Report No. DOT/FAA/CT-81/194B

TEST AND EVALUATION OF SOLID-STATE DOPPLER VERY HIGH FREQUENCY OMNIDIRECTIONAL (DVOR) DISTRIBUTOR ASSEMBLY

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PROJECT PLAN
ADDENDUM

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Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
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PREFACE

This document is the second addendum to project plan "Test and Evaluation of Solid-State Doppler Very High Frequency Omnidirectional Range (DVOR) Distributor Assembly," No. DOT/FAA/CT-81/194, by Wayne Bell, dated February 1982.

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1. PROJECT DEFINITION.

1.1 PURPOSE.

The purpose of this project is to conduct reliability tests of the first production type solid-state Doppler very high frequency omnidirectional range (VOR) distributor assembly (DVDA), type FA-9967, at the experimental Doppler facility.

1.2 BACKGROUND.

The Federal Aviation Administration (FAA) is in the process of replacing existing tube-type very high frequency omnidirectional range tactical air navigational and (VORTAC) and Doppler VOR facilities with new solid-state equipment referred to as second generation VOR/Doppler very high frequency omnidirectional range (DVOR), type FA-9996. In support of this effort, the Program Engineering and Maintenance Service Branch, APM-420, has a current contract, DOT-FA 78 WAI-940, with Henderson Industries, an 8A contractor, to build solid-state distributors. The breadboard and prototype DVDA was tested June 1982 at the FAA Technical Center Experimental DVOR Facility to ascertain that the design approach was consistent with performance requirements.

APM-420 has requested that reliability tests be conducted on the first production-type distributor (FA-9967) at the Technical Center's experimental Doppler Facility (building 188). Test measurements will be conducted at periodic intervals for 7 months to determine performance and stability.

1.3 TECHNICAL REQUIREMENTS.

The contractor's approved "Reliability Demonstration Tests Procedures and Data Sheets" document dated May 1984 is the criteria to be used during the reliability test period (see the appendix). Ground and flight measurements and data collection will be in accordance with the above test procedures.

2. TEST PROCEDURES.

These tests will be conducted at the experimental DVOR facility. The facility will be configured as a double sideband (DSB) Doppler VOR using the solid-state distributor with the second generation VOR equipment (FA-9996). A Convair 580 (N-91) aircraft will be used for flight testing.

Assembly and initial testing on the DVDA will be performed jointly by Technical Center personnel and an APM-420 representative. Reliability tests will start upon satisfactory completion of initial ground and flight tests.

2.1 FLIGHT TESTS.

Flight tests will be conducted prior to start of reliability tests. Flight tests will consist of one 12-nautical orbit (nmi) at 1,500 feet altitude and a 225° radial at 3,500 feet altitude, to a distance of 40 nmi. Guidance will be provided by the extended area instrumentation radar (EAIR) facility. The VOR

flight inspection system consisting of an FA65.3A Bendix VOR receiver and oscillograph recorder will be used to record various VOR receiver signal levels of the DVOR radiated navigation signal. Flight tests and ramp time is estimated to require approximately 4 hours.

2.2 GROUND TESTS.

After installation, adjustment, and alignment of the DVDA, an initial ground bearing error check will be made. This is a unique Doppler facility in that the entire antenna array can be physically rotated through 360°. The indicated digital display of angles at the control panel are determined from accurately measured marks on the rotating portion of the antenna array and a fixed photo cell sensor. The second generation monitor, FA-9996/2.4, will be used for recording each 10° azimuth angle. This will establish base line data prior to start of the reliablity tests. Test procedures, measurements, and data collection are documented in the contractor's test plan (see the appendix).

2.2.1 Solid State Distributor (FA-9967) Tests.

The following list of DVDA test measurements at the distributor are part of test procedures of the appendix.

Daily Measurements

1. Carrier sample input power
2. Upper sideband input/output power
3. Lower sideband input/output power
4. Goniometer input/output power
5. 30 Hertz (Hz) output level

Weekly Measurements

1. 30 Hz frequency stability
2. Oscillator stability
3. Distributor timing precision
4. Alarm delay
5. Sideband output alarm limit
6. 30 Hz distortion

2.3. SECOND GENERATION VOR EQUIPMENT (FA-9996).

2.3.1 General.

The second generation VOR equipment (FA-9996) for operations consist of the VOR transmitter (FA-9996/2.1), monitor (FA-9996/2.4), facility central processing unit (FCPU) (FA-9996/2.3), and power subsystem cabinet. An input/output terminal (IOT) and teleprinter are used for monitoring and recording transmitter and monitor data information.

The VOR transmitter is used to supply radio frequency (RF) power to the Doppler carrier antenna. A Yagi antenna located on the 90° radial and 500 feet from the station provides a sample of the radiated signal to the monitor.

The IOT and teleprinter terminals are provided to allow the operator to interface with the FCPU. The IOT displays data and status information and is used to enter and display commands. The teleprinter will provide hard copy records of formatted status information.

The FCPU oversees: (a) automatic fault isolation to modules, (b) maintenance data collection, (c) collection of real time status information of the VOR monitor and VOR transmitter, (d) programmable parameter control, (e) certification testing, and (f) monitor integrity testing.

The following VOR monitor and transmitter test measurements will be recorded daily.

2.3.2 Monitor (FA-9996/2.4) Tests.

The IOT will be used to collect the following VOR monitor data:

a. Azimuth Angle
b. 30Hz Modulation
c. 9960 Hz Modulation
d. 9960 Hz Deviation (Ratio)
e. Ident Modulation
f. Field Intensity

2.3.3 Transmitter (FA-9996/2.1) Tests.

The IOT will be used to collect the following VOR transmitter data:

a. Azimuth Angle
b. 30 Hz Modulation
c. Power Out
d. Ident Modulation
e. Audio Modulation

The above data are some of the requirements of the contractor's test plan and will be recorded daily.

2.4 SIDEBAND TRANSMITTER (FA-9453).

The sideband transmitter provides upper and lower sideband RF power to the solid-state distributor. Power output will be measured at the distributor.

2.5 TEST EQUIPMENT.

The following test equipment will be available for test measurements:

a. Oscilloscope Ballantine type 1040A on Tektronix type 465.
b. H.P. distortion analyzer type 334A.
c. Digital multimeter B&K type 2831.

d. Frequency counter, Systron Donner type 6053.

e. RF wattmeter (3) Bird model 4301, for test set up. Two wattmeters are used for daily measurement.

3. DATA COLLECTION AND REDUCTION.

3.1 FLIGHT TESTS.

Flight test data collection and reduction will be conducted to ascertain that the operational performance of the Doppler's performance is comparable to previous test data.

3.2 GROUND TESTS.

The ground test data reduction will be in accordance with the contractor's approved test plan (see the appendix).

4. SCHEDULE.

The estimated test schedule of this effort is shown in figure 1.

5. PRODUCT.

Reliability performance and tests results will be documented in a Technical Note.

MILESTONE SCHEDULE	MONTHS FROM PROJECT START												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Distributor Installation	X	X											
Pre Ground and Flight Tests	X	X											
Reliability Tests		X							X				
Data Reduction		X								X			
Technical Note											X		

FIGURE 1. SCHEDULE

APPENDIX A

CONTRACTOR'S RELIABILITY DEMONSTRATION

TESTS PROCEDURES AND DATA SHEETS

DOPPLER VOR DISTRIBUTOR ASSEMBLY

Contract No. DOT-FA78WAI-940

RELIABILITY DEMONSTRATION TESTS

PROCEDURES & DATA SHEETS

PREPARED BY: SYSTEMS CONTROL CORP

FOR: H. F. HENDERSON INDUSTRIES

45 FAIRFIELD PLACE

WEST CALDWELL, NJ 07006

Doc. No. 820120
Revised 3-16-82, 6-14-82, 4-5-84

Rev. 6-20-84 P-12

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List of Reference Documents

FAA-E-2589	Doppler VOR Distributor Assembly
FAA-G-2100/1b	Electronic Equipment, General Requirements
H.F. Henderson Ind.	Doc. 8110130 Design Qualification Tests
H.F. Henderson Ind.	Doc. 8110270 Type Tests
H.F. Henderson Inc.	Doc. 8112150 Production Tests
FAA AC 73-8138	Doppler VOR System Training Manual
ICAO	Doc. 8071 3rd Ed. Manual on Testing of Radio Navigation Aids Vol. 1
MIL-STD-781B	Reliability Tests
H.F. Henderson Ind.	Doc. 4-1-81 Rev. B Feasibility Analysis and Reliability Prediction

1. Discussion of Reliability Demonstration Test Plan

The specified demonstration test plan is Test Plan VI of MIL-STD-781B. It has a decision risk of 10%, for consumer and producer, as defined in MIL-STD-781B Section 3.1.

The discrimination ratio is 5.0:1, which for a specified MTBF of 10,000 hours implies a minimum acceptable MTBF of 2000 hours . Paragraph 4.2.8.6 of MIL-STD-781B specifies a minimum test time to accept of 5500 hours. The following table shows the total test time to reject or accept given a number of failures.

No. of Failures	Test Hours to Reject (equal or less)	Test Hours to Accept (equal or less)
0	N/A	5500
1	400	9500
2	4400	12500
3	8500	12500
4	12500	N/A

The total test time is the cumulative test time of each equipment totalized for the duration of the tests until a decision to accept or reject has been reached. Since the lot size is variable and depends on the number of equipment released for production and the production schedule, the sample size is undefined but will be based on the following table.

Lot Size	Sample Size
1-3	All
4-16	3 to 9
17-52	5 to 15

The following table lists minimum elapsed time for the minimum test time to accept of 5500 hours for a given number of units assuming equal test time distribution between equipments.

No. of Equipments	Minimum elapsed test time (hrs/mo. or wk.)
1	5500/7.6 mo.
2	2750/3.8 mo.
3	1834/2.5 mo.
4	1375/1.9 mo.
5	1100/1.5 mo.
6	917/5.5 wk.
7	786/4.7 wk.
8	688/4.1 wk.
9	611/3.6 wk.
10	550/3.3 wk.

The minimum test time for any single equipment shall be at least one half the time shown in the minimum test time column. In order to demonstrate a true MTBF as early as possible it will be advantageous to include as many equipments as possible into the demonstration test.

The tests shall be conducted at operating VOR facilities under normal ambient conditions and by FAA operating personnel. The operating temperature shall be ambient temperature: $25 \pm 5^{o}C$; it shall be recorded. Input line voltage shall be nominal voltage: 120 volts, +5 -2%, as specified in MIL-STD-781B paragraph 4.1.2 Test Level A-1; input line voltage shall be recorded.

An FAA supervisory person shall be assigned to oversee the data logging and to compile the data summary. He shall cumulate the number of test hours and decide when this number is sufficiently large to allow an accept or reject decision to be made. After the minimum MTBF of 2000 hours has been reached, he shall review the data once a week.

2. DVOR Operational Set-up

The reliability demonstration tests are conducted under normal VOR operating conditions, with the normal set-up as shown in the block diagrams of Figures 1 and 2. A list of DVOR facility equipment is given in Table 1. In this set-up, additional instrumentation has been included to facilitate continuous monitoring of the equipment; it is listed in Table 2 together with the test equipment not continuously connected. The test equipment is the normal government furnished VOR station test equipment unless otherwise noted.

The block diagram of Figure 1 shows the functional set-up for the condition where the DVDA solid-state goniometer is used. This requires a complete DVDA equipment.

The block diagram of Figure 2 shows the functional set-up for the condition where amplitude modulation of the carrier by the 30Hz reference signal is produced at the carrier transmitter. In this case, the DVDA equipment can operate without a goniometer, board A4A1.

The DVDA equipment shall be installed and integrated within the DVOR system. All adjustments and alignments specified in the technical manual shall be performed. Normal procedures shall be followed to conduct ground checks and flight checks on the DVOR system. Once all checks have been satisfactorily completed and the station is placed in operation (commissioned) the reliability demonstration tests can proceed.

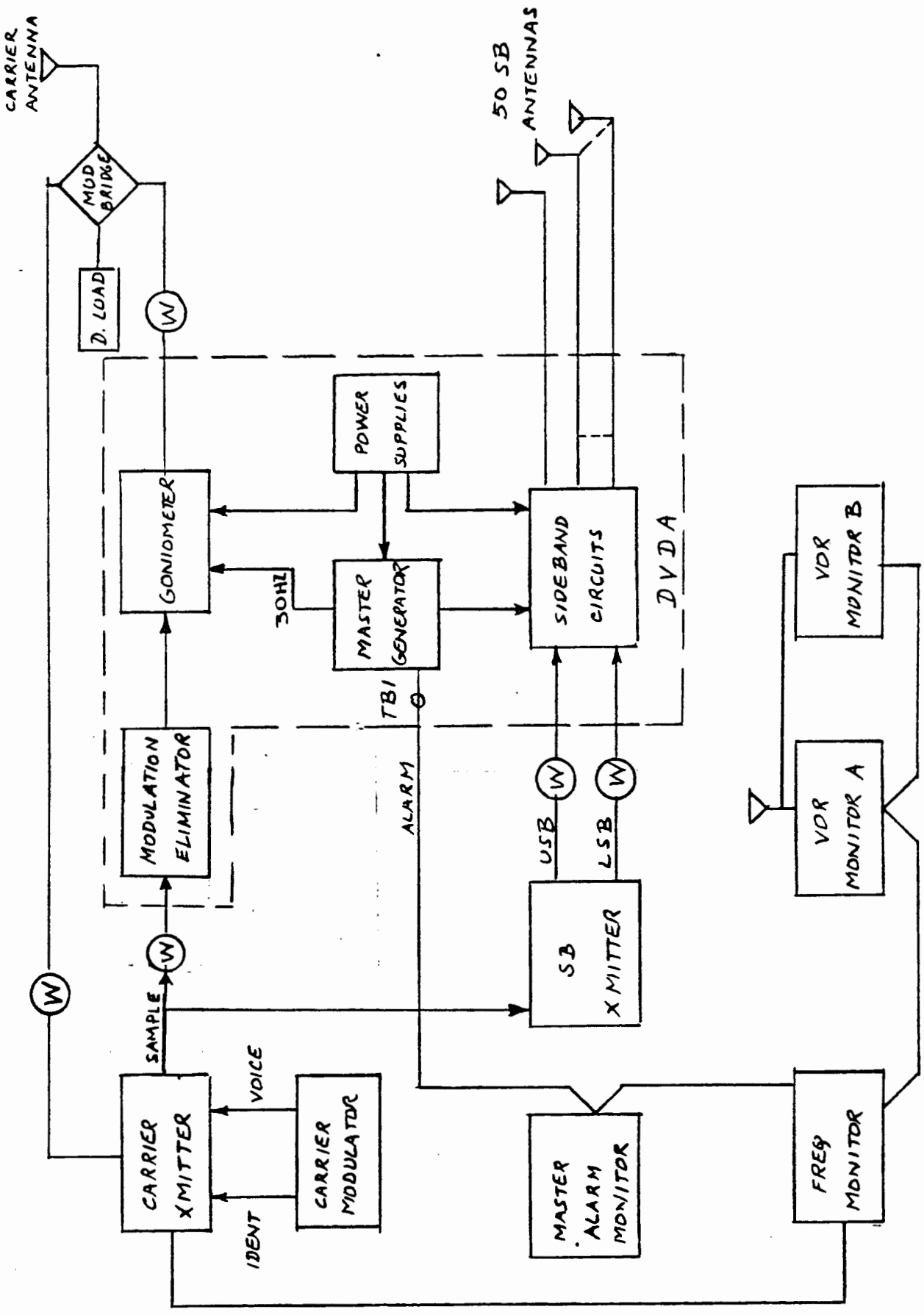

Figure 1. DVOR System Block Diagram with Goniometer

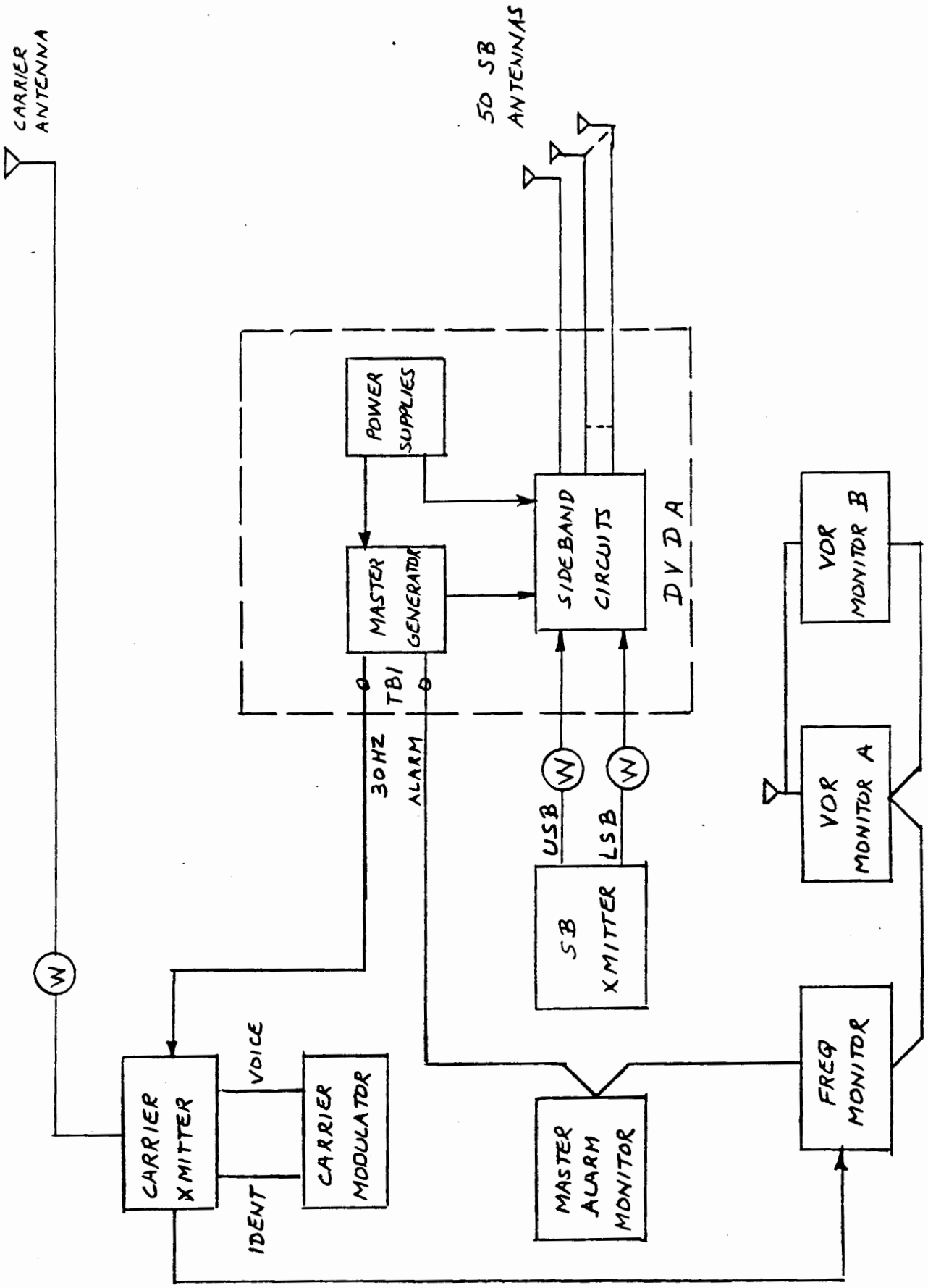

Figure 2. DVOR System Block Diagram with Direct Carrier Transmitter Modulation

TABLE 1

DVOR FACILITY EQUIPMENT

	TYPE/MODEL NO.	SERIAL NO.	INSTALLATION DATE
Carrier Transmitter #1			
#2			
Carrier Modulator #1			
#2			
Modulation Eliminator #1			
#2			
Modulation Bridge			
VOR Monitor A			
B			
Frequency Monitor			
Master Monitor			
DVDA Equipment A1			
A2			
A3			
A4			

TABLE 2

LIST OF TEST EQUIPMENT

EQUIPMENT	MODEL NO.(or equiv.)	TEST
RF Wattmeter (5)	Bird Model 4301	Set-up
DMM	Fluke 8100A	Output Level
Frequency Counter	HP Model 5383A	Frequency Stability
Distortion Analyzer*	HP Model 331A	30 Hz Distortion

* not standard VOR station test equipment

3. Reliability Test Procedures

3.1 Preliminary Data

Record the date, time and facility location. List all equipment units that make up the DVOR system, including serial numbers and installation dates relative to the solid-state DVDA installation in the DVOR system. If for any reason an equipment unit is replaced the new unit serial number shall be recorded.

3.2 Preliminary Procedures

Perform any preventive maintenance required on all DVOR system equipments. Since the DVDA equipment is new, no maintenance should be required for it.

Operate the DVOR system in a standard and FAA approved manner and determine that it operates properly under the test conditions specified in paragraph 1.

Record all performance data and all monitored data as listed on the test data sheets. Performance data are direct measurements on operating parameters at the transmitter and DVDA equipments. Monitored data are parameter measurements derived from an extermal RF detector and processed into a monitor unit.

Allow a continuous burn-in period of 48 hours. As specified in MIL-STD-781B paragraph 5.1.7, failures occuring during the burn-in period may be considered non-relevant but shall be recorded and reported. Non-relevant failures are defined in a following paragraph 3.4.

At the conclusion of the burn-in period, and provided no failure has been observed, a new set of data shall be recorded. Should a failure have occurred and repair been made, a post-repair burn-in period equal to the initial burn-in period shall be allowed (refer to MIL-STD-781B paragraph 5.6).

3.3 Demonstration Test Procedures

Following the burn-in period and recording of data proceed with the demonstration tests. Record date and time of start for each DVOR facility.

Operate the DVOR system in a standard and FAA approved manner. One half hour before the end of the work day, record the data specified in data sheet 1 (Table 4).

On the following work day, within the first hour, record the data specified in data sheet 1, and again one half hour before the end of the work day.

At the start of a work week, within the first day, record the data specified in data sheet 2 (Table 5). If no failure is encountered, at least once a week, cumulate the number of operating hours (Table 5 and Figure 3).

If a failure occurs and it is not relevant the repair shall be made and the timing resumed immediately after repair. If the failure is relevant and a part is replaced, a post-repair burn-in cycle shall take place for 24 hours.

Continue testing until a decision to accept or reject the equipment has been made.

On a continuous basis, enter the time and performance item data in the individual facility test log sheet of Figure 3. Performance items to be entered on this sheet are:

Burn-in initiated
Burn-in completed
Demonstration tests initiated
Failure: relevant
Failure: non-relevant
Repair completed
Tests resumed

Enter the cumulated hours from each facility into the demonstration summary log of Figure 4.

3.4 Failure Categories

A DVOR system failure is defined as the inability of the equipment to perform its function as a navigational aid operating in the double sideband mode within previously established limits (derived from MIL-STD-781B paragraph 3.1).

A failure can be relevant or non-relevant. The following is a list of failures relevant to the DVDA reliability demonstration tests:

1. Any independent failure in the DVDA equipment and which directly causes a DVOR system failure.
2. An independent failure in the DVDA equipment and which causes a dependent failure either external or internal to the DVDA system.

The following is a list of failures non-relevant to the DVDA reliability demonstration tests:

1. Any failure in the DVDA equipment and which does not prevent the DVOR system from performing its function as a navigational aid within previously established limits.

2. A failure in a DVDA equipment function which was not considered in the MTBF calculations for reliability prediction, such as built-in test equipment, LED displays, front panel indicators which are used as maintenance aids.
3. Any independent failure external to the DVDA equipment.
4. A dependent failure in the DVDA equipment and which is caused by an independent failure external to the DVDA equipment.
5. A dependent failure in the DVOR system and which is simultaneous with an independent failure, when it is agreed that the independent failure is entirely responsible for the failure of the dependent part (MIL-STD -781B paragraph 5.5.1 (2)).

3.5 Performance Parameters

On a daily basis, measure and record the data listed in Table 4: Service Conditions and Performance Data Daily Scheduled Tests. Duplicate the blank data sheet as necessary (one blank sheet can be used for several days). Parameter nominal values and tolerance limits are given in Table 6.

On a weekly basis, measure and record the data listed in Table 5: Performance Data Weekly Scheduled Tests.

Carry on established FAA procedures to obtain the standard DVOR and Sideband Transmitter data.

Detailed procedures pertaining to DVDA measurement methods are given in a separate section 4.

4. DVDA Measurement Procedures

4.1 30 Hz Output Level

Using a DVM, measure the 30 Hz output at the DVDA interface sub-assembly TB1 terminals 1 and 2.

4.2 30 Hz Frequency Stability

Using frequency counter, measure time period at the 30 Hz output of the DVDA interface sub-assembly TB1 terminals 1 and 2.

4.3 Oscillator Stability

Using frequency counter, measure frequency at TP7 of pw board A5, in DVDA signal generator unit A4.

4.4 Distributor Timing Precision

1. Set-up electronic counter to read time interval, start-stop mode.
2. Connect start input to feed thru terminal C1 on DVDA switching unit A2 upper sideband A1. Connect stop input to feed thru terminal C1 on switching unit A3 upper sideband A1.
3. Measure time interval.

4.5 Alarm Delay

1. Verify no alarm is present.
2. Temporarily connect a shorting wire across the remote alarm terminals 1 and 2 of TB1 on DVDA interface sub-assembly (rear of rack).
* 3. On DVDA A4 signal generator inner panel, temporarily change the Alarm limit setting to 2.0.
4. Wait up to 8 seconds for alarm indicator (red) on the DVDA A4 signal generator front panel to go on. Also the normal lamp indicator (green) will go off.
* 5. Restore the Alarm limit setting to normal.
6. Wait 4 seconds. Observe the DVDA front panel indicators return to normal.
7. Proceed with the following measurement: sideband output VSWR.

4.6 Sideband Output VSWR

Alarm Limit

* 1. Decrease alarm limit switch settings with unit and tenth thumbwheels until an alarm is detected. For each switch change wait at least 8 seconds to be sure no alarm condition is present.
2. Record the highest setting that creates an alarm condition.
3. Return the alarm limit setting to normal.

4.7 30 Hz Distortion

Using distortion analyzer measure the 30 Hz output distortion at TP6 of pw board A7 in DVDA signal generator unit A4.

5. Failure Analysis and Corrective Action

5.1 Procedure in case of Failure

In the case of a failure, an entry shall be made in the Facility Test Log of Figure 3. The failed component or board shall be replaced with minimum interruption of the tests. The site with the equipment under test shall be supplied with an appropriate complement of spare boards, modules and components.

The FAA technician will replace the failed plug-in board, module or component. Whenever practical the failed board or module shall be repaired at the normal FAA repair depot. Or, the necessary repair shall be performed at the H.F. Henderson Industries plant provided the failed unit is returned to said plant. Each repair shall be recorded on an appropriate unit record. See Figure 5 and paragraph 5.4.

5.2 Failure Analysis

The cause of each DVDA equipment or part failure shall be determined by investigation and analysis. Any applicable method (such as test, application study) may be used in the analysis.

All failures observed during the equipment reliability test should be confirmed. Failure to do so is insufficient grounds for deletion of such failures in the count of total failures. Lack of failure confirmation should instigate close review of the test facility. If the test facility can be shown to be both at fault and completely accountable for the failure to the satisfaction of the procuring activity, then and only then can the count of such failure be eliminated. (refer to MIL-STD-781B paragraph 5.5.3).

5.3 Failure Report

A failure report shall be prepared each time an equipment fails. The report shall contain the necessary information to permit determination of the origin and possible correction of failures. See Figure 5. The test operator shall record information which will indicate the symptoms of the failure and the prevailing test conditions at the time of failure. This information shall accompany the equipment to the repair activity. The repair activity shall record the extent of confirmation of the failure symptoms, the identification of the failures, and a description of all repair action taken. The project engineer shall record information which shall indicate the analysis of all part failures and shall include appropriate recommendations, if any, concerning corrective action to prevent failure recurrence. All available information regardless of source, concerning each failure shall be used to assist with the completion of the failure report.

* 5.4 Contractor Contact

In case of equipment problems, and to request contract support contact the following personnel at H.F. Henderson Industries, 45 Fairfield Place, West Caldwell, New Jersey 07006, telephone (201) 227-9250 any work day between the hours of 8:00 A.M. and 5:00 P.M.

For technical support:
Marcel Kozuch, Program Manager
Greg Hodowanec, Project Engineer

For parts replacement and repair:
Phil Van Houten, Vice President-Manufacturing

For contract interpretation:
Gabe Panepinto, Vice President-Administration

TABLE 3

DVOR STATION DATA

Technician/Approval

Facility Name and Code
Address

Facility Location Latitude
Longitude
Elevation
Magnetic Declination

Carrier Frequency

Authorized RF power

Double Sideband Operation

Direct Carrier Modulation or
Goniometer to Bridge Modulation

Sideband Antenna Alarm Settings

Parasitic Currents in SB Antennas

Ground Check Error at Installation

Flight Check Error at Installation

TABLE 4

SERVICE CONDITIONS & PERFORMANCE DATA DAILY SCHEDULED TESTS

Technician/Approval				
DVOR Facility				
Date				
Time				
Temperature				
Humidity				
AC Line Voltage				
Frequency				
Carrier Transmitter Output Power				
FWD				
Refl.				
Sideband Transmitter Output Power				
FWD				
Refl.				
Sideband Input VSWR (calculated)				
Goniometer Input Power				
FWD				
Refl.				
Goniometer Input VSWR (calculated)				
Goniometer Output Power				
FWD				
Refl.				
30 Hz Output Level				
Monitored 9960 Hz Level (%)				
Monitored 30 Hz AM Level (%)				
Monitored 1020 Hz Level (%)				
Monitored Voice Level (%)				

TABLE 5

PERFORMANCE DATA

WEEKLY SCHEDULED TESTS

Technician/Approval					
DVOR Facility:					
Date					
Time					
Carrier Frequency Accuracy					
30 Hz Frequency Stability					
DVDA Oscillator Stability					
Distributor Timing Precision					
DVDA Alarm Delay					
* Sideband Output Alarm Limit					
30 Hz Distortion					
Ground Check Error					

REL DEMO

TABLE 6

TEST PARAMETERS

Parameter	Nominal Value	Limits
Carrier Transmitter Power FWD Refl.	Rated	±10%
Sideband Transmitter Power FWD Refl.	5W	+1,-3 db
SB Input VSWR (calculated)	1.0	1.6
Goniometer Input Power FWD Refl.	1W	+1,-3 db
Goniometer Input VSWR (calculated)	1.0	1.6
Goniometer Output Power FWD Refl.	Rated	(See Modulation Levels)
SB Output Alarm Limit	(See Procedure)	±10% ±0.1
Alarm Delay	6.5 sec	±1.5 sec
30 Hz Distortion	--	2 %
30 Hz Frequency Stability	33.3333msec	±.0033msec
30 Hz Output Level	0.5 to 2.0 V	5%
Oscillator Stability (A4A5TP7)	75,000 Hz	±7.5 Hz
Timing Precision (A2A1C1 to A2A2C1)	666.667 usec	±.067 usec

TABLE 6 (continued)

MODULATION LEVELS	NOMINAL VALUE	INITIAL LIMITS	OPERATING LIMITS
9960 Hz	30%	29% to 31%	28% to 32%
30 Hz AM	30%	29% to 31%	28% to 32%
1020 Hz Ident	5%	4% to 8%	4% to 8%
Voice	30%	28% to 32%	26% to 32%
FREQUENCY			
USB to Carrier Frequency Difference	9960 Hz	±1 Hz	±5 Hz
LSB to Carrier Frequency Difference	9960 Hz	±1 Hz	±5 Hz
FACILITY MONITOR REF RADIAL			
Monitored Azimuth		To be determined at installation	± 1 degree

FIGURE 3

FACILITY TEST LOG

DVOR Facility:

DATE	TIME	HRS FROM PREV ITEM	CUMUL TEST HRS	PERFORMANCE ITEM	TECHNICIAN APPROVAL

FIGURE 4

DEMONSTRATION SUMMARY LOG

DVOR FACILITY	DATE/TIME											
	CUMUL. HOURS											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

FIGURE 5

FAILURE REPORT AND REPAIR RECORD

DVOR Equipment: Serial No.:

Assembly/Component Name:

Part Identification: Serial No.:

Date, Time Report No.:

Test Reference: Test Technician:

Test Conditions:

Failure Symptoms:

Failure Confirmation:

Repair Action: Repair Technician:

Failure Analysis: Engineer:

Recommendations: