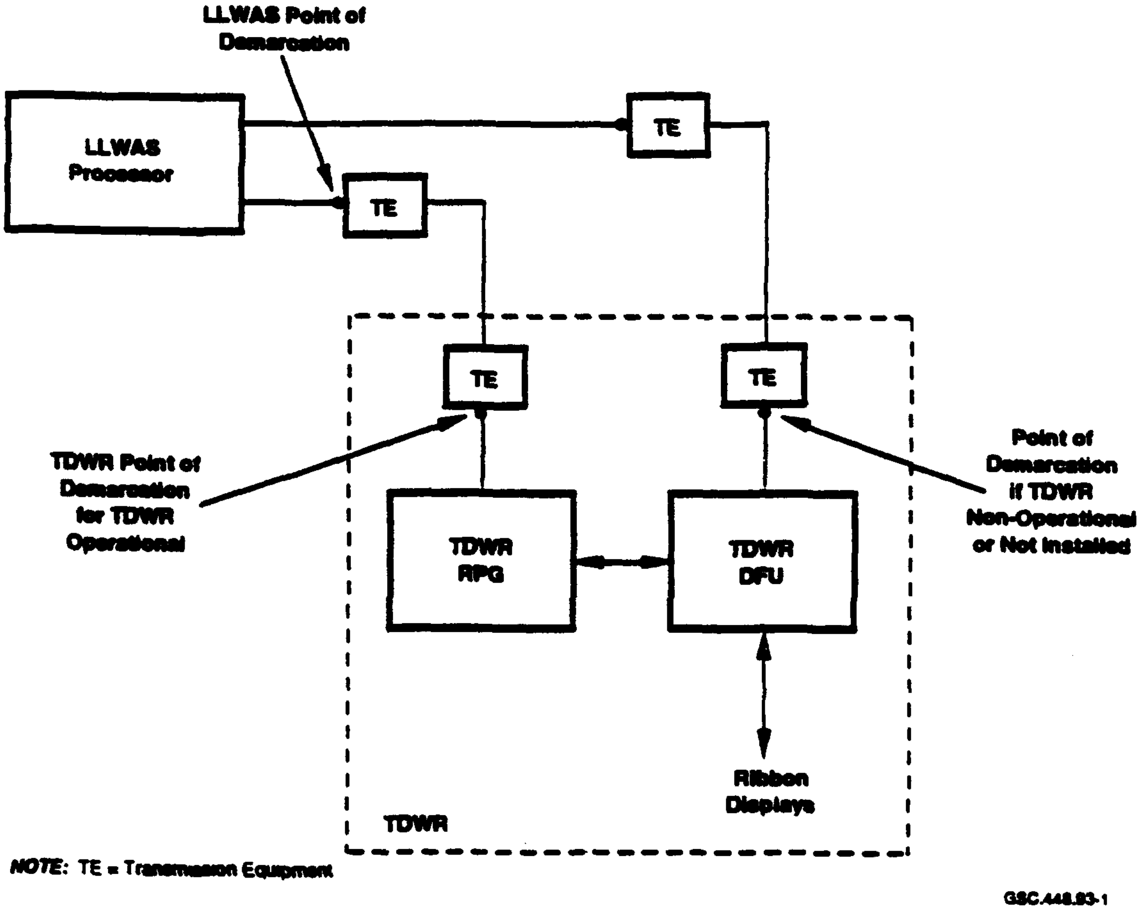


FIGURE 3.5.2-1. TDWR/LLWAS III INTERFACE DEPICTION

3.5.3 Remote Maintenance Monitoring Subsystem (RMMS).

The TDWR interfaces with the RMMS for the transmission of maintenance data and the receipt of commands and messages. The RMMS will remotely control and monitor the maintenance status of the TDWR. RMMS subsystems and their respective interface test requirements include:

a. Maintenance Processor Subsystem (MPS): Link layer OT&E will ensure the MPS to RMS link level activity is in accordance with NAS-MD-790, June 1986; and application layer testing will ensure the MPS can send commands and monitor equipment status as required.

b. Maintenance Data Terminal (MDT): OT&E will verify the MDT port is RS-232, asynchronous, self adjustable to 1200, 2400, 4800, or 9600 Bd, and ASCII 8-bit code compliant per ANSI X3.4 and ANSI X3.41. Application layer testing will show compliance with the requirements of FAA-E-2806/1, NAS-MD-793, and NAS-SS-1000 Volume I, appendix III.

Figure 3.5.3-1 presents the TDWR to MPS and MDT interfaces.

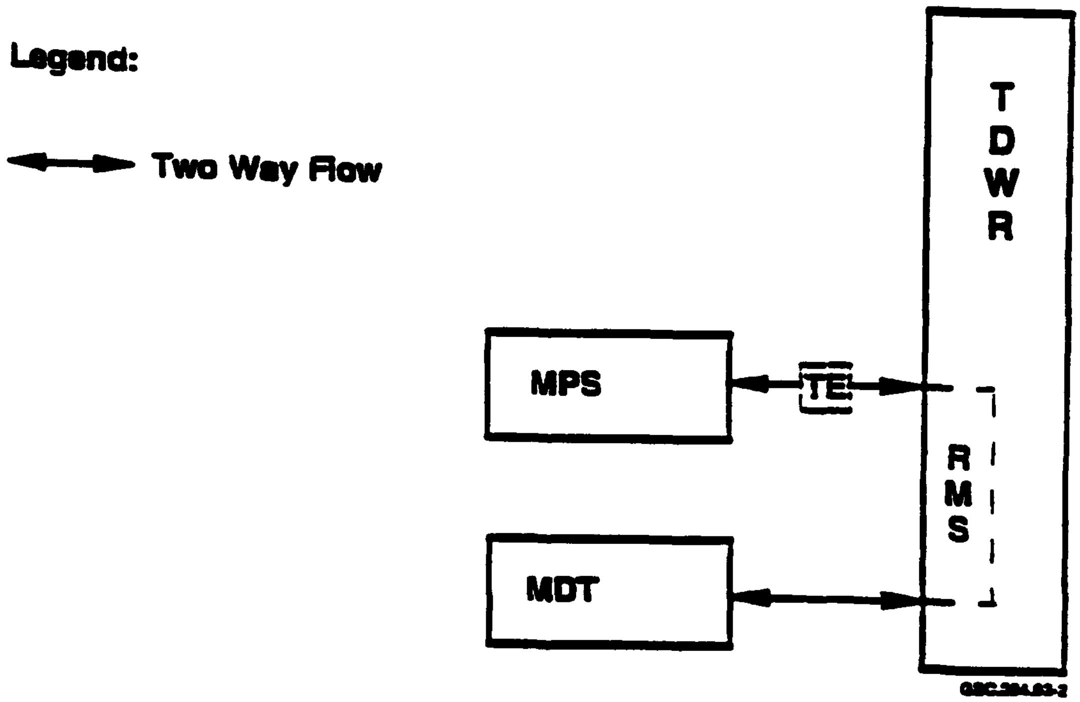


FIGURE 3.5.3-1. TDWR/MPS AND MDT INTERFACE DEPICTION

3.5.4 Tower Control Computer Complex (TCCC).

The TDWR interface will provide for the transmission of products, equipment status, TDWR modes, and receipt of commands. Communications between the TDWR and the TCCC will be 9600 bits per second (bps), point-to-point, two-way, simultaneous, and nonswitched. The physical interface shall conform to ANSI X3.66-1979 protocol. The TCCC will provide data to appropriate air traffic control (ATC) facilities when it becomes available. Figure 3.5.4-1 presents the TDWR and TCCC interface.

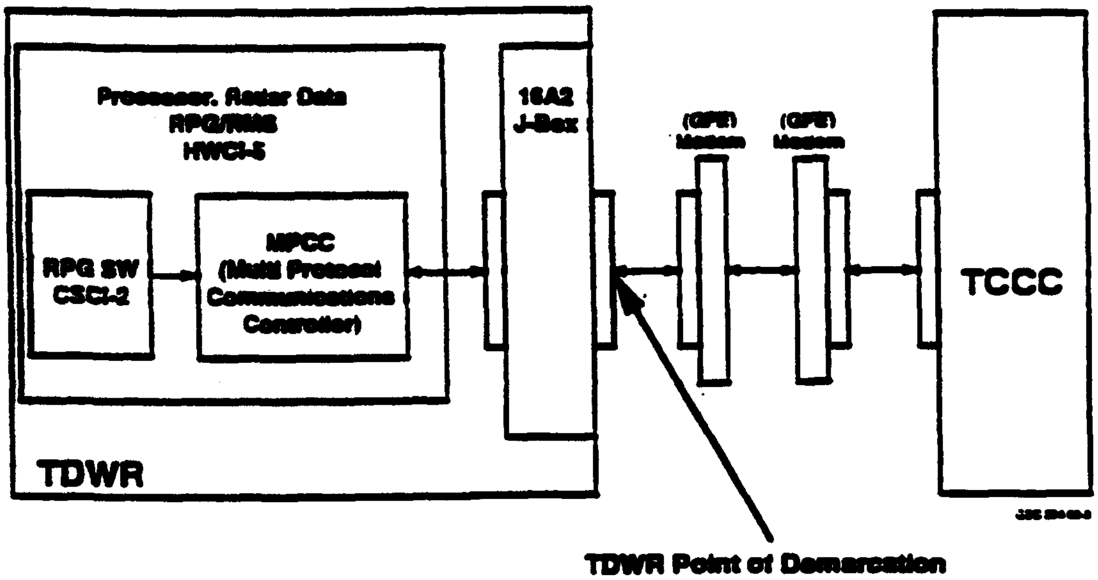


FIGURE 3.5.4-1. TDWR/TCCC INTERFACE DEPICTION

3.5.5 Unique Characteristics.

The Build 5 enhancement is to improve reliability of Wind Shear and microburst reporting by combining the capabilities of the TDWR and LLWAS systems. The TDWR, for Build 5A, will accept LLWAS II center field and sensor winds for display on the GSD and RDT. For Build 5B configurations, the TDWR will accept Wind Shear and microburst alarms for integration with the TDWR produced alarms, along with centerfield and runway threshold winds. Build 5 consists of hardware and software changes to integrate LLWAS II and III data with TDWR.

3.6 REQUIRED OPERATIONAL CHARACTERISTICS.

The Build 5 enhancement will have the following capabilities:

a. Interface with and accurately display LLWAS II and III data/status,

b. Perform the government-furnished LLWAS integration algorithm,

c. Reduce overwarnings due to MSIA processing,

d. Meet Microburst Probability of Detection (POD) design goal of 90 percent (for microbursts within 6 nautical miles (nmi) of the Airport Reference Point),

e. Meet microburst false alarm ratio (FAR) design goal of 10 percent (for microbursts within 6 nmi of the Airport Reference Point),

f. Transfer LLWAS CFW products to the RPG within 15 seconds per FAA-E-2806/1, table IV,

g. Generate and distribute microburst or gust front alarm within 25 seconds from collection of data,

h. Distribute gust front, LLWAS Winds, LLWAS Threshold Winds, LLWAS CFW products to displays and ports within 15 seconds and precipitation products within 60 seconds,

i. Provide 15-day archiving capability.

3.7 REQUIRED TECHNICAL CHARACTERISTICS.

The following are key technical characteristics, performance goals, and thresholds which must be met. OT&E will ensure:

a. Gust Front Integrated LLWAS alarm product is provided the RPG within 5 seconds; (Specification FAA-E-2806/1 requirement is 15 seconds)

b. CFWs are displayed within 5 seconds at the SUN-IPX; (Specification FAA-E-2806/1 requirement is 15 seconds)

c. Link layer communications provide reliable data transmission;

d. Digitized windspeed, direction, and gust data are provided to the air traffic control tower (ATCT) once every 10 seconds;

e. Wind Shear alert information is transmitted to the ATCT within 10 seconds of detection;

f. LLWAS and TDWR equipment contains built-in capabilities for monitoring and control of equipment; e.g., RMS provides equipment failure alarms, certification data, and diagnostic testing;

g. System reliability meets a Mean Time Between Failure (MTBF) of 550 hours. The Mean Time Between Critical Failures (MTBCF) meet or exceed 1500 hours;

h. The SUN-IPX work station does not diminish basedlined system performance.

3.8 CRITICAL TEST AND EVALUATION ISSUES.

3.8.1 Technical Issues.

The following describes technological or engineering risks that might either impact testing or must be addressed by testing:

a. Build 5 test accomplishment per the TEMP schedule depends on the LLWAS III prime development contractor completing the LLWAS III to TDWR interface software.

b. Historical TDWR data indicates that required system reliability and availability have been unsatisfactory. Build 5 OT&E will need to ensure that contractor implemented "fixes" have been effective.

c. Previous test reports have commented on questionable test integrity due to software "fixes." OT&E test personnel will need to minimize this risk at the start of test by not conducting testing if assurances cannot be provided that the software is baselined.

d. The TDWR during initial testing failed to meet POD design goals for microbursts. The test team will need to be careful in their conclusions regarding Build 5 impact on system performance.

3.8.2 Operational Issues.

The following describes key operational effectiveness or suitability issues which must be addressed during testing. OT&E test teams will have responsibility for:

a. Ensuring reliable operation from both software and hardware in delivering required weather products,

b. Ensuring no degradation in the timely receipt of weather products using the Build 5 enhancement,

c. Ensuring RMS maintenance data is processed and transmitted in accordance with applicable directives,

d. Ensuring the Build 5 can process information from both an LLWAS II and LLWAS III system simultaneously,

e. Ensuring the operational effectiveness of the MSIA (will be difficult to assess unless Wind Shear or microburst weather is available during the test period),

f. Ensuring the RDT and GSD screens are blanked and an equipment status message is displayed on the RDT when any of the following conditions occur:

1. RDT communication is interrupted longer than an adaptable time period (with a default value equal to approximately 1 minute),

2. The TDWR and LLWAS is nonoperational due to a failure,

3. The GSD fails.

The RDT screen shall again present data when the blanking condition(s) no longer exists. These blanking conditions are specified per FAA-E-2806/1.

g. Ensuring the RDT is readable in full sunlight. The RDT shall be readable:

1. from a distance of 10 feet and at angles of -+ 60° from center line for the Standard Ribbon Display;

2. from a distance of 6 feet and at angles of -+ 60° from center line for small Envelope Ribbon Display. No hood shall be used.

h. Ensuring the TDWR accurately archives 15 days of derived products.

In summary, the TDWR must be thoroughly evaluated in its capability to suitably provide LLWAS wind information, centerfields and runway threshold winds, along with TDWR weather products on the GSD and RDT. If the two LLWAS systems and TDWR are sited at the same location, testing must demonstrate that the TDWR functions satisfactorily.

4. PROGRAM SUMMARY.

4.1 MANAGEMENT (ORGANIZATIONAL AND FUNCTIONAL RESPONSIBILITIES).

4.1.1 Organization Primary Roles and Functions.

ANR-500 The Program Manager (PM) directs and manages all FAA activities for TDWR and Build 5 development and implementation. The PM is responsible for the supervision, design, development, integrated logistics support, evaluation, and NAS implementation. The PM is the program spokesperson inside and outside the FAA, including Congress, other government agencies, contractors, the aviation community, and the media. The PM is responsible for receiving Test Policy Review Committee (TPRC) approval; distributing the TEMP; approving OT&E Integration and Operational test requirements, plans, and reports; presenting test deployment issues to Deployment Readiness Review (DRR); and preparing test NAS Change Proposals (NCPs) for designated test locations.

ANR-900 The Associate Program Manager for Engineering (APME) directs, manages, and accomplishes engineering activities delineated in program directives. The APME approves program directives jointly with the FAA Technical Center; approves test budgets and appoints the Project Manager. The Project Manager provides assistance and support to the implementation of this TEMP through the review of related test plans, procedures, test data and test reports. The APME in conjunction with the ACW-200D Associate Program Manager for Test (APMT) presents reviews to the TPRC as required.

ANS-430 The Associate Program Manager for Logistics (APML) directs, manages, and accomplishes logistics and training activities delineated in program directives.

ACW-200D The APMT is the focal point for testing; acts as the agent of the PM to manage the T&E Program; establishes overall test schedules; coordinates tests; ensures that all test requirements are satisfied; and ensures tests are performed in accordance with approved procedures. The APMT ensures preparation of FAA TEMP, OT&E Integration and OT&E Operational Test Plan and Procedures are in accordance with FAA-STD-024a and FAA Order 1810.4B; is responsible for all aspects of OT&E Integration and OT&E Operational testing; writes test reports; witnesses factory/development testing; conducts Test Schedule Status Review (TSSR) meetings; provides recommendations based on test results in support of the DRR Executive Committee (EXCOM) process; and coordinates required system downtime with sector Airway Facility (AF) personnel.

ANA-200/700 The Maintenance Automation APME provides, if required, MPS simulator, RMS simulator, and Interface Control Document Database Development Tool (ICDDT) software. ANA-200/700 will install the Interim Monitor Control Software (IMCS) decoder module and conduct confidence testing.

AOS-200 AOS-200 is responsible for the development and preparation of the Build 5 OT&E Shakedown plan, procedures and reports. AOS identifies and develops with the PM and APMT, OT&E Shakedown requirements for inclusion in the FAA TEMP; approves OT&E Shakedown plans, procedures and reports; and conducts OT&E Shakedown. AOS reviews technical instruction books for completeness and technical accuracy; approves in coordination with Air Traffic Plans & Requirements Service (ATR) additional OT&E Shakedown requirements that do not exceed OT&E Shakedown durations or costs as baselined in the TEMP. ATR will support and participate in those tests that are applicable to ATR OT&E Shakedown requirements. AOS provides a deployment recommendation based on OT&E Shakedown results to the DRR.

AOS-530 AOS-530 performs key site deployment testing of IMCS software.

ACN-100D	ACN-100D conducts OT&E RMMS testing in accordance with approved plans and procedures.
ASE-600	ASE Engineering Specialties and Configuration Management Division (ASE-600) serves as TPRC Secretariat; formulates revisions to test policy, test standards, and definitions for consideration and endorsement by the TPRC. ASE verifies compliance with FAA Order 1810.4B and standards such as FAA-STD-024a. ASE provides and maintains implementation traceability for NAS Verification via the VRTMs contained in the NAS-SS-1000 System Specifications.
ATQ	ATQ is a member of TPRC; responsible for program oversight; co-approves TEMPs; reviews and comments on T&E requirements, plans, procedures, and reports. ATQ, the Office of Independent Operational Testing and Evaluation (IOT&E) Oversight will monitor the Build 5 enhancement to TDWR program.
NSSL	National Severe Storms Lab (NSSL) provides meteorological support, test data, and test reports to ACW-200D.
Contractor Support	Support contractors provide assistance in the accomplishment of T&E activities; e.g., planning, conducting, and reporting.
Prime Developer	The prime development contractor develops and performs testing according to government direction. The prime development contractor provides test support, as requested, and resolves deficiencies related to testing.
Regions	Region personnel support activities which lead to site acceptance and field shakedown.
TPRC	The TPRC is responsible for approving TEMPs; providing information indirectly to the EXCOM for the final deployment decision; approves test policy waivers; and resolves disagreements on T&E issues when agreements cannot be reached at lower levels of FAA management.
ATR-120	ATR provides TEMP requirements; reviews the FAA TEMP; provides operational expertise and planning for conducting and analyzing test data; reviews PAT&E requirements; provides personnel to support monitoring and conduct of PAT&E; supports test plan development; reviews OT&E Integration and OT&E Operational test plans and procedures for tests; determines the operational acceptability of new ATC operational computer programs or systems prior to their delivery for operational testing and use in field facilities; monitors the conduct of Field Shakedown; reviews Field Shakedown reports; provides a deployment recommendation based on OT&E Shakedown results to the DRR; and is a member of the TPRC.
ASU	The Office of Acquisition Support (ASU) is a member of TPRC; reviews FAA TEMP, contractor's TEMP, Production Acceptance Test and Evaluation (PAT&E) test plans, procedures and reports; and verifies completeness of program testing by reviewing final OT&E reports.

Regional AF	Regional AF personnel are responsible for overall Field Shakedown in cooperation with the Air Traffic Division.
Division AF Sectors	Sector personnel provide maintenance support for OT&E activities and is responsible for coordinating schedule outages with Air Traffic (AT).
Regional AT Division	AT provides coordination to Airway Facilities Division for Field Shakedown requirements, plans, procedures and reports; participates in conduct of OT&E as coordinated with the ATR organization.
AT Facilities	AT participates in FAA TEMP activities as requested by ATR through Regional Air Traffic Division; supports development of Field Shakedown requirements plans, procedures, and reports in coordination with AF organizations.

4.2 INTEGRATED SCHEDULE.

High level planning anticipates Build 5A will be completed during November 1993; and the Build 5B software will be delivered to the FAA during August 1994. The following variables have the potential for disrupting this schedule:

a. Funding could limit the scope of testing and severely impact the duration of testing.

b. A lack of Wind Shear and microburst weather during the scheduled fall test periods will likely impact quality of weather testing. Continuation of weather testing will be conducted at Orlando, FL, during April 1995. The Orlando site during the spring offers considerable weather phenomena. Test oversight personnel have raised the concern about not having strong convective weather phenomena during testing for valid operational assessments.

c. The schedule does not address the TCCC/TDWR interface due to the unavailability of the TCCC. Once developed, the Advanced Automation System (AAS) Program Office will have the responsibility for verifying and conforming to this interface.

d. TDWR/RMS IMCS is expected to be available to provide for RMS testing during Build 5B. The TEMP test schedule has provided for RMS testing at Denver during the Build 5B test.

e. ANA-700 will need to receive the TDWR RMS/MPS ICD containing the new data points for review and evaluation in a timely manner to ensure the IMCS software is available for testing as proposed.

Reference appendix A for the TEMP OT&E schedule. This schedule evolved out of the TSSR, September 22, 1993, which was held at the FAA Technical Center. The schedule appears to be reasonable at this time.

4.3 TEST PLANS.

The major test documents to be developed for the Build 5 effort, and the responsible organizations, are listed in table 4.3-1. Separate test plans and procedures will be written for the Build 5A and Build 5B due to potential funding shortfalls. Funds may not be available to write all plans and do all testing.

TABLE 4.3-1. TEST PLAN/PROCEDURES LISTING

DOCUMENT TITLE	RESPONSIBLE ORGANIZATION
FAA TEMP	ACW-200D
Contractor's Mast Test Plan (CMTP)	Development Contractor
Software Test Plan	Development Contractor
Turnkey Installation Test Plan	Development Contractor
System Test Procedures	Development Contractor
Final Initial Checkout and Acceptance (IC&A) Test Procedures	Development Contractor
Test Reports (System/Software)	Development Contractor
Contractor's Test Procedures	Development Contractor
Two FAA OT&E Operational and Integration Test Plans (Build 5A & Build 5B)	ACW-200D
Two FAA OT&E Operational and Integration Test Procedures (Build 5A & Build 5B)	ACW-200D
RMS OT&E Test Plan/Procedures	ACN-100D
Two OT&E Shakedown Plans Build 5A & Build 5B	AOS-200
Two OT&E Shakedown Procedures Build 5A & Build 5B	AOS-200

4.3.1 FAA TEMP.

This test plan follows FAA-STD-024a and includes FAA Order 1810.4B philosophy and organizational information. The TEMP identifies verification methods for contractor, integration, operational, and shakedown. The TEMP's purpose is to define the overall approach for conducting the Build 5 test program.

4.3.2 Development Test and Evaluation Plan.

Build 5 does not require a DT&E plan.

4.3.2.1 Reliability Plan.

The development contractor is not required to develop a separate Reliability Plan for the Build 5 enhancement. Reliability reporting will continue as presently established under the TDWR program.

4.3.2.2 Maintainability Plan.

The development contractor is not required to develop a separate maintainability Plan for the Build 5 enhancement.

4.3.2.3 Electromagnetic Interference.

The Build 5 enhancement will not require Electromagnetic Compatibility (EMC) or Electromagnetic Interference (EMI) testing.

4.3.3 Operational Test & Evaluation (OT&E) Plans.

The FAA conducts OT&E to evaluate the subsystem operational effectiveness and suitability including interoperability, degraded operations, maintainability and supportability. OT&E also identifies deficiencies in NAS hardware, software human performance factors and/or operational concepts. OT&E consists of three test phases: Integration, Operational, and Shakedown. Each of these phases is addressed in the TEMP. Division of responsibilities for FAA OT&E (Integration, Operation, Shakedown) are illustrated in figure 4.3.3-1. Since Build 5 is an enhancement to the basic TDWR only those areas not shadowed will be evaluated. The OT&E Integration and OT&E Operational Test Plan will be combined into one plan for separate Build 5A and Build 5B plans. Separate test plans will be written for Build 5A and Build 5B OT&E Shakedown.

FAA OT&E Integration/Operational/Shakedown Test Philosophy

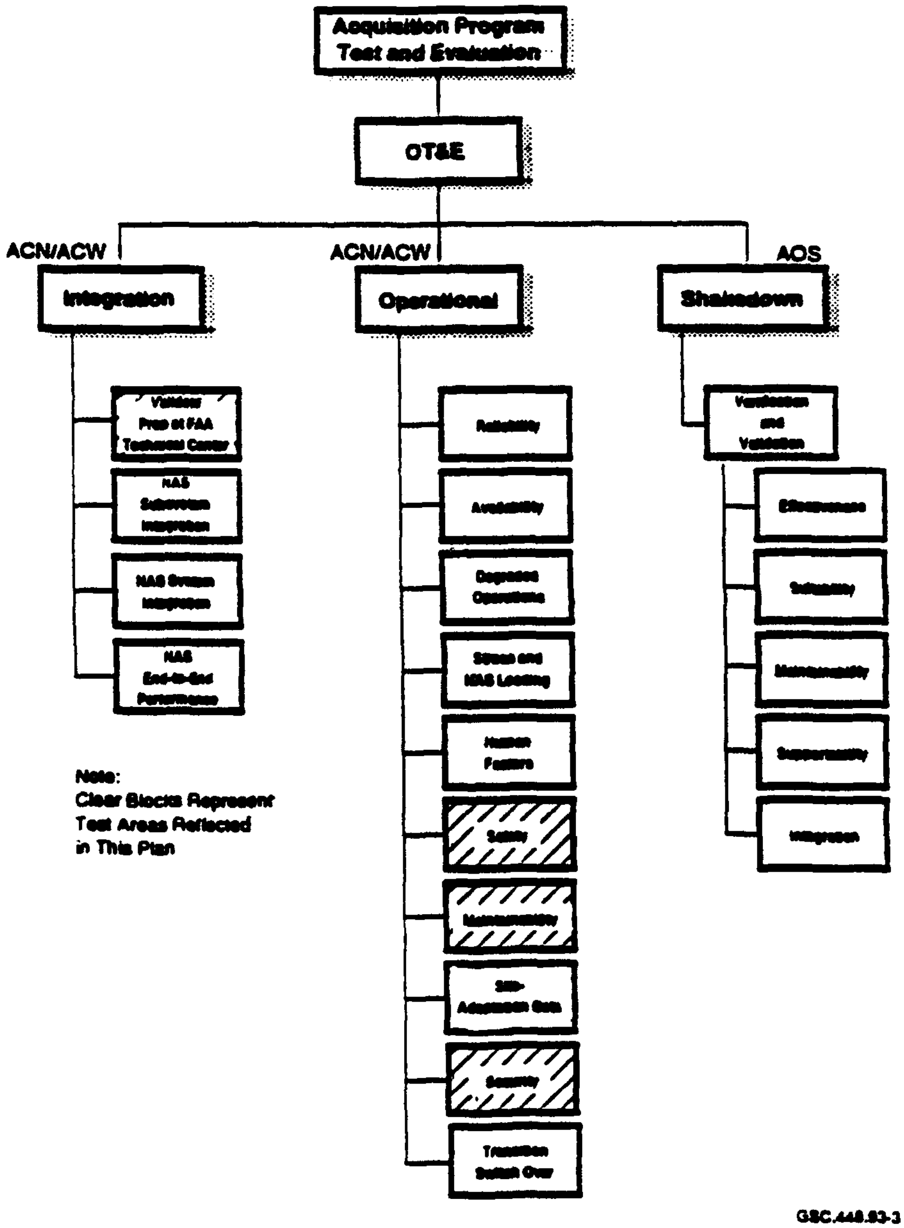


FIGURE 4.3.3-1. DEPICTION OF OT&E TEST RESPONSIBILITIES

4.3.3.1 FAA OT&E Integration and OT&E Operational Test Plan.

The APMT has responsibility for developing the OT&E Integration and OT&E Operational Test Plan in accordance with FAA-STD-024a. OT&E Integration consists of testing NAS system end-to-end performance which is addressed in NAS-SS-1000, Volume I (system level) and Volumes III and V (subsystem level). This testing establishes NAS baseline performance (end-to-end) and verifies that previously existing NAS performance has not been degraded. To the greatest extent possible, subsystem testing will be tested in a NAS equivalent environment. The tests addressed in this plan shall be of a quantitative and qualitative nature and are deemed successful if the results meet FAA-E-2806/1 and NAS-SS-1000 qualification requirements. Included are test criteria which OT&E personnel will use to verify the operation of multiple interfaces and integration with other systems in the operational environment. Requirements not practical for testing by the prime development contractor, such as interface with IMCS software and human factors, shall be included.

OT&E Operational issues reflect system/subsystem response and performance requirements for those areas indicated in figure 4.3.3-1.

4.3.3.2 FAA OT&E Shakedown Plan.

AOS-200 will develop this test plan in accordance with FAA-STD-024a. Shakedown is an independent verification and validation to verify operational effectiveness, suitability, supportability, and maintainability of the Build 5 enhancement.

4.3.4 Prime Development Contractor Build 5 Contractor's Master Test Plan.

The prime development contractor shall develop and execute an addendum to the CMTP. This plan will prove through test, demonstration, inspection, and analysis that the Build 5 requirements described in specifications FAA-E-2806, System/Segment Design Document (S/SDD), and Engineering Report, ER/300-87-08-001 are satisfied. Since Build 5 is an enhancement to the initial TDWR procurement, the plan will not address the following:

a. Algorithm Implementation Test/Demonstration,
b. Clutter Suppression Demonstration,
c. EMI and EMC Radio Frequency Interference (RFI) Tests,
d. Environmental/type tests,
e. Federal Communications Commission (FCC) Type acceptance,
f. Hardware tests,
g. Human engineering,
h. Maintainability demonstration,
i. National Telecommunication and Information Administration (NTIA) Spectrum,
j. PAT&E Procedure Validation,
k. Pulse Repetition Frequency (PRF) Selection Demonstration,
l. Reliability Demonstration,
m. Signal Processing Simulation,
n. System alignment.

Build 5A interface testing will verify that the TDWR interfaces with the LLWAS II for receipt of LLWAS status, wind, and configuration data. A government supplied MPS simulator will be used to emulate RMMS functions. A PC LLWAS simulator must be available for LLWAS II and LLWAS III integration testing with the TDWR.

4.3.5 Prime Development Contractor DT&E Plan.

No Development Test and Evaluation (DT&E) Plan is required for Build 5. However, In-Plant System-Level testing will be included in the CMTP. An Interface, test will be accomplished to qualify new system-level LLWAS II and LLWAS III requirements utilizing LLWAS simulators. A system demonstration will be performed to validate end-user system operation and will utilize baseline certified procedures from Contract Data Requirements Lists (CDRLs) D010-11a (RMS Demonstration) and D010-23a (Weather Demonstration) to assess functional compliance of the TDWR.

4.3.6 Prime Development Contractor PAT&E Plan.

Build 5 is a software intensive effort and will not require a PAT&E Plan. PAT&E for this software will consist of an inspection of the end product and associated documentation to verify it is identical to the software baseline.

4.3.7 Prime Development Contractor IC&A Plan.

Final Initial Checkout and Acceptance (IC&A) Test Procedures will be developed. The primary objective of IC&A is to verify satisfactory operation of the software at each installed site.

5. DT&E/PAT&E OUTLINE.

5.1 DT&E/PAT&E TO DATE.

The DT&E for the TDWR primary system has been completed. PAT&E has been completed on some production systems.

5.2 FUTURE DT&E/PAT&E.

The DT&E will be performed according to CDRLs for Build 5. The most illustrative of future contractor testing involves a System Enhancement Test to ensure:

a. Requirements specified in the government directed enhancement have been correctly implemented.

b. The Build 5 enhancement has not adversely affected other system functions and parameters. Testing should consist of certification checks, on-line diagnostics, weather algorithms, performance monitoring, GSD, RDT, and operational entries.

c. Testing shall be run utilizing a full load weather scenario consisting of five microbursts and six gust fronts as a minimum. During this test any valid operational command shall be permitted and system timing and capacity shall be verified.

5.3 DT&E/PAT&E OBJECTIVES.

The DT&E will be performed to ensure the developed system complies with the software requirements specification and the Statement of Work (SOW). PAT&E objectives are normally developed to ensure product quality is retained for all systems during manufacturing and implementation. However, no PAT&E objectives are applicable to Build 5 enhancement.

5.4 DT&E/PAT&E SCOPE, EVENTS, SCENARIOS.

The DT&E will be performed per CDRLs to ensure Build 5 compliance with applicable specifications. Most significant of the DT&E effort will be a 24-hour test which will fully stress the software to the maximum extent possible within the factory environment.

5.5 CRITICAL DT&E/PAT&E ITEMS.

No critical DT&E/PAT&E items have been identified relative to Build 5 enhancement.

6. OT&E INTEGRATION TESTING.

Test procedures will be developed to ensure compliance with NAS-SS-1000, Volumes I, III, and V requirements, and any additional requirements needed to ensure successful integration of the system into the NAS.

6.1 OT&E INTEGRATION TESTING TO DATE.

The following reports provide the status of OT&E Integration to date: Terminal Doppler Weather Radar (TDWR) Operational Test and Evaluation Integration and Operational Quick Look Report, November 12, 1992, and Terminal Doppler Weather Radar, Operation Test and Evaluation (OT&E) Integration and OT&E Operational Tests/Rests, Quick Look Report, September 21, 1993.

The following reflects on initial TDWR RMS OT&E Integration testing conducted at Oklahoma City, OK, October 13 through October 30, 1992, and retesting at Houston, TX, May 3 through 13, 1993.

MPS integration testing was conducted using Interim Monitor and Control Software (IMCS), version PCC0711, LM-1 protocol analyzer and the ACD-350 Enhanced MPS Simulator, version 1.01. Logical Unit data point reporting, erroneous alarm responses, and incorrect MDT data were major deficiencies. Testing identified 32 critical failures related to the RMS. Retesting in Houston solved 25 of the original 37 problems, however, 34 new problems were identified. The retest Quick Look Report recommended the TDWR not be deployed until all 22 critical and major problems associated with the RMS/MPS are corrected.

6.2 OT&E INTEGRATION FUTURE TESTING.

ACW-200D will develop and perform functional and integration tests on the Build 5 System Enhancement. OT&E testing will be accomplished in two phases:

a. Build 5A, and

b. Build 5B.

Build 5B testing will evaluate the LLWAS III interface, microburst shear integration algorithm, GSD, RDT, audible alarm timeout, ribbon display blanking, and 15-day archiving.

The TDWR RMS will require testing upon baseline of the TDWR RMS/MPS ICD, and correction of previously identified failures. ACN-100D will conduct RMS OT&E Integration testing to ensure any RMS operational suitability has not been degraded because of Build 5. New data points have been added for the Build 5 modification which will require testing in accordance with NAS specification requirements presented in appendix B.

6.3 OT&E INTEGRATION TEST OBJECTIVES.

This testing is to ensure the successful integration of NAS subsystems and NAS systems. The TDWR must be operationally integrated with the LLWAS II and LLWAS III systems. The TDWR RMS interface must show compliance to NAS-MD-790 and NAS-SS-1000, Volume V requirements. The archiving function must meet with user satisfaction. Weather processing must be timely and result in reliable products for the ATC community. The ultimate goal of integration testing is to ensure NAS end-to-end performance is suitable to the user community.

6.4 OT&E INTEGRATION TEST SCOPE, EVENTS, SCENARIOS.

NAS integration requirements are derived from the NAS System Specification. ACW-200D will determine the methodology for testing these interfaces, either through actual connection or simulation. An independent exercise of each interface will occur to validate that the TDWR performs correctly with the Build 5 interfaces. Build 5A testing at Memphis, TN, will ensure this combination of TDWR and LLWAS II satisfactorily interfaces to provide useable products to the ATC. The Memphis site offers the highest possibility of correlating TDWR and LLWAS II data. The Denver site should provide the maximum stressing of the software due to the large amount of data produced by the LLWAS III. The TCCC interface will be tested when it becomes available. Each message instead of consisting of 7 to 12 sensors will consist of 29 sensors. Test scope will verify the integration requirements presented at appendix B. Specific events and scenarios will be detailed in the OT&E Integration Test Plan and subsequently test procedures. The Memphis site will demonstrate correlation of TDWR and LLWAS II data. The Denver site will result in stressing of the software since the Denver site will have the largest amount of site adaptation data which must be accommodated and the greatest amount of data for the processors to integrate.

6.5 CRITICAL OT&E INTEGRATION TEST ITEMS.

a. Developing techniques which adequately evaluate the full operational configuration and degraded performance modes will require test creativity. In the fully operational configuration, data from both the TDWR and LLWAS is integrated in the RPG and the resulting alarm messages and wind data are displayed. Since the TDWR is required to provide coverage for two airports, the test scenario will need to ensure the TDWR can ingest data from two different LLWAS systems. The Build 5B is required to process LLWAS II and III data simultaneously. An LLWAS II simulator will be required for this test since only the LLWAS III is installed at Denver.

b. A secondary critical test item will be to evaluate the proper LLWAS operation when the TDWR is in either a failed or maintenance mode. System operation differs for LLWAS II and III in these configurations. For instance:

1. The DFU shall provide for LLWAS II, a capability to map LLWAS sensor winds to specific runways for presentation as threshold wind information. This information shall be routed to specific ribbon displays according to the runway configuration table. The CFW also are displayed.

2. LLWAS III alerts and threshold wind data are presented directly to the GSD and RDT displays.

3. Testing will need to establish that the DFU software sets the switch to LLWAS to indicate whether the TDWR goes into the maintenance or failed mode. In this configuration, a red X should appear on the situation display. The software will need to be evaluated to determine whether the switch is reset when the TDWR resumes normal operation.

c. A test risk exists regarding the LLWAS prime development contractor's ability to complete the LLWAS III to TDWR interface software within the test schedule provided at appendix A.

d. A baselined ICD is necessary to the completion of IMCS software.

7. OT&E OPERATIONAL TESTING.

7.1 OT&E OPERATIONAL TESTING TO DATE.

TDWR OT&E Integration and OT&E Operational tests were performed in Oklahoma City, OK, in August to October 1992. TDWR OT&E Integration and OT&E Operational tests and retests were performed in Oklahoma City, OK; Houston, TX; and Memphis, TN, in March to September 1993. The following OT&E Operational test/retests were performed: Weather Detection Performance, Reliability, Availability, Grounding/Lightning Protection, Solar Track Measurement, Air Traffic Control Suitability Evaluation, Security, and Vibration Analysis.

Testing conducted at Oklahoma City concluded that the TDWR required correction of system reconfiguration, power interruption, RMMS, and documentation. High Gust Front false alarm rates and lack of weather products in attenuated areas were considered deficiencies. Concern was expressed that procedures needed to be in place to optimize weather detection parameters prior to future installations.

Preliminary OT&E Operational Weather Retesting data analysis indicated the following:

a. Microburst POD of 95 percent (design goal - 90 percent for microbursts within 6 nmi of the Airport Reference Point);

b. Microburst FAR of 18 percent (design goal - 10 percent for microbursts within 6 nmi of the Airport Reference Point);

c. Gust front POD of 66 percent (gust fronts within 33 nmi of the TDWR);

d. Gust front FAR of 24 percent (gust fronts within 33 nmi of the TDWR).

Gust front and microburst FAR and gust front POD were unacceptable.

System reliability had a MTBF of 28 hours (specification requirement is 550 hours). The Mean Time Between Critical Failures (MTBCF) was 112 hours, whereas the specification requirement is 1500 hours. The system also failed to recover after 1-second power interruptions.

The ATC evaluation resulted in the evaluators rating the TDWR with a 89 percent favorable response. However, two critical operational issues were identified:

a. A red X was displayed on the tower and TRACON GSD several times for unknown reason(s);

b. A gust front crossed all active runways highlighting the ARENAs but did not alarm the ribbon display terminal (RDT).

Three software builds were used during this test period which caused test integrity concerns. Additional follow-on testing will be required.

The TDWR requires system reconfiguration, power interruption recovery, and RMMS corrective actions in order for the system to become a reliable member of the NAS. These problems potentially affect both the operational use of the TDWR and the maintenance philosophy of the unmanned site.

7.2 OT&E OPERATIONAL FUTURE TESTING.

ACW-200D will perform operational tests on the Build 5A at Memphis, TN, and Build 5B at Denver (new airport). Continued user involvement is necessary to ensure present and future product satisfaction. Future OT&E will need to address reliability, availability, and maintainability issues.

7.2.1 Reliability.

Build 5 hardware and software failures will be documented and reported during all phases of OT&E. Failures will be investigated to determine if they were inherent to the software and hardware or were nonrelevant (induced by operator or environment; e.g., tornado damage). During previous operational testing, the TDWR did not meet specified reliability requirements due to numerous failures; e.g., pedestal and computer boards. Test personnel will document all hardware and software incidents/failures. MTBF will be documented in the Build 5 test reports. Test personnel, upon verification that relevant failures have occurred, will document MTBF in the Final OT&E Operational Test Report. Failures will be reported to participating OT&E test organizations and the Program Office.

7.2.2 Maintainability.

Specific problems will not be induced, but should failures occur, the time to repair will be documented and compared to established maintainability criteria.

7.2.3 Fault Detection and Fault Isolation.

Should failures occur during testing of Build 5, the effectiveness of fault detection and isolation will be documented and analyzed in the appropriate OT&E test report. RMS OT&E Integration will ensure that the Build 5 software has not been limited in its ability to detect communications or failures related to the LLWAS and TDWR.

7.2.4 Mean Time to Repair (MTTR).

Mean Time to Repair (MTTR) will be computed if sufficient data is collected during failures occurring during the Build 5 OT&E test.

7.3 OT&E OPERATIONAL AND TEST OBJECTIVES.

This testing is to ensure the operational effectiveness and suitability of the equipment from a user perspective. Aspects of this testing are further defined as follows:

a. Reliability,
b. Availability,
c. Degraded operations and operational utilization scenarios,
d. Stress and NAS loading testing of all interoperable subsystems,
e. Human factors,
f. Site adaptation,
g. Transition switchover.

7.4 OT&E OPERATIONAL TEST SCOPE, EVENTS, SCENARIOS.

NAS operational requirements are primarily derived from NAS System Specifications, user groups, FAA Orders, Contract Working Papers, Program Directives, Memoranda of Agreement, Operational Concept Documents, and subsystem specifications. ACW-200D will determine the methodology for evaluating system reliability, human factors, and transition switchover (such as when the TDWR fails). ACW-200D will develop scenarios which will assess degraded operations (such as loss of primary power and system overload). Scenarios will be developed which will assess maximum loading of processing resources.

Test personnel will degrade the system to ensure a string of 9s are displayed for all LLWAS centerfield wind information and that threshold winds are blanked. A single LLWAS sensor will be disconnected to ensure a string of 9s will be displayed rather than the wind information for that sensor.

7.5 CRITICAL OT&E OPERATIONAL TEST ITEMS.

a. A test risk exists regarding to the LLWAS prime development contractor's ability to complete the LLWAS III to TDWR interface software within the test schedule provided at appendix A.

b. Reliable operation and timely receipt of weather products using the Build 5 software represent critical operational test items. System load assessment will require innovative test techniques. Test methodology will need to be developed which will evaluate system effectiveness as operations degrade.

c. A lack of appropriate weather (microbursts/Wind Shears) during the schedule test periods will impact either the quality or completion of testing. The OT&E Operational Plan will include contingency planning to address a lack of appropriate weather during testing. Weather testing shall take precedence over all other testing.

8. OT&E SHAKEDOWN.

Shakedown typically determines the overall readiness of the system through the analysis of human factors, procedures, documentation, logistics support, and technical training. Training on the use of IMCS and the Maintenance Management System (MMS) also will need to be fully assessed.

AOS-530 will conduct OT&E Shakedown for the TDWR RMS/MPS IMCS.

AOS-200 will construct a series of tests that meet the objectives of OT&E Shakedown.

8.1 OT&E SHAKEDOWN TO DATE.

Initial Shakedown was accomplished on the primary TDWR systems by AOS-200, October 13 to November 20, 1992, at Nesbit, MI. The following are conclusions reached by the test personnel:

a. Equipment/system status monitoring and alarm reporting failed when the MPS/TDWR (RMS subsystem) interface failed its tests. The human interface would be unusable without extensive training of MCC personnel. Reported performance, parameter, and alarm information at the MDT was inaccurate or unusable.

b. Personnel safety failed due to unsafe maintenance procedures, the lack of emergency exit lighting, and a poorly functioning emergency pushbutton. The emergency pushbutton had to be manually depressed for 4 or 5 seconds to achieve system shutdown.

c. Equipment/system performance characteristics failed because the parameters required for accurate weather event detection were not optimized.

d. Facility Reliability/Availability failed because an engine/generator was not installed. The power fail recovery tests did not pass. The lightning protection package was not installed.

e. Maintainability was unsatisfactory due to incorrect alignment procedures and unusable software loading procedures. Logistics support was unsatisfactory due to unavailability of site spares, test equipment, and special tools.

f. Workload conditions were rated unsatisfactory because maintenance procedures are more time consuming than projected. In addition, the maintenance workload and type of maintenance requires more trained technicians than initially expected.

g. Antenna pedestal vibration testing was accomplished. This test indicated a high probability that the azimuth bearing had failed. Personnel performing the vibration testing noted there were insufficient inputs for grease for the antenna elevation bearings. Improper lubrication will cause accelerated wear.

Followup regression testing during May 1993, identified major issues which could impact a positive recommendation by Shakedown organizations regarding TDWR deployment. Issues were:

a. System Monitoring. The TDWR experiences repetitive alarms (instability residue, system noise, Sensitivity Time Control (STC) calibration, azimuth servo reference, etc.). Either the monitoring software or the conditions for monitoring a data point are causing frequent alarms. These repetitive alarms cause unnecessary maintenance and loss of confidence in the system. The MDT reports a constant flow of alarms, alerts, and Return-To-Normal (RTN).

b. System Diagnostics. System diagnostics do not always accurately report the failed Lowest Replaceable Units (LRUs). Inability of system diagnostics to accurately report failed units will extend any restoration or corrective maintenance time.

c. Instruction Lookss. Numerous alignment procedures do not work or are incomplete.

d. System reliability remained poor.

8.2 OT&E SHAKEDOWN FUTURE.

Future testing will be conducted at Denver and Memphis. Tests will demonstrate whether logistics, training, documentation, and other operational requirements have been met. AOS-530 will conduct IMCS testing at the FAA Technical Center, Atlantic City International Airport, New Jersey, prior to field release.

8.3 OT&E SHAKEDOWN OBJECTIVES.

Shakedown is accomplished by the user organizations to independently evaluate the following operational objectives:

a. NAS system integration (validate system interfaces),

b. Supportability and maintainability,

c. Subsystem/system suitability and identification of operational deficiencies,

d. Site adaption parameters optimized and archive functional verification,

e. Operational procedures are available.

These Shakedown objectives will determine the degree to which Build 5 can be reliably placed into the NAS.

8.4 OT&E SHAKEDOWN SCOPE, EVENTS, SCENARIOS.

Shakedown will verify requirements denoted in the site column of the VRTM presented in appendix B; and, those effectiveness, suitability, maintainability, supportability, and integration requirements addressed in this plan. An experienced technician will perform test scenarios and communicate with technical personnel in the ATCT and at interfacing locations.

8.4.1 Maintainability.

a. Technical Instructions. This test will evaluate software documentation required for fielding. Documentation will be evaluated for completeness and clarity.

b. Operational Accuracy. This test evaluates the system's capability to accurately present readings and system status to the maintenance technician.

c. Human Factors. This test assesses the human/machine interface to ensure the display is useable.

8.4.2 Supportability.

Supportability for Build 5 will address documentation, and adequacy of trained personnel, configuration management, and training.

a. Software Documentation. This activity will determine if documentation (and any revisions) are readily available and current.

b. Adequacy of Trained Personnel. This activity will establish AOS-200's capability to support field activities from a total system perspective (software/hardware maintenance, configuration management, miscellaneous technical support).

8.4.3 System Effectiveness.

a. Operational Reliability. Shakedown personnel will have access to the TDWR Reliability Analysis Database for their assessment regarding potential system effectiveness in providing reliable service.

b. Backup Power Effectiveness. This activity confirms system effectiveness in operating on backup power or on airport power.

8.4.4 Suitability Considerations.

This assessment will determine suitability of display information and system response.

8.4.5 System Integration.

a. Resolution of Test Deficiencies. Determines if OT&E Integration and OT&E Shakedown discrepancies have been satisfactorily resolved.

b. OT&E Operational Considerations. Determines if enhanced TDWR operation will have any negative impact on the existing air traffic control.

8.5 OT&E SHAKEDOWN CRITICAL ITEMS.

Build 5 testing cannot be isolated from the overall TDWR system. The TDWR system and Build 5 together must meet system required operational requirements prior to fielding. Therefore, OT&E Shakedown must evaluate the TDWR and Build 5 as a single entity and previously identified failures must be treated as critical test items.

8.5.1 Equipment/System Status Monitoring and Alarm Reporting.

Previous failure of the MPS/TDWR (RMS subsystem) interface tests will require testing to ensure performance/parameter and alarm information is accurate.

8.5.2 Personnel Safety.

Testing will need to ensure that all unsafe maintenance procedures have been corrected, emergency exit lighting added as necessary, and emergency pushbutton operation timely achieves system shutdown.

8.5.3 Equipment/System Performance Characteristics.

Testing will need to ensure weather event detection has been optimized. Installation of an Engine/Generator and lightning protection package will need to be verified. Power fail recovery tests will need to be reaccomplished.

8.5.4 Maintainability.

Maintenance, alignment, and software loading procedures will need to be verified to ensure their useability. Adequacy of site spares, test equipment, and special tools will need to be reassessed.

8.5.5 Workload Considerations.

Revised maintenance procedures will need to be evaluated to determine if the contractor has improved maintenance procedure efficiency. The RMS final configuration will need to be evaluated to determine if it will reduce the previously identified unacceptable technician workload.

8.5.6 Other Considerations.

Follow-on testing will need to ensure adequate inputs for grease for the antenna elevation bearings have been added to minimize wear.

9. SPECIAL RESOURCE SUMMARY.

9.1 TEST PERSONNEL.

a. NSSL will provide experienced meteorologists for OT&E Operational test planning, procedure development, test conduct, and reporting.

b. ACW-200D will provide an ATC analyst to accomplish ATC operational testing.

c. ACW-200D will require test engineers to draft plans, procedures, conduct testing, and draft reports.

d. AOS-200 will require test personnel to accomplish program monitoring and accommodate test activities.

e. Regional manpower will be required for system and maintenance support.

9.2 SPECIAL SUPPORT REQUIREMENTS.

9.2.1 MPS Simulator.

Synchronous EnMPS Communications Simulator and LM1 Protocol Analyzer (version 8.0) will be required for testing link level communications.

9.2.2 Software.

TDWR RMS/MPS testing will require updated IMCS, TDWR RMS Terminal Software, and Procomm software for the MDT. Database software such as DBIV should be procured and used for analysis of failure data.

10. ACRONYMS AND ABBREVATIONS.

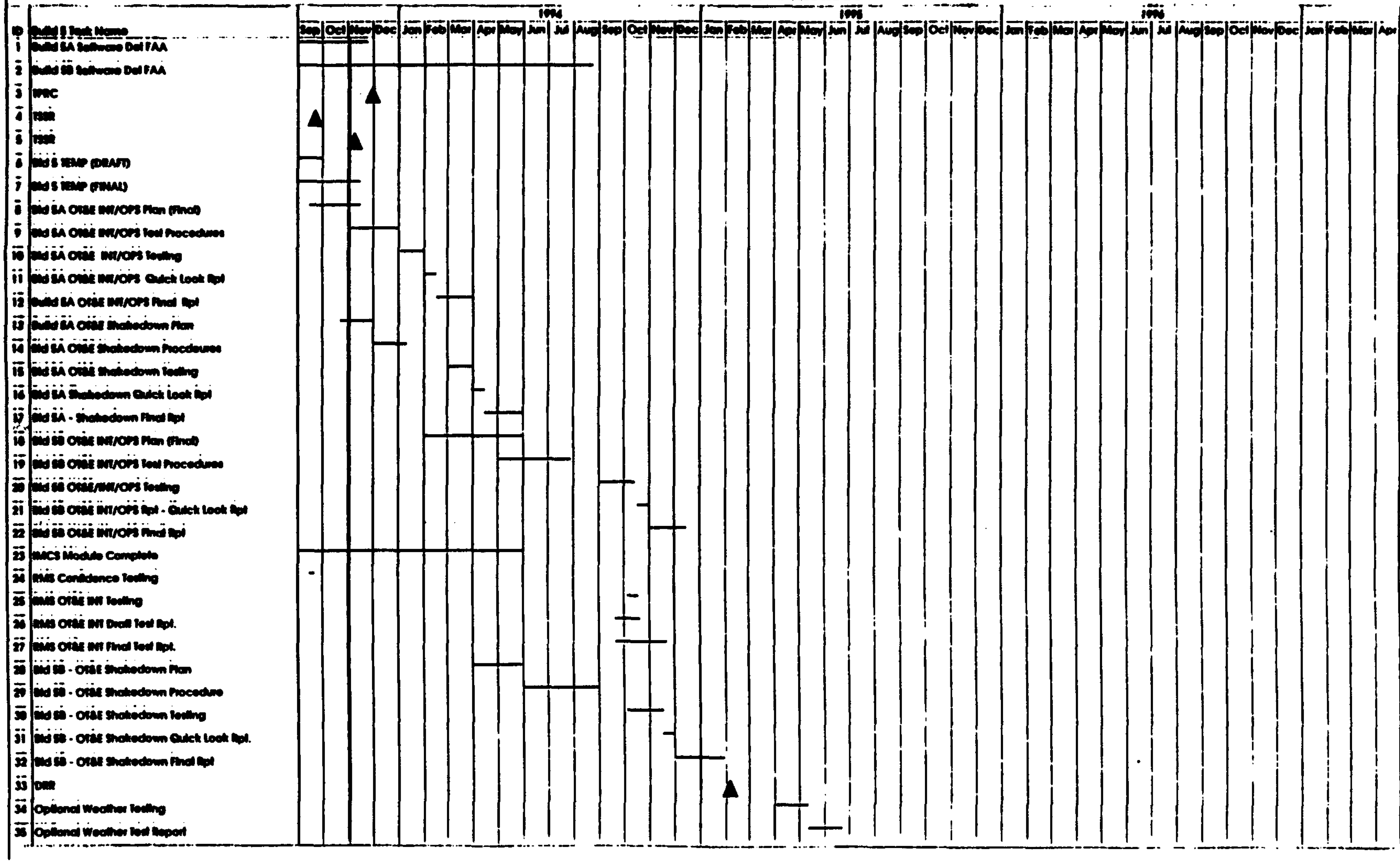
AAS	Advanced Automation System
ADCCP	Advanced Data Communications Control Procedures
AF	Airway Facilities
APME	Associate Program Manager for Engineering
APML	Associate Program Manager for Logistics
APMT	Associate Program Manager for Test
ARENA	Area Noted for Attention
ASU	Office of Acquisition Support
AT	Air Traffic
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
ATR	Associate Administrator for Regulation and Certification
ATQ	Office of Independent Operational Test and Evaluation Oversight
Bd	baud
bps	bits per second
CDRL	Contract Data Requirements Lists
CFW	Center Field Wind
CMTP	Contractor's Master Test Plan
CSCI	Computer Software Configuration Item
DFU	Display Functional Unit
DRR	Deployment Readiness Review
DT&E	Development Test and Evaluation
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EXCOM	Executive Committee
FAA	Federal Aviation Administration
FAR	False Alarm Ratio
FCC	Federal Communications Commission
GFI	Government Furnished Item
GSD	Geographic Situation Display
ICD	Interface Control Document
ICDDT	Interface Control Document Database Development Tool
IC&A	Initial Checkout and Acceptance
IMCS	Interim Monitor Control Software
IOT&E	Independent Operational Testing and Evaluation
LLWAS	Low Level Wind Shear Alert System
LLWAS II	Low Level Wind Shear Alert System (Six Sensor System)
LLWAS III	Low Level Wind Shear Alert System (Network Expansion System)
LLWAS NE	Low Level Wind Shear Alert System (Network Expansion System)
LRU	Lowest Replacement Unit
MDT	Maintenance Data Terminal
MMS	Maintenance Management System
MPS	Maintenance Processor Subsystem
MSIA	Microburst Shear Integration Algorithm
MTBCF	Mean Time Between Critical Failures
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
M&OS	Maintenance and Operations Support
NAS	National Airspace System
NCP	NAS Change Proposal
NE	Network Expansion

nmi	nautical miles
NSSL	National Severe Storms Lab
NTIA	National Telecommunications Information Agency
OT&E	Operational Test and Evaluation
PAT&E	Production Acceptance Test and Evaluation
PM	Program Manager
POD	Probability of Detection
PRF	Pulse Repetition Frequency
RDA	Radar Data Acquisition
RFI	Radio Frequency Interference
RDT	Ribbon Display Terminal
RMMS	Remote Maintenance Monitoring System
RMS	Remote Maintenance Subsystem
RMSC	Remote Maintenance Subsystem Concentrator
RPG	Radar Product Generation
RTN	Return-to-Normal
SCN	Specification Change Notice
S/SDD	System/Segment Design Document
SOW	Statement of Work
STC	Sensitivity Time Control
TCCC	Tower Control Computer Complex
TDWR	Terminal Doppler Weather Radar
TEMP	Test and Evaluation Master Plan
T&E	Test and Evaluation
TPRC	Test Policy Review Committee
TSSR	Test Schedule Status Review
VRTM	Verification Requirements Traceability Matrix

APPENDIX A

BUILD 5 TEMP SCHEDULE

TDWR Build 5 - TEMP Schedule



APPENDIX B

VRTMS

Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID#	NAS-SS-1000 Volume I	Title/Description	Verification Level/Method				Remarks
			DT&E	OTE-O	OTE-I	OTE-S	
1001	3.2.1.1.1.1.I	Air traffic control functional characteristics - Disseminate weather data	X	X	D	D	
1002	3.2.1.1.4.1.B	Weather functional characteristics - Collect and/or sense whether information that pertains to the area of NAS responsibility for terminal and en route operations.	X	X	D	D	
1003	3.2.1.1.4.1.D	Weather functional characteristics - Display weather information - Provide tabular and pictorial displays of weather information to support the specialists.	X	X	D	X	
1004	3.2.1.1.4.1.G	Weather functional characteristics - Classify weather information as hazardous which may impact flight operations.	X	X	D	X	
1005	3.2.1.1.4.1.H	Weather functional characteristics - Alert specialists when hazardous weather or NOTAM information is received.	X	D	X	X	
1006	3.2.1.1.4.1.I	Weather functional characteristics - Disseminate weather and NOTAM information to NAS specialists and users in support of flight operations.	X	D	X	X	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID#	NAS-SS-1000 Volume I	Title/Description	Verification Level/Method				Remarks
			DT&E	OTE-O	OTE-I	OTE-S	
1007	3.2.1.1.4.1.K	Weather functional characteristics - Generate weather products which support the interpretation of weather conditions by NAS specialists and users.	X	X	D	X	
1008	3.2.1.1.4.1.N	Weather functional characteristics - Archive weather information for use in event reconstruction and accident investigation.	X	X	D	X	
1009	3.2.1.1.8.1.3	Data and voice archiving - The NAS shall provide data and voice recording and playback capabilities for archiving and reconstruction purposes.	A	X	D	D	
1010	3.2.1.1.9.1.A	Maintenance and Operations Support (M&OS) functional characteristics - The NAS shall continually monitor subsystem performance to obtain the data needed by specialists for maintenance and operations support.	X	X	D	X	
1011	3.2.1.1.9.1.B	M&OS functional characteristics - The NAS provide the status of subsystems to specialists and shall generate an alarm upon the deviation of designated parameters from prescribed limits.	X	X	D	X	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID#	NAS-SS-1000 Volume I	Title/Description	Verification Level/Method				Remarks
			DT&E	OTE-O	OTE-I	OTE-S	
1012	3.2.1.1.9.1.C	M&OS functional characteristics - The NAS shall provide the capability for a specialist on-site or at an off-site location to control selected subsystems for maintenance purposes.	X	D	X	X	
1013	3.2.1.1.9.1.D	M&OS functional characteristics - The NAS shall provide the specialist the capability to identify the line replaceable unit causing an equipment failure	X	D	X	X	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID #	NAS-SS-1000 VOLUME I	TITLE/DESCRIPTION	DT&E	OT&E-O	OT&E-I	OT&E-S	Remarks
1014	3.2.1.1.9.1.E	M&OS functional characteristics - The NAS shall provide the capability to retain the values of all monitored subsystem data and the preventive and corrective maintenance data input by specialists.	X	D	X	X	
1015	3.2.1.1.9.1.F	M&OS functional characteristics - The NAS shall provide for the organization and processing of the information necessary for the management of maintenance resources and the preparation of NAS status reports.	X	X	D	X	
1016	3.2.1.1.9.1.G	M&OS functional characteristics - The NAS shall provide the specialist access to the monitoring, control, and data management capabilities of the NAS as required and as authorized by administrative directive.	X	D	X	D	
1017	3.2.1.2.4.A.1	Weather performance characteristics - Detect the current surface weather conditions at selected airports at least once every minute.	X	D	X	X	
1018	3.2.1.2.4.A.2.B	Weather performance characteristics - Terminal: Shall be from ground level to 10,000 feet at AGL within 45 NMI of designated airports.	X	X	I	T	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID #	NAS-SS-1000 VOLUME I	TITLE/DESCRIPTION	DT&E	OT&E-O	OT&E-I	OT&E-S	Remarks
1019	3.2.1.2.4.B.1.A	Weather performance characteristics - Classify weather information as hazardous - terminal: Within one minute from the time NAS receives the hazard weather information.	X	I	I	X	
1020	3.2.1.2.4.C.4.A	Weather performance characteristics - Hazardous weather information - terminal operations - One minute for terminal operations.	X	D	I	X	
1021	3.2.1.2.4.E.1	Weather performance characteristics - Deriving from raw data the products needed by NAS specialists and users.	X	X	D	X	
1022	3.2.1.2.4.E.2	Weather performance characteristics - Using automated weather detection systems.	X	X	D	X	
1023	3.2.1.2.4.F.2	Weather performance characteristics - Real-time depiction of weather conditions - Includes the current condition and near-term prediction of the following: thunderstorm location and intensity, precipitation areas, cloud coverage, cloud tops, icing levels, turbulence, winds aloft, clear air turbulence, low level Wind Shear, and areas of IFR, MVFR, and VFR.	X	I	A	T	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID #	NAS-SS-1000 VOLUME I	TITLE/DESCRIPTION	DT&E	OT&E-O	OT&E-I	OT&E-S	Remarks
1024	3.2.1.2.4.F.3	Weather performance characteristics - Wind shift warning - At 5 minute intervals to provide for at least 20 minutes advanced warning of sustained wind to the NAS specialists for use in planning airport operations.	X	D	X	X	
1025	3.2.1.2.4.F.4	Weather performance characteristics - Hazardous weather warning - Allowing user/specialist to receive at least a one (1) minute warning prior to the existence hazardous weather data (i.e., microburst, gas front) in the terminal area.	X	D	X	X	
1026	3.2.1.2.4.G	Weather performance characteristics - Archive all weather data - The NAS shall archive all weather information in accordance with section 3.2.1.2.8.3.	X	X	T	X	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID#	NAS-SS-1000 VOLUME I	TITLE/DESCRIPTION	DT&E	OT&E-O	OT&E-I	OT&E-S	Remarks
1027	3.2.1.2.8.4.B	NAS time standard performance characteristics - Provide synchronization of non-ATC processors - A system dealing with non-ATC functions (e.g., maintenance, weather, traffic management, flight planning) shall be synchronized to within 6 seconds of UTC.	X	X	T	T	
1028	3.2.1.2.8.4.C	NAS time standard performance characteristics - Provide interfaces to synchronization and coded time signal - The NAS shall provide interfacing capabilities to the coded time signal and synchronization in accordance with Volumes II through V of NAS-SS-1000.	X	X	T	I	
1029	3.2.1.2.9.A through 3.2.1.2.9.E (These para have same Title)	M&OS performance characteristics - The NAS shall provide the capability to determine and present alarms,alerts, and state changes from NAS subsystems to NAS specialists within an average time of 10 seconds and a maximum time (99th percentile) of 60 seconds.	X	D	T	X	

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Terminal Doppler Weather Radar
NAS-SS-1000 Volume I Test Verification Requirements Traceability Matrix

Req ID#	NAS-SS-1000 VOLUME I	TITLE/DESCRIPTION	DT&E	OT&E-O	OT&E-I	OT&E-S	Remarks
1030	3.2.1.2.9.B	M&OS performance characteristics - The NAS shall provide the capability to execute control commands (that cause a state change) initiated by NAS specialists within an average time of 5 seconds and a maximum time (99th percentile) of 15 seconds.	X	T	T	X	
1031	3.2.1.2.9.C	M&OS performance characteristics - The NAS shall provide the capability to develop and present diagnostic test and facility data as requested by NAS specialists or determined in adaptation within an average time of 2 minutes and a maximum time (99th percentile) of 10 minutes.	X	T	T	X	
1032	3.2.1.2.9.D	M&OS performance characteristics - The NAS shall provide an acknowledgement to a specialist of a subsystem's receipt of a valid test command, input by the specialist, within an average time of 15 seconds and a maximum time (99th percentile) of 75 seconds;	X	T	T	X	
1033	3.2.1.2.9.E	M&OS performance characteristics - The NAS shall provide subsystems for the Engineering field support subsystem sectors that meet the performance requirements specified in Volumes II through V of NAS-SS-1000.	X	T	T	X	

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Req ID#	NAS-SS-1000 (Feb 93 SCN)	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3001	3.2.1.2.5.1.1	Receive weather products. The TDWR shall receive wind/Wind Shear products from the low-level Wind Shear alert system (LLWAS).	D	X	D	X	
3002	3.2.1.2.5.1.2	Identify weather. The TDWR shall identify the presence of the following weather: a. Microburst; b. Gust front; c. Precipitation; d. Storm motion.	X	X	X		Lead-in
3003	3.2.1.2.5.1.3	Measure weather phenomena. The TDWR shall measure and make estimates of the following: a. Reflectivity; b. Mean radial velocity; c. Spectrum width.	D	X	D	X	
3004	3.2.1.2.5.1.4	Weather data processing. The TDWR shall analyze return radar signals to determine the following: a. Type of weather; b. Location of weather; c. Velocity of weather; d. Severity of weather; e. Direction of storm movement.	D	X	D	X	
3005	3.2.1.2.5.1.5	Generate weather products. The TDWR shall generate the following weather products: a. Microburst map; b. Microburst message/alarm; c. Gust front map; d. Gust front message/alarm; e. Precipitation map; f. Storm motion map.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	NAS-SS-1000 (Feb 93 SCN)	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3006	3.2.1.2.5.1.5.1	LLWAS data integration. The TDWR shall integrate data from LLWAS to provide an integrated output. The TDWR shall: a. Receive LLWAS wind and Wind Shear products; b. Generate TDWR microburst and gust front alert and maps as in the TDWR stand-alone configuration (see 3.2.1.2.5.1.5); c. Validate LLWAS generated microburst/Wind Shear with loss information using TDWR Wind Shear information. d. Merge TDWR and LLWAS maps and alert to reduce redundancy; and e. Transmit LLWAS Wind Shear with gain and winds products upon receipt from LLWAS.	D	X	D	X	
3007	3.2.1.2.5.1.6	Generate alerts. The TDWR shall generate alert messages indicating the presence of microburst or gust front when pre-specified threshold conditions occur.	D	I	D	X	
3008	3.2.1.2.5.1.7	Disseminate weather data. The TDWR shall disseminate products and alarm messages to the TCCC.	Q	Q	Q	Q	
3009	3.2.1.2.5.1.8	Remote maintenance monitoring. The TDWR shall implement the RMS functional characteristics as specified in Volume I, Appendix III of the NAS-SS-1000.	D	X	D	X	
3010	3.2.1.2.5.1.9	Operational status. The TDWR shall be capable of supplying operational status.	D	I	D	X	
3011	3.2.1.2.5.1.10	Operational control. The TDWR shall accept and process operational control commands from valid external sources.	D	X	D	X	
3012	3.2.1.2.5.1.11	Standard time reference. The TDWR shall receive and maintain timing synchronized to universal coordinated time to support system recording and maintenance and distribution of products.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	NAS-SS-1000 (Feb 93 SCN)	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3013	3.2.1.2.5.1.12	Growth and flexibility. The TDWR shall provide the capability to disseminate weather products and alarm messages to additional subsystems and support future interfaces.	D	X	D	X	
3014	3.2.1.2.5.2	Performance characteristics. The TDWR shall meet the following performance characteristics:	L	X	L	L	
3015	3.2.1.2.5.2.1	Detection envelope. The TDWR shall detect hazardous weather phenomena between 0 and 360 degrees in azimuth, between .25 and 48 nmi in range, and from 0 to 24,000 feet AGL.	T	X	T	X	LEAD-IN
3016	3.2.1.2.5.2.2	Resolution. The TDWR shall have the following resolutions: a. Azimuth; 1 degree; b. Range: 150 meters; Elevation 0.5 degree for elevations less than or equal to 3.0 degrees; 1 degree for elevations above 3.0 degrees.	T	X	T	X	
3017	3.2.1.2.5.2.3	Accuracy. The TDWR shall have the following accuracies: a. Azimuth: Error shall not exceed .05 degree over the entire detection envelope; b. Range: Error shall not exceed 50 meters. c. Elevation: Error shall not exceed .05 degree.	T	X	T	X	
3018	3.2.1.2.5.2.4	System sensitivity. The TDWR shall be capable of detecting a - 10.0 dBz range bin and beam filling target with signal-to-noise ratio of 6 Db at a range of 16 nmi.	T	X	T	X	

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NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	NAS-SS-1000	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3019	3.2.1.2.5.2.5	Frequency. The TDWR shall be capable of operating within the frequency band of 5.60 gigahertz (GHz) to 5.65 Ghz.	T	X	X	X	
3020	3.2.1.2.5.2.6	Scanning strategies. The TDWR shall be capable of providing weather data continuously while operating under the following scanning strategies: a. 360 degrees azimuth scans; b. Azimuth sector scans; c. Range height indicator scan.	D	I	T	X	
3021	3.2.1.2.5.2.7	Archiving. The TDWR shall be capable of archiving 15 days of derived products.	T	I	T	X	
3022	3.2.1.2.5.2.8	Alarm. The TDWR shall generate and distribute a microburst or gust front alarm within 25 seconds from collection of data.	A	T	X	T	
3023	3.2.1.2.5.2.9	Update rate. The TDWR shall provide weather data to specialists that is no older than 1 minute.	A	T	X	T	
3024	3.2.1.2.5.2.9.1	Wind distribution. The TDWR shall distribute wind data within 10 seconds of receipt of data.	A	X	T	T	
3025	3.2.1.2.5.2.10	Data destination. The TDWR shall disseminate data to the following destination (maximum): TCCC and location quality is 1.	Q	Q	Q	Q	
3026	3.2.1.2.5.2.11	Maintenance monitoring performance characteristics. The TDWR shall meet the maintenance monitoring performance characteristic as specified in 3.2.1.1.1.2 of volume V of the NAS-SS-1000.	X	X	X	X	*REFER TO VOL V LEAD-IN*

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NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	NAS-SS-1000	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3027	3.2.1.2.5.2.12	Weather processing performance. Weather data shall be categorized into 6 levels of intensity as follows: a. Six level monitoring: The six levels shall be designed as one through six as follows: 1. Level 1: 18=< dBz< 30; 2. Level 2: 30=< dBz< 41; 3. Level 3: 41=< dBz< 46; 4. Level 4: 46=< dBz< 50; 5. Level 5: 50=< dBz< 57; 6. Level 6: dBz=>57. b. No data display shall be made for dBz values less than 18; c. Storm motion: The storm motion product shall be generated for Level 2 or greater weather and include the direction and speed that the storm is moving.	D	X	X	X	
3028	3.2.1.2.5.3	Functional/physical interfaces. The TDWR shall interface functionally and physically as shown in Figure 3.2.1.2.5.3-1. The TDWR functional interfaces are defined in Table 3.2.1.2..5.3-1.	X	X	L	X	
3028	3.2.1.2.5.1.9	Operational status	D	X	X		
3029	3.2.1.2.5.1.10	Operational control	D	X	X	X	
3030	3.2.1.2.5.1.11	Standard time reference	D	X	X	X	
3031	3.2.1.2.5.1.12	Growth and flexibility	D	X	X	X	
3032	3.2.1.2.5.2.1	Performance characteristics - Detection envelope	T	X	X	X	
3033	3.2.1.2.5.2.2.A	Resolution - Azimuth	T	X	X	X	
3034	3.2.1.2.5.2.2.B	Resolution - Range	T	X	X	X	
3035	3.2.1.2.5.2.2.C	Resolution - Elevation	T	X	X	X	
3036	3.2.1.2.5.2.3.A	Accuracy - Azimuth	T	X	X	X	

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NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	NAS-SS-1000	Title/Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
3037	3.2.1.2.5.2.3.B	Accuracy - Range	T	X	X	X	
3038	3.2.1.2.5.2.3.C	Accuracy - Elevation	T	X	X	X	
3039	3.2.1.2.5.2.4	System sensitivity	T	X	T	X	
3040	3.2.1.2.5.2.5	Frequency	T	X	X	X	
3041	3.2.1.2.5.2.6.A	Scanning strategies - 360 degrees	T	X	X	X	
3042	3.2.1.2.5.2.6.B	Scanning strategies - Azimuth sector scans	T	X	X	X	
3043	3.2.1.2.5.2.6.C	Scanning strategies - Range height indicator scan	T	X	X	X	
3044	3.2.1.2.5.2.7	Archiving	T	X	T	X	
3045	3.2.1.2.5.2.8	Alarm	A	X	X	T	
3046	3.2.1.2.5.2.9	Update Rate	A	X	X	T	
3047	3.2.1.2.5.2.9.1	Winds distribution	A	X	X	T	
3048	3.2.1.2.5.2.10	Data destination	D	X	X	X	
3049	3.2.1.2.5.2.11	Maintenance monitoring performance characteristics	D	X	D		
3050	3.2.1.2.5.2.12.A	Weather processing performance - Six level monitoring	T	X	X	X	
3051	3.2.1.2.5.2.12.B	Weather processing performance - No data display	X	D	X	X	
3052	3.2.1.2.5.2.12.C	Weather processing performance - Storm motion	D	I	T	X	
3053	3.2.1.2.5.3.A	Functional/physical interfaces - LLWAS - TDWR	X	X	T	X	
3054	3.2.1.2.5.3.B	Functional/physical interfaces - MDT - TDWR	X	X	I	X	
3055	3.2.1.2.5.3.C	Functional/physical interfaces - TDWR - MDT	X	X	I	X	
3056	3.2.1.2.5.3.D	Functional/physical interfaces - MPS - TDWR	X	X	D	X	

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NAS-SS-1000 VOLUME III TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

3057	3.2.1.2.5.3.E	Functional/physical interfaces - TDWR-MPS	X		D	X	
3058	3.2.1.2.5.3.F	Functional/physical interfaces - TCCC-TDWR	Q		Q	Q	
3059	3.2.1.2.5.3.G	Functional/physical interfaces - TDWR-TCCC	Q		Q	Q	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5001	3.2.1.1.1.1.1.f	Subsystem performance data collection. The RMS will collect data from the associated NAS subsystem as indicated below:	D	X	D	X	
		a. An RMS shall collect subsystem key performance parameters in real time by use of hardware sensors, software sensors, or both from the subsystem of which it is an inherent part;					
		d. The RMS shall collect self-test and monitoring information on the status, performance, and use of its own hardware and software for inclusion as part of the key performance or diagnostic performance parameters or both and make this data available to the MPS upon request;					
		e. The RMS shall collect operating status and performance data that includes configuration and mode of operation from each subsystem within the subsystem of which it is inherent part;					
		f. When directed by the MPS or MDT, the RMS shall initiate diagnostic routines, then collect the results for transfer to the location specified by the requestor.					
5002	3.2.1.1.1.1.1.3	Control data collection. The RMS will collect control data which direct its actions as indicated below:					
		a. The RMS shall receive and recognize valid commands from either the MPS or the MDT including those to activate the functions given in 3.2.1.1.1.1.2.3;	X	X	X	D	
		b. Upon request from an MDT, the RMS shall collect performance data for and switch control to the MDT;	D	X	D	X	
		c. The RMS shall automatically disable alarms and alerts when in local mode.	X	X	X	D	

Verification Methods: T=Test, D=Demonstration, A=Analysis, I=Inspection, X=Not Applicable, Q=Not Available in the NAS

TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5003	3.2.1.1.1.1.1.4	Automated functions for data collection. The RMS will implement the automated functions in the collection process indicated below:		X			
		a. The RMS shall perform all collection functions including monitoring performance data, configuration data, and incoming requests at sampling rates which allow the system to detect changes commensurate with allocated RMS performance requirements;	D		D	X	
		b. The RMS shall accept general messages and requests for data from either an MPS or an MDT.	D		D	X	
5004a	3.2.1.1.1.1.2.1	Subsystem performance data processing. The RMS will process performance as indicated below: a. compare the measured values of the performance parameters of the subsystem with up to two sets of stored thresholds-one set defining the ideal operating range representing the best possible conditions and one set defining the acceptable operating range representing the minimum permissible conditions-and determine within which range the parameters reside. Each range will be defined by up to two values to include an upper and a lower limit; b. filter or average the performance parameters to prevent the declaration of alarms due to transient conditions; c. generate an alarm when a key performance parameters value is outside the acceptable operating range; d. generate an alert when a key performance value is outside the ideal operating range but inside the acceptable range; e. In the event of simultaneous multiple alarm conditions all alarms are stored in the RMS, and the RMS shall forward for transmission to the active interface all alarms on a first-in, first-out basis;	D	X	D	X	

Verification Methods: T=Test, D=Demonstration, A=Analysis, I=Inspection, X=Not Applicable, Q=Not Available in the NAS

TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5004b	3.2.1.1.1.1.2.1 (conti)	Subsystem performance data processing. The RMS will process performance as indicated below: f. monitor and check each and every key performance parameter value for an alarm or an alert condition at least once during each general status cycle. A general status cycle consists of collecting and evaluating all data necessary to determine the health of the system and reporting the results (e.g. alarms, alerts, or sys okay) to the RMS/MPS interface or the RMS/MDT interface or both as required by the communications mode in effect. The time period in which the general status cycle must be completed shall be programmable from five seconds to 60 second in increments of 5 second or less; g. Monitor and check each and every key performance parameter value, detect any changes in value, and report the changed values to the RMS/MPS interface or the RMS/MDT interface or both as required by the communications mode in effect. The time period in which the general status cycle must be completed shall be programmable from 10 second to 2 minutes in increments of 10 second or less;	D	I	D	D	
5004c	3.2.1.1.1.1.2.1 (conti)	Subsystem performance data processing. The RMS will process performance as indicated below: h. Generate a general status message and a key performance parameter message at times which depend on the individual cycle time defined above; i. generate a RTN message when a parameter causing an alarm or alert condition returns to its ideal operating range; j. determine if a monitored data point, status, or condition has changed between the sampling of parameter values and generate a state change message if the state has changed; k. initiate a diagnostic test of a subsystem, which includes fault solation, in response to appropriate MPS or MDT command; l. initiate a fault recovery routine if an alarm or alert is generated.	D	X	D	X	

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REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5005	3.2.1.1.1.1.2.2	Security data processing. The RMS will process both facility and data access security data as follows: The RMS shall: e. provide for the disabling of automatic log off of an MDT by an authorized operator; f. generate an access denied message to be sent to the MPS and to the originating device when an invalid user identification code or password is collected or when an unauthorized function is attempted; g. generate a state change message for transmission to the MPS when an MDT is connected to or disconnected from an RMS; h. allow communication with an MDT via an external link only if processed through an MPS, including MDT's connected to a separate RMS.	D	I	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5006a	3.2.1.1.1.1.2.3	Control data processing. The RMS will process control actions as indicated below: a. Upon receipt of a valid command from either the MPS or the MDT, the RMS shall execute the control command; b. Upon receipt of a valid command from either an MDT or an MPS, the RMS shall change the current operating mode or configuration of a subsystem to the operating mode or configuration requested; c. Upon receipt of a valid command from either an MDT or an MPS, the RMS shall adjust the subsystem parameter as requested; d. Upon receipt of a valid command from either an MDT or an MPS, the RMS shall reset a subsystem or a part of a subsystem; e. Upon receipt of a valid command from either an MDT or an MPS, the RMS shall disable an alarm or alert indication; f. Upon receipt of a valid command from either an MDT or an MPS, the RMS shall change the requested threshold values of the parameters being monitored; g. Upon receipt of a valid command from on-site MDT, the RMS of single thread equipments shall switch from remote communication with the MPS to a local communication mode with the MDT, providing exclusive control of the subsystem from the MDT;	X	I	X	D	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL. V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5006b	3.2.1.1.1.1.2.3	h. Upon receipt of a valid command from an on-site MDT, the RMS of multi-thread (redundant) equipments shall provide communication and exclusive control without interruption of off-line units to the MDT monitoring of on-line equipments; i. Upon disconnect of an on-site MDT, the RMS shall automatically return to the remote communication mode with the MPS;	X	I	X	D	
5007a	3.2.1.1.1.1.2.4	Automated functions for data processing. The RMS will provide the capabilities indicated below: b. compare filtered key performance parameter values with the two sets of threshold values as part of each General Status Cycle to determine if an alarm or alert condition has occurred. One set of threshold values is for alarm condition determination while the other set of thresholds is for thresholds is for alert condition determination; c. generate a report containing parameter values in response to a data request; d. generate a status report containing alarm and alert condition in response to a subsystem status request; e. generate a maintenance data message containing information requested by either an MDT or an MPS; f. provide a date in the form of month/day/year and universal time code (UTC) in the form of hours/minutes/seconds on each message and report; g. accept commands and requests from the MDT; h. generate the appropriate response to all commands;	D	X	D	X	

Verification Methods: T=Test, D=Demonstration, A=Analysis, I=Inspection, X=Not Applicable, Q=Not Available in the NAS

TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5007b	3.2.1.1.1.1.2.4	Automated functions for data processing. The RMS will provide the capabilities indicated below: i. The RMS shall make available all command responses to the MPS or the MDT or both depending upon the nature of the request; j. The RMS shall prepare all messages for transmission in the appropriate protocol; k. The RMS shall convert sensor input information into values directly related to engineering units such that no scaling other than decimal placement shall be required of the receiving MPS or MDT; l. The RMS shall contain two modes - a remote mode for communication solely with the MPS, a local mode for communication solely with the MDT, and a dual mode which provides all messages to both the MPS and the MDT while being controlled solely via the MDT interface.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5008	3.2.1.1.1.1.3.1	Subsystem performance data storage. The RMS will store instructions and data as indicated below: a. The RMS shall store all detected alarms and alerts until such alarm or alert condition no longer exists; b. The RMS shall be able to store key performance parameter values, diagnostic results, and operating mode data in temporary storage in preparation for transferring said information to the MPS; c. The RMS shall store terminal messages routed from an MDT to an MPS and routed from an MPS to an MDT until the transfer has been successfully received by the MPS or the MDT; d. The RMS shall store two sets of threshold values (each set to include: an upper limit, a lower limit, or both) with one set for alarm thresholds and one set for alert thresholds in nonvolatile storage; e. The RMS shall store general programs needed for filtering data, formatting messages, encoding messages, converting data, and addressing messages in nonvolatile storage; f. The RMS shall store cycle time intervals for each of the cycles required by 3.2.1.1.1.1.2.1.f. g. The RMS shall maintain records of the value of each monitored parameter, periodically updating each record.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5009	3.2.1.1.1.1.3.3	Control data storage. The RMS will store control data as indicated below: a. The RMS shall store information needed to decode control and adjustment commands for that RMS; b. The RMS shall store the initialization data needed to initialize the subsystem including all site dependent parameters in non volatile memory; c. The RMS shall store all disable commands received until the alarm is re-enabled.	D	X	D	X	
5010	3.2.1.1.1.1.3.4	Automated Functions of data storage. The RMS will provide automated storage capabilities as indicated below: a. The RMS shall store only filtered key performance parameter values obtained through monitoring; b. The RMS shall store alarm and alert threshold values, initialization tables, data required for interpreting addressing, and control and adjustment message function codes in non volatile storage; c. The RMS shall update stored performance parameter values and status data at least once during the general status cycle time interval, only keeping the most current equipment performance data; d. The RMS shall store, in nonvolatile memory, the data necessary for interpreting a message function code (the code within a message used by the RMS to determine the type of message); e. The RMS shall retrieve maintenance data stored in the RMS and deliver it to the requesting unit upon receipt of a valid command.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5011	3.2.1.1.1.1.4.1	Subsystem performance data transfer function. The RMS will transfer monitoring data as indicated below: a. The RMS shall transfer collected subsystem performance data and status messages to the MDT and MPS upon request; b. The RMS shall transfer performance parameter data as a data report to the MPS upon at a specified interval defined as the key performance parameter cycle time interval; c. At a specified interval defined as the general status cycle time interval, the RMS shall transfer general status information consisting of a subsystem identifier, a date and time-stamp, and an indication that the subsystem is either 1) in an alarm condition (red status), 2) in an alert condition (yellow status), or 3) operating properly (green status); d. The RMS shall transfer a state change message when such a change is determined and requires MPS notification. If appropriate, this message includes information indicating a specialist has logged on or off the RMS via an MDT; e. The RMS shall transfer the diagnostic performance parameter values to either the MDT or the MPS when requested. This request does not imply MPS control; f. If an alarm or an alert condition is detected, the RMS shall transfer the appropriate alarm or alert message containing measured parameter values to the MPS once.	D	X	D	D	
5012	3.2.1.1.1.1.4.2	Facility security data transfer. All security alarms, either facility or data access, shall be transmitted to the MPS.	D	X	D	D	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5013	3.2.1.1.1.1.4.3	Control data transfer control data as indicated below:	D	X	D	D	
		a. The RMS shall transfer a message indicating a state change whether the change is due to an automatic process or a command;					
		b. Upon receipt of an invalid command, the RMS shall transfer a message indicating that the received command is invalid to the source of the input;					
		c. The RMS shall report the disabling and enabling of an alarm or an alert as a state change.					
5014	3.2.1.1.1.1.4.4	Automated functions for data transfer. The Rms will provide automated data transfer as indicated below:	D	X	D	D	
		a. When an MDT is attached to the RMS port, the RMS shall provide the MDT operator access to the RMMS network provided that the operator satisfies the appropriate security procedures;					
		b. The RMS shall transmit data in response to a valid request from the MPS and the MDT.					
5015	3.2.1.1.1.3	Functional and physical interfaces. The RMS shall interface functionally and physically as shown in figure 3.2.1.1.1.3-1. The RMS functional interfaces are defined in Table 3.2.1.1.1.3-1. The RMS shall have the following functional and physical interfaces:	X	X	X	X	LEAD-IN
		a. The NAS subsystem containing the RMS shall contain a dedicated port for attachment of an MDT;	D		X	X	
		b. No RMS function shall interfere with other functions of the RMS or the subsystem of which it is a part.	X		X	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5016	3.2.1[illegible]1.1	Subsystem performance data collection. The MDT will collect data associated with monitoring subsystem performance as follows: a. The MDT shall collect key performance parameter values, diagnostic performance parameter values, status messages, alarm messages, and alert messages from the RMS either directly or through the MPS; b. The MDT at an RMS location shall collect maintenance management information via the RMS for use by the maintenance specialist; c. The MDT shall collect the maintenance documents, including manuals and drawings, necessary for the technician to perform corrective and preventative maintenance on a NAS subsystem; d. The MDT shall collect data from the MPS via modem.	D	X	D	X	
5017	3.2.1.1.3.1.1.2	Security data collection. The MDT will collect security data as indicated below: a. The MDT shall collect subsystem security data including facility and data access security alarms from the RMS; b. The MDT shall collect passwords and user identification codes to pass through the appropriate unit for either MPS or RMS log on from the specialist.	D	X	D	X	
5018	3.2.1.1.3.1.1.3	Control data collection. The MDT shall collect control commands listed in 3.2.1.1.3.1.2.3	D	X	D	X	
5019	3.2.1.1.3.1.1.4	Automated functions for data collection. The MDT shall collect user messages.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5020	3.2.1.1.3.1.2.1	Subsystem performance data processing. The MDT will process performance data as indicated below: a. The MDT shall format and display key performance parameter values, diagnostic performance parameter values, status messages, alarm messages, and alert messages from the RMS and the MPS; b. The MDT shall display (visual and aural) indications of alarm and alerts to specialists.	D	X	D	X	
5021	3.2.1.1.3.1.2.2	Data access security for data processing. The MDT will process security data as follows: a. The MDT shall interact with the RMS or the MPS eventually to verify a specialist's authorization and permitted access to the RMMS by passing the user entered user identification code and password to the RMS; b. The MDT shall initiate a message commanding the RMS to inhibit all alarms generated by a facility or subsystem when in the local control mode.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5022	3.2.1.1.3.1.2.3	Control data processing. The MDT shall translate and encode the following type of requests from the user and prepare each for transfer to the RMS: a. On-off control b. Change mode c. Change configuration d. Adjust subsystem parameter e. Disable and enable alarm or alert reports f. Switch to local or dual mode g. Maintenance data residing in the MPS h. Maintenance documents residing in the MPS and the MDT.	X	X	X	X	
5023	3.2.1.1.3.1.2.4	Automated functions for data processing. The MDT will provide the automated data processing capabilities indicated below: a. The MDT shall accept alphanumeric data and free-form text, and syntax checks on selected entries for standard formats; b. The MDT shall format and display alphanumeric text and graphics; c. The MDT shall work with all RMS and MPS application software functions.	D	X	D	X	
5024	3.2.1.1.3.1.3.1	Subsystem performance data storage. The MDT shall retain log entries for later transfer to the MPS in the event that communication between an MDT and an MPS is lost or nonexistent.	D	X	D	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5025	3.2.1.1.3.1.3.4	Automated functions for data storage. The MDT will perform the following automated functions: a. The MDT shall retain software applications which the specialist to initiate diagnostic routines, keep maintenance logs, and change parameters at the RMS; b. The prepared MDT display (screens) described in software applications shall look and act like those screens contained in the MPS or the MCCP-MMC; c. The MDT shall date and time-stamp all log entries in the format YYMMDD (YY - year, MM - month, and DD - day) if storing temporarily.	D	X	D	X	
5026	3.2.1.1.3.1.4.1	Subsystems performance data transfer. The MDT shall transfer log entries either from storage or directly when entered to the MPS for storage.	D	X	D	X	
5027	3.2.1.1.3.1.4.3	Control data transfer. The MDT shall transfer stored control actions to the MPS including: a. Control actions taken b. Parameter changes c. Configuration changes.	D	X	D	X	
5028	..1.1.3.1.4.4	Automated functions for data transfer. When connected to either an MPS or an RMS, the MDT shall transfer electronic messages from the keyboard to the RMS for pass through to the MPS.	X	X	X	X	LEAD-IN
5029	3.2.1.1.3.2.2	Communication. The MDT shall provide for the transfer of specialists' messages up to 4000 characters within an average time of 60 seconds and a maximum time of 120 seconds. This time is measured from the time the message is output by the MDT to the message receipt at the MPS.	AT	X	T	X	

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TERMINAL DOPPLER WEATHER RADAR
NAS-SS-1000 VOLUME V RMS/MDT VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

REQ#	NAS-SS-1000 VOL V PARA # (February 1993-SCN)	DESCRIPTION VOL V GENERAL & PERFORMANCE REQUIREMENTS (RMS/MDT)	DTE	OTE (O)	OTE (I)	OTE (S)	REMARKS
5030	3.2.1.1.3.3	Functional and physical interfaces. The MDT shall interface functionally and physically as shown in figure 3.2.1.1.3.3-1. The MDT functional interfaces are defined in Table 3.2.1.1.3.3-1. The MDT will have the following functional and physical interfaces: a. The MDT shall support peripheral devices including a plotter and a printer; b. The MDT shall have the capability to interface with the commercial telephone network; c. The MDT shall contain a standard port for interface with the RMS; d. The MDT shall have the capability to physically interface with the MPS.	D	X	D	X	

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Terminal Doppler Weather Radar
Build 5 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	SPECIFICATION FAA-E-2806/1	Title / Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
S1001	1.3.3.4	Display Function: TDWR will display integrated TDWR and LLWAS information.	T	I	I	D	Build 5A & 5B
S1002	1.3.4	Archiving: TDWR will automatically archive the latest fifteen (15) days of products.	T	T	X	D	Build 5B
S1003	1.3.7	TDWR will provide LLWAS wind products provided by the LLWAS.	T	D	I	I	Build 5A & 5B
S1004	1.3.8	Relation between Products, Algorithms, Maps, and Alarms: Government will provide algorithms to derive hazardous weather information from the base radar and LLWAS data.	T	D	T	I	Build 5B
S1005	1.3.11	The TDWR will provide LLWAS wind information, center fields and runway threshold winds, along with TDWR weather products on the situational display and RDT. TDWR will interface with LLWAS III when both systems exist at a site.	T	I	T	I	Build 5A & 5B

VERIFICATION METHOD: T=TEST, D=DEMONSTRATION, A=ANALYSIS, I=INSPECTION, X=NOT APPLICABLE, Q=NOT AVAILABLE IN THE NAS

Terminal Doppler Weather Radar
Build 5 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	SPECIFICATION FAA-E-2806/1	Title / Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
S1006	3.1.4.4.2.1	Archive Media Status: During Archive transfer, total number of kilobytes to transfer, kilobytes written to archive medium, and indication of archive complete will be displayed. The situation display shall display alphanumeric and graphic products, equipment status, TDWR mode, archive status, and active runway configuration. See specification page 38, & 39 for more information.	T	I	T	X	Build 5B
S1007	3.1.4.4.2.3.2	TDWR/LLWAS Backup: ATCT and TRACON DFUs shall have the capability to accept and display from the LLWAS-II/III whenever TDWR is in maintenance mode or TDWR alphanumeric/graphic data is unavailable.	T	I	T	I	Build 5A & 5B
S1008	3.1.7.1.1.3	LLWAS: TDWR shall interface with the LLWAS for receipt of LLWAS status, wind, and configuration data.	T	I	T	D	Build 5A & 5B
S1009	3.1.7.1.3.2.1	Interface Configuration: NAS-IR-31023105, Part 1 (Interface Requirements Document (IRD) for LLWAS III), NAS-IR-31023105, Part 2 (IRD for LLWAS II), NAS-IR-22013105 (IRD for TCCC), NAS-MD-790 (ICD for RMMS)	Q	Q	Q	Q	Build 5A & 5B

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Terminal Doppler Weather Radar
Build 5 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	SPECIFICATION FAA-E-2806/1	Title / Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
S1010	3.3.1.1.2	Loading: Software shall not be loaded to more than sixty percent of capacity when averaged over any continuous fifteen second period. Function of a fixed, unvarying nature, such as conventional mathematical relations, or expressions governed by well-recognized physical laws, are excluded from this load. The interim situation display hardware is excluded from this requirement. subsystem status/Generate alarm.	T	I	I	I	Build 5A & 5B
S1011	3.3.1.1.4	Auxiliary Storage: Each type of memory (ROM), RAM, NVRAM, PROM, EPROM,EEPROM) for each TDWR system shall not be loaded to more than seventy-five percent of capacity when averaged over any continuous fifteen second period. Reference page 65 of the specification.	T	X	I	X	Build 5A & 5B

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Terminal Doppler Weather Radar
Build 5 VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

Req ID#	SPECIFICATION FAA-E-2806/1	Title / Description	Verification Level/Method				Remarks
			DT&E	OT&E-O	OT&E-I	OT&E-S	
S1012	3.5.1.7.3	Archive Data Recorder: The TDWR shall have a portable Archive Data Recorder for transferring archive data from the situation display. Specific characteristics: playback of archive data via the Archive Product Playback unit and a minimum storage capacity of 15 days of archive data per single storage medium.	T	D	D	I	Build 5B
S1013	4.2.1.16	System Enhancement Test: System test shall be performed to ensure: 1) requirements specified in the government directed enhancement have been correctly implemented; and that the enhancement has not adversely affected other system functions and parameters. Test should consist of certification checks, on-line diagnostics, weather algorithms, performance monitoring, GSD, RDT, and operational entries. The last hour of this test shall be run utilizing a full load weather scenario consisting of five microbursts and six gust fronts as a minimum. During this test any valid operational command shall be permitted and system timing and capacity shall be verified.	T	X	X	X	Build 5A & 5B

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S1014	10.1.2	Product Distribution. The following products need to be distributed to displays and ports within 15 seconds: microburst, gust front, LLWAS Winds, LLWAS Threshold Winds, LLWAS CFW. Precipitation product has up to 60 seconds.	T	D	X	I	Build 5A & 5B
S1015	10.5.5	LLWAS Winds. The LLWAS winds product shall depict the current wind speed and direction of winds detected by the LLWAS II sensors.	T	D	X	I	Build 5A & 5B
S1016	10.5.5	LLWAS Threshold Winds. The LLWAS threshold winds product shall depict the current wind speed and direction of runway threshold winds detected by LLWAS III sensors.	T	T	X	I	Build 5B
S1017	10.5.6	LLWAS Center Field Wind. The LLWAS center field wind product shall depict the current wind speed and direction, and gust wind speed.	T	T	X	I	Build 5A & 5B

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S1018	20.1.1.1.5	Readability. The situation display shall have an adjustable brightness control. The displayed characters, graphics, and symbols shall be readable from a distance of 5 feet and +- 40 degrees.	T	D	X	I	Build 5A & 5B
S1019	20.1.1.9	Data Archiving. The situation display shall provide for the archiving of fifteen days or more of generated products, system status messages, and end-user inputs. All data shall be tagged with Julian date, hour, minute, and second.	T	D	X	I	Build 5B
S1020	20.1.1.9.1	Product and Data Storage. The situation Display shall store-on-line fifteen days of data, including the latest generated data, required for archiving and retain this data during power loss and maintenance activities.	T	D	X	I	Build 5B
S1021	20.1.1.9.2	Archive Transfer. Upon execution of a protected command, the Situation Display shall transfer the archived data to a transportable storage medium.	T	D	X	I	Build 5B

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S1022	20.1.1.9.3	Archived Data Erasing. The Situation Display shall not erase or overwrite the archived data except: 1) in response to explicit physical and software actions, such as password entry and mechanical switching; or 2) to overwrite archive data that is over fifteen days old in order to archive new data.	T	D	X	I	Build 5B
S1023	20.1.2.1.1	Size. A standard size and a small envelope size Ribbon Display will be required. The Ribbon Display shall have the least area required to display 10 lines of 25 characters.	D	I	X	I	Build 5A & 5B
S1024	20.1.2.1.4	Readability. The Ribbon Display shall be readable in full sunlight. The Ribbon Display shall be readable: 1) from a distance of ten feet and at angles of -+ 60 degrees from center line for the Standard Ribbon Display; and 2) from a distance of 6 feet and at angles of =- 60 degrees from center line for small Envelope Ribbon Display. No hood shall be used.	D	I	X	I	Build 5A & 5B

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S1025	3.4.1.3.1	Mean Time Between Failure. The TDWR shall have MTBF as follows: TDWR System: 550 Base Data Recorder: 5000 Portable Base Data and Product Display: 5000 Situation Display: [illegible]0 Ribbon Display: 9000 hours.	D	D	X	A	Due to the extensive number of failures observed on the TDWR during operational testing, the DT&E Demonstration cannot be used as an indicator that the system has passed required MTBF requirements.
S1026	20.1.2.1.6	Display Blanking. The Ribbon Display screen shall be blanked and an equipment status message displayed when any of the following conditions occur: 1) Ribbon Display communication is interrupted longer than an adaptable time period (with a default value equal to approximately 1 minute), 2) the TDWR and LLWAS is non-operational due to a failure, 3) the GSD Display fails. The Ribbon Display shall resume operation when the blanking condition(s) no long exists.	T	D	I	I	Build 5B

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