1 March 1978
Superseding AR-8B
24 December 1974

M I L I T A R Y S T A N D A R D

UNIT UNDER TEST COMPATIBILITY WITH AUTOMATIC TEST EQUIPMENT GENERAL REQUIREMENTS FOR

FSC MISC

DEPARTMENT OF THE NAVY

NAVAL AIR SYSTEMS COMMAND

WASHINGTON, D.C. 20360

UNIT UNDER TEST COMPATIBILITY WITH AUTOMATIC TEST EQUIPMENT, GENERAL REQUIREMENTS FOR

MIL-STD-2076(AS)

1. This Military Standard is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Recommended corrections, additions or deletions should be addressed to Commander, Naval Air Systems Command, Attn: AIR-53424, Washington, D.C. 20360.

FOREWORD

The ease and effectiveness of testing with Automatic Test Equipment (ATE) is governed, to a large extent, by the design of the Unit Under Test (UUT). The UUT design must encompass features that make it compatible with an ATE in a manner which facilitates rapid interconnection. In addition, once connected, the UUT design must be sufficiently modular to allow rapid analysis of functional ability and diagnosis in the event of a malfunction. In addition, critical parametric indicators, or test points from the UUT modular elements must be accessible to the ATE and designed in a manner that allows their evaluaion by the ATE without distortion or deviation of the parameter of interest.

This Standard presents the design requirements for a UUT which will make it compatible for test on an ATE. Thus designed, the UUT will possess the attributes necessary to maximize the benefits possible through use of ATE and minimize the cost necessary to achieve those benefits.

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd) Page

UNIT UNDER TEST COMPATIBILITY WITH AUTOMATIC TEST EQUIPMENT GENERAL REQUIREMENTS FOR

1. SCOPE

1.1 Scope. This standard contains requirements for design features which must be incorporated into equipment which is to be supported with Automatic Test Equipment (ATE). It includes those necessary electrical and mechanical attributes, as well as access needs which will facilitate full, effective and efficient utilization of ATE to perform test and diagnostic functions.

2. REFERENCE DOCUMENTS

2.1 Issues of Documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

Military Standards

MIL-STD-480	Configuration Control, Engineering Changes, Deviations and Waivers
MIL-STD-1309	Definition of Terms for Test Measurement and Diagnostic Equipment
MIL-STD-2077(AS)	Test Program Sets, General Requirements for

Naval Air Systems Command

AR-10	Maintainability of Avionics Equipment and Systems, General Requirements for

(Copies of specifications, standards and publications required by contractors in connection with specific procurement functions should be obtained from Naval Publications and Forms Center)

2.2 Other Publications. The following documents form a part of this standard to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

Avionics Design Guide for VAST compatibility, RCA report CR-70-588-7 1 March 1970.

Test Accessibility Design Guide for Army Mechanical Hydraulic and Pneumatic Material, RCA report FCF-10-76, 1 September 1976.

IEEE-416-1976 ATLAS Language Standard.

(Application for copies should be addressed to the Naval Air Engineering Center (Code 925), Lakehurst, New Jersey 08733).

3. DEFINITIONS

3.1 Source of Terms. The definition of terms used in this document may be found in MIL-STD-1309 referenced in Section 2, and as follows.

3.2 Weapon Replaceable Assembly. As defined in MIL-STD-proposed (AS)

3.3 Shop Replaceable Assembly. As defined in MIL-STD-proposed (AS)

3.4 Sub-Shop Replaceable Assembly. As defined in MIL-STD-proposed (AS)

3.5 UUT Test Program Sets. As defined in MIL-STD-2077(AS)

4. GENERAL REQUIREMENTS

4.1 ATE Compatibility. Systems or subsystems for which "ATE compatibility" or "compatible with ATE" is a specified requirement shall be designed to incorporate features which facilitate performance verification and diagnostic fault isolation on each Unit Under Test (UUT) of the system or subsystem, automatically by ATE, to the levels specified. Testing of these systems shall be accomplished using UUT test programs and interface devices designed in accordance with MIL-STD- 2077 (AS). Once the UUT is connected to the ATE and testing is initiated, operator actions permitted are limited to mechanical/electrical adjustments, necessary data entries, observations which are not within the programmable capabilities of the ATE, and connections made to the UUT from an ATE special purpose probe(s). The UUT design must incorporate those necessary features to allow the level of automation described above.

4.1.1 Weapon Replaceable Assembly (WRA) Performance Verification. All cases of failure reflected at the operational input/output interface shall be detectable. A WRA failure is defined as a deteriorated performance level at which, if the WRA were installed in the next higher assembly (i.e., an avionic weapon system platform) would cause a required function of the assembly to be unavailable or below the level required for mission effectiveness (e.g., a system failure). Therefore, the allowable degradation of, or the parameter tolerances permitted, on signals must be accurately specified and referenced on drawings or other technical data. Further, the design of the assembly must be such that the necessary signals and parameters are available for measurement by the ATE such that measurement of these signals must not impact the measurement accuracy. It is a requirement that all WRAs be capable of test by the ATE without stimulation by another WRA; therefore, the allowable degradation of the parameter tolerance permitted in signals transferred between major assemblies of a weapon system must be accurately calculated, specified on the WRA drawings and used in the analysis required to complete the applicable Test Requirements Documentation herein after referred to as a TRD. When such testing requires complex electronic inputs or results in complex outputs to be generated and measured which are not within the capability of an ATE, it shall be a requirement that sufficient test points be provided at the WRA interface to permit indirect testing, piece-wise linear testing, or testing by individual functions.

4.1.2 WRA Diagnostic Fault Isolation. Those failures reflected at the input/output interface of a WRA as described in paragraph 4.1.1 shall be isolatable to the next lower level of assembly. The ambiguity which is permitted in the final isolation is as specified in AR-10.

4.1.3 Shop Replaceable Assembly (SRA) Performance Verification. All cases of failure reflected at the SRA input/output interface shall be detectable. SRA failure is defined as a performance level at which the SRA, if it were installed in its next higher assembly (the applicable WRA) would cause a failure of the WRA as defined in paragraph 4.1.1 above. Therefore, the allowable degradation of, or the parameter tolerances permitted on, signals transferred between SRA's of the same WRA must be accurately calculated and specified on the SRA drawings or in the other technical data referenced on the drawings, and used in the analysis required to complete the TRD details in Appendix A of this standard. Do not overspecify tolerances or understate allowable degradation. Required synchronization between input/output signals must be specified.

4.1.4 Shop Replaceable Assembly (SRA) Diagnostic Fault Isolation. When the SRA is to be repairable at any level of maintenance, those failures reflected at the input/output interface of an SRA, as described in 4.1.3 above, shall be isolatable to the next lower level of assembly. If the next lower level of assembly is a Sub-SRA the ambiguity which is permitted in the final isolation is as specified in the procurement specification and/or AR-10. If the next lower assembly contains discrete components (microelectronic integrated circuits, resistors, transistors, diodes, capacitors, etc.) the ambiguity which is permitted in final isolation is the number of devices specified in the procurement specification and/or AR-10.

4.1.5 Sub-SRA Performance Verification. All cases of failure reflected at the Sub-SRA input/output interface shall be detectable. Sub-SRA failure is defined as a performance level at which the Sub-SRA, if it were installed in its next higher assembly, the applicable SRA, would cause a failure of the SRA as defined in 4.1.3 above. Therefore, the allowable degradation of, or the parameter tolerances permitted on, signals transferred between Sub-SRA's of the same SRA must be accurately calculated, specified on the Sub-SRA drawings, and used in the analysis required to complete the TRD in Appendix A of this standard. Do not overspecify tolerances or understate allowable degradation.

4.1.6 Sub-SRA Diagnostic Fault Isolation. It shall be a design goal that Sub-SRA's have a cost MTBF ratio such as to qualify as non-repairable items, as defined by LOR analysis. However, if the Sub-SRA is a repairable item, those failures reflected at the input/output interface of the Sub-SRA (described in paragraph 4.1.5) shall be isolatable to the next lower level of assembly. The ambiguity permitted in the final isolation shall be as specified in the procurement specification and/or AR-10.

5. DETAILED REQUIREMENTS

5.1 Test Features. Among the test features required of UUT's within the scope of this standard are the following:

5.1.1 Design for Test on Automatic Test Equipment (ATE). For testing on ATE design requirements include:

a. Design for ATE shall be directed toward the use of simple Interface Devices (ID) (Definition for simple ID's may be found in proposed MIL-Standard for Test Program Sets). When necessary to utilize an intermediate

or complex ID, the contractor shall submit a deviation request as described in paragraph 6.2. Prior to submission of such a request, consideration shall be given to the use of conditioning circuits in the UUT that tend to facilitate the transmission and measurement of test information. Some examples of this type of conditioning are:

Resistive divider used to convert high dc or ac power/voltages to safer levels.

Peak detector used to convert amplitude of very narrow pulses to a dc level.

Follower circuits used to effectively reduce the impedance of a normally high impedance source and to remove any critical dependence on ID cable length.

b. The stimulus and measurement signal required by the UUT must be in programmable increments within generally available ATE capabilities.

c. Particular emphasis on the UUT design (1) to insure that the interface between the UUT and ATE will be simple; (2) with functionally modularized SRA's; (3) with adequate test point placement and accessability; and (4) the elimination/minimization of manual actions.

d. Digital UUT's in the "paper design" stage (prior to production) shall be analyzed to determine compatibility with an Automatic Test Generator (ATG) Program (government to advise on availability of Government Furnished Equipment (GFE) digital simulator) and to determine additional design parameters which can insure test capability. Some compatibility design guides are listed below:

Partition analog and digital circuitry, physically and/or with test points.

Provide for breaking circuit loops.

Provide initialization for all memory elements, whether normally used or not.

Partition free-running clocks or provide external gating and clock inputs.

Give preference to clocked "Flip-Flops" over cross-coupled gates.

Use standard Integrated Circuit (IC).

Give preference to IC's over discretes.

e. Utilization of "Avionic Design Guide for VAST Compatibility"

f. Utilization of "Test Accessibility Guide for Army Mechanical Hydraulic and Pneumatic Material".

g. Provide access at all test levels (WRA, SRA, Sub-SRA) to control signals that allow synchronization of the ATE and UUT.

5.1.2 Test Points

5.1.2.1 Access. All test points used for WRA Performance Verification and Diagnostic Fault Isolation shall be available in connectors that are external to the WRA. All test points used for SRA Performance Verification and Diagnostic Fault Isolation shall be available through Input/Ouput (I/O) or test connectors. All test points used for Sub-SRA Performance Verification and Diagnostic Fault Isolation shall be available through I/O or test connectors. (Within repairable SRA's and Sub-SRA's "probe points" should be made available to facilitate the manual "offline testing process" which may be necessary to resolve any ambiguity among discrete components permitted by paragraphs 4.1.4 and 4.1.6 above). Connectors shall comply with AR-10 (Connectors).

5.1.2.2 Safety. Voltage potentials impressed on test points shall not exceed 500 volts rms. Where higher voltages are to be monitored, these voltages shall be stepped down accordingly. Test points having 350 to 500 volts rms impessed thereon shall have barriers or guards provided to prevent accidental contact with such voltages. In addition, a clearly labeled warning plate shall be provided and located in close proximity to the test points.

5.1.2.3 Category. There shall be two test point categories: functional and maintenance.

5.1.2.3.1 Functional Test Points. Functional test points are those points which are available in external connectors by virtue of normal I/O signal transfer.

5.1.2.3.2 Maintenance Test Points. Maintenance test points are those points which are available in external maintenance connectors to supplement functional test points as required to accomplish performance verification and diagnostic testing defined in paragraph 4.1. (This does not exclude maintenance test points being available in functional connectors).

5.1.2.4 Selection. Test points shall be selected and assigned as needed to meet the fault isolation requirements of this standard and the procurement specification.

5.1.2.5 Protection. Test points shall be designed such that damage to a UUT shall not result from a short circuit between any test point and ground.

5.1.2.6 Sensitivity. Test points shall have interface capability sufficient to accomodate the input impedance and/or load of at least 10 feet of interface (RG-188 and RG-195) cable length between the UUT and ATE. Typically, such interface cables shall have lengths varying from 2 to 10 feet. In addition, test points shall be designed to accomodate interface to ATE measurement devices without distortion of the measured signals or effecting the normal operation of the UUT.

5.2 Precedence of Documents

a. The contract

b. This standard

5.3 UUT/ATE Test Requirements Document

5.3.1 Format, Content and Control. A TRD shall be prepared for each WRA, SRA and Sub-SRA in accordance with Appendix A. (Refer to Navy Data Item Description (DID) UDI-T-21367A). Configuration control, engineering changes deviations and/or waivers shall be handled in accordance with MIL-STD-480 unless otherwise specified by contract procedures.

5.4 Deviations. When it is not technically feasible to comply with specific requirements of Section 4 of this standard, the proposed deviation will be processed in accordance with procedures specified in the contract. However, in order for the procuring activity to evaluate the impact of the proposed deviation, all deviation requests shall be accompanied by the following information.

a. UUT Nomenclature

b. Connector name and pin number as applicable.

c. Reference to the applicable paragraph of this standard and technical description of the problem.

d. Proposed alternative support concept or proposed solution. A detailed justification for the proposed solution provided and/or the alternative support concept shall be fully described.

5.4.1 UUT/ATE Incompatibility. Any UUT parameters or characteristics which represent test and/or compatibility problems with the target ATE and/or ATE in general shall be presented as a potential problem report to the procuring agency and the government cognizant ground support activity when the problem becomes known.

6. QUALITY ASSURANCE

6.1 ATE Compatibility Verification. The Contractor's compliance with the requirements of this standard will be subject to procuring activity verification, inspection, demonstration and approval in accordance with Appendix A, TRD and WRA/SRA hardware demonstration.

6.1.1 ATE Compatibility Verification Process. ATE/UUT System compatibility will be determined by consideration of the following areas:

a. UUT Packaging.

b. Physical interface between UUT and target ATE.

c. Electronic and power interface between UUT and target ATE.

6.1.1.1 Specific Characteristics. The following specific characteristics and features will be analyzed:

a. Functional packaging scheme that results in WRA's/SRA's that can be independently tested.

b. Test point access and pin placement to permit testing to lowest level required.

c. Design amenable to test by target ATE test stimuli and measurement devices. This will include accuracies required and available, accuracy ratio calculations, resource matching, and timing requirements.

d. Uniform and compatible interface plugs and receptacles.

e. Power source compatibility.

f. Need for manual intervention to allow operator to make adjustments to variable components.

g. Need for equipment external to ATE to generate signals or monitor responses.

Checklists indicating compatibility characteristics and their representative weighting are found in Appendix B. These weights will be applied to appropriate formuli by the compatibility review team to establish the adequacy of the UUT design related to compatible requirements. Scores below 70% attained when the UUT is measured against the Appendix B checklist will be cause for rejection of the UUT. Any checklist item with a score of 0 will require special written justification and approval by compatibility review team and procuring activity.

Rejected UUT's will require modification and/or redesign to attain at least a score of 70%. Modification and/or redesign will also be required for those checklist items whose zero score justifications are unacceptable. The score of 70% referenced above is a normalized score wherein a perfect rating is 100%.

6.1.2 UUT Documentation Analysis and Hardware Inspection. The capability reflected in these items will be determined with reasonable accuracy by analysis of UUT documentation supplemented by actual hardware inspection. Reviews shall be performed as an adjunct to the normal hardware design reviews and acceptance tests. The effort will be performed at the contractor's plant where adequate work facilities and contractor personnel/technical assistance shall be provided.

6.1.2.1 Review Phases and Requirements. Typical review phases and requirements shall be as follows:

a. Initial Phase. Review preliminary TRD for appropriate content. Discuss changes and additional elements as necessary. Approve baseline document.

b. Design Phase. Evaluate equipment testability during required design reviews of the updated TRD, analysis of system documentation (block, schematic, wiring diagrams, etc.) and examination of breadboard, prototype and production models, as applicable. The appropriate approach during this phase, considering workload, may be to review sample WRA's/SRA's for compatibility factors to gain a level of confidence. Subsequent reviews may address previous or new equipment items. It should be noted that as computer programs for

maintenance analysis (utilizing equipment schematics) are perfected they will be used to supplement or replace the manual reviews previously defined.

c. Test Phase. The test procedures for hardware design assurance/acceptance phase shall include tests to utilize test points for signal inputs, measurement outputs and accuracy determinations, as well as sample tests for load values, drive capability, sensitivity, etc. The test results shall be compared to expected design values and ATE compatibility factors. The successful completion of this testing shall be considered with the same priority as other design acceptance tests.

6.2 Target ATE. The target ATE is that ATE designated as the vehicle used to supply maintenance support to the UUT. Should no ATE be designated at the time the UUT is being designed, good practice ATE techiques and methods shall be used as the basis for compatible design.

7. PREPARATION FOR DELIVERY

7.1 Packaging and Packing. Reports required by this standard shall be packed and packaged for delivery in accordance with the contractor's best commercial practice.

7.2 Marking of Shipments. All shipments of reports shall be marked as stated in the contract or as otherwise instructed by the procuring agency.

Preparing Activity:

NAVY - AS
(Project MISC-NB-73)

APPENDIX A

10. SCOPE

10.1 Scope. This appendix establishes the requirements for the preparation, control, and acceptance of the Test Requirements Data (TRD) necessary for the specification, implementation and maintenance of testing requirements for the system, subsystem, assembly or subassembly herein referred to as the Unit Under Test (UUT).

10.2 Applicability. The requirements of this appendix are applicable to the extent specified by the procuring agency of TRD. Compliance with the requirements of this appendix shall not be cause for failing to satify the requirements of any precedent document.

20. REFERENCED DOCUMENTS

20.1 Applicable Documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this appendix to the extent specified herein.

STANDARDS

Military

MIL-STD-12	Abbreviations for use on Drawings and in Technical Type Publications
MIL-STD-100	Engineering Drawing Practices
MIL-STD-806	Graphic Symbols for Logic Diagrams

HANDBOOKS

Military

MIL-HDBK-217	Reliability Data

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

Other Publications. The following documents form a part of this appendix to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

American National Standards Institute

ANSI Y 32.2	Graphic Symbols for Electrical and Electronics Diagrams
ANSI Y 32.16	Reference Designations for Electrical and Electronic Parts and Equipment

(Application for copies should be addressed to the American National Standards

Institute, 1430 Broadway, New York, N.Y. 10018.)

Institute of Electrical and Electronic Engineers

IEEE ATLAS Language Specification IEEE-STD-416-1976

(Application for copies should be made to the Institute of Electrical nad Electronic Engineers, 345 East 47th Street, New York, N.Y. 10017.)

20.2 Document Precedence. If any requirements of the procurement order, this appendix, and documents referenced herein, conflict, the following precedence shall apply:

a. The governing procurement order shall have precedence over this appendix.

b. This appendix shall have precedence over all documents referenced herein.

20.3 Paragraph Requirements. Where paragraphs of this appendix or any other document are referenced herein, it shall be understood that all subparagraphs of the referenced paragraphs are applicable, unless otherwise stated.

30. DEFINITIONS

a. Test Requirement. The stimulus, measurement, power, loads and any special test equipment or procedure essential to validate proper operation of a device per some predetermined design control or product specification definition.

b. Test Program Set. A TPS is defined as a test program recorded on a computer storage medium such as a disk or tape, a test program instruction booklet which describes the operator procedures necessary to initiate and execute a given test program, an interface device which is required to provide a compatible electronic/mechanical interface between the unit being tested and the test system and supplementary data required to analyze and resolve testing ambiguities which may take place during the testing process.

c. Unit Under Test. A functionally self-contained electronic/mechanical assembly, subassembly or module with a defined set of input/output parameters and performance characteristics which is used as the test vehicle for verifying attainment of the device design performance specifications. The term UUT throughout this specification refers to the Unit for which the TRD data is being prepared, or which is necessary to perform testing. Separate TRDs may be required for an assembly, its major subassemblies and any of their subassemblies for which a unique test program/procedure will be necessary.

40. GENERAL REQUIREMENTS

40.1 Format. The TRD format shall be as shown in Apprndix C of this standard. Data shall be legible and of sufficient quality to be reproduc-

ible on standard office copiers. It shall be submitted on 8½ x 11 inch paper or 8½ x 11 inch foldouts, except for drawings that cannot be reduced to this size without compromising legibility.

40.2 Contents. The TRD contents shall include the following items as required by the governing procurement order. Those items specified for inclusion in the TRD shall be assembled in the sequence shown.

a. Cover sheet (reference 50.1)

b. Approval sheet (reference 50.2)

c. Revision index sheet (reference 50.3)

d. Configuration-related data sheet (reference 50.4)

e. UUT data (reference 50.5)

1. UUT drawings (reference 50.5.1)

2. UUT design data (reference 50.5.2)

3. UUT performance characteristics (reference 50.5.3)

4. UUT interface definition (reference 50.5.4)

f. UUT test requirements (reference 50.6)

1. ATLAS test requirements (reference 50.6.1)

2. Test diagrams (reference 50.6.2)

3. Acceptance test procedure (reference 50.6.3)

40.3 Classified/Proprietary Data. All data which is considered classified or proprietary shall be so identified. No data deemed necessary by the procuring agency to accomplish the scope of work as defined in paragraph 1.1 shall be considered proprietary. Classified data shall not be incorporated in the body of the TRD, but shall be referenced and provided in a separate document. This document shall be identified, handled, controlled and transmitted in accordance with appropriate security directives.

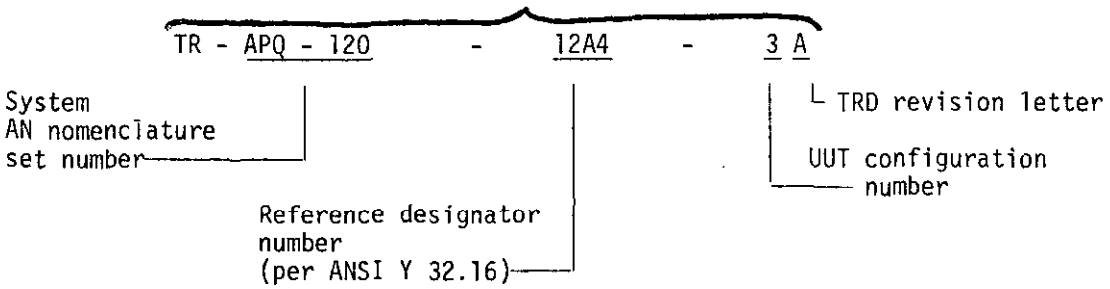
40.4 UUT Configuration Changes. The TRD supplier shall be responsible to update the TRD for all UUT changes which affect any TRD data items. A TRD shall be required for each subsequently approved UUT configuration that results in changes to any of the data items included in the baseline TRD.

40.5 TRD Revisions. Changes to the TRD that are necessary to correct TRD errors and omissions, or make TRD improvements, shall be submitted as revisions to the applicable document. Revisions shall include a new cover sheet, revisions index sheet, and all changed pages. A "letter" shall be appended to the TRD number (reference 40.6) to designate the particular revision. The first revision shall be designated by "A". A new TRD number

shall be provided to reflect subsequent configurations of the UUT. The new TRD may be provided by modifying the TRD of a previous UUT configuration.

40.6 TRD Number Assignment. A document identification number shall be assigned for each TRD. This number shall consist of the prefix "TR" followed by the system AN nomenclature set number, the UUT reference designation number, and a number designating the UUT configuration and TRD revision. The reference designation number shall be in accordance with ANSI Y 32.16. Where the TRD applies to more than one reference designator items or UUT configurations, a list of the reference designators and configurations of all UUT's supported shall be provided on the configuration-related data sheet (reference 50.4).

The following is an example of a TRD number assignment:



40.7 TRD Completion. The TRD shall initially be prepared to reflect the configuration of the preproduction model of the UUT. This version of the TRD shall be complete when the configuration of the first preproduction model is established. The TRD shall be revised to reflect the configuration of the first production model when this configuration is established. The scheduling of TRD completion dates for TRD's reflecting configurations that are subsequent to the first production model shall be as specified by the procuring activity.

50. DETAIL REQUIREMENTS

50.1 Cover Sheet. The cover sheet shall identify the TRD. Format shall be in accordance with Figure 1 of Appendix C and the following:

a. Page(s).

(Shall indicate Page 1 and total number of pages, e.g., Page 1 of x, Page 2 of x, etc.)

b. TRD No.:

(Shall be in accordance with paragraph 40.6 of this requirement)

c. Revisions:

(Shall be alpha character sequential with "A" being First Revision, "B" Second Revision, etc.)

d. Date:

(Shall be calendar date of TRD submittal)

e. Name and Nomenclature:

(Shall indicate Unit Name and Nomenclature. If AN Nomenclature assigned, use assigned AN nomenclature)

f. Supplier Unit No.:

(Shall indicate in accordance with ANSI Y 32.16)

g. Supplier Part No.:

(Shall indicate in accordance with supplier drawings)

h. Prepared by:

(Shall indicate name and title of preparer)

i. Contract No.:

(Shall indicate current contract/procurement order)

50.2 Approval Sheet. The approval sheet shall contain page number, TRD number, revision, and date information as described in paragraph 50.1 (a thru d) for the cover sheet. The supplier name and appropriate supplier signatures shall be provided. The format for the approval sheet shall be in accordance with Figure 2 of Appendix C. This sheet shall also be used for approvals of revisions.

50.3 Revision Index Sheet. The revision index sheet shall contain page number, TRD number, revision and date information as described in paragraph 50.1 (a thru d) for the cover sheet. The format for the revision index sheet shall be in accordance with Figure 3 of Appendix C. All pages of the TRD shall be listed with its corresponding revision letter. No-change pages shall not carry a revision letter. For each revised page the appropriate supplier approval signature, date of approval, and reason for change shall be provided.

50.4 Configuration-related Data Sheet. The configuration-related data sheet shall contain page number, TRD number, revision and date information as described in paragraph 50.1 (a thru d) for the cover sheet. The format for the configuration-related data sheet shall be in accordance with Figure 4 of Appendix C. It shall consist of the identification of all UUT part numbers, configurations, and reference designators for which the TRD is applicable. In addition, the engineering data listed in Figure 4 of Appendix C and used in the preparation of the TRD shall be identified. All drawings used/listed shall be in a released status unless otherwise specified by the procuring agency. Drawing numbers shall include the revision used in the preparation of the TRD.

50.5 UUT Data. The UUT data section shall consist of that data which is necessary and sufficient to specify and provide an understanding of the physical, electrical, and operational characteristics of the UUT. The data to be supplied as part of the UUT data section of the TRD shall consist of the following or as amended by the governing procurement order:

a. UUT drawings (reference 50.5.1)

b. UUT design data (reference 50.5.2)

c. UUT performance characteristics (reference 50.5.3)

d. UUT interface definition (reference 50.5.4)

The UUT data section shall be identified with a cover sheet in accordance with Figure 5 of Appendix C*. The UUT data section cover sheet shall contain page number, TRD number, revision, and date information as described in paragraph 50.1 (a thru d). In addition, it shall identify the contents of the UUT data section and specify the TRD page location for each item listed.

50.5.1 UUT Drawings. The UUT drawings shall be prepared in accordance with MIL-STD-100 and supplied as specified below or as required by the governing procurement order.

50.5.1.1 Outline Drawings. Outline drawings shall be provided in accordance with the applicable equipment specification.

50.5.1.2 Unit (main) Assembly Drawings. Unit (main) assembly drawings shall be provided in accordance with the applicable equipment specification.

50.5.1.3 Detail and Subassembly Drawings. The detail and subassembly drawings shall consist of module, subassembly schematics, connection/wiring diagrams, and logic diagrams and shall be prepared in accordance with the requirements of the applicable equipment specification.

50.5.1.3.1 Module/Subassembly Schematics. A schematic shall be provided for each module and subassembly including all items which are not standard parts. For all non-standard parts a specification control drawing shall be provided. In satisfaction of this requirement, the portions of circuitry within any module or subassembly may be indicated on the unit schematics.

50.5.1.3.2 Connection/Wiring Diagrams. Wiring diagrams shall be provided to show the actual physical wiring arrangement. Wire running lists or tables, where available, shall be used to supplement wiring diagrams. Printed circuit layouts showing the components and modules (symbolically or actual shape), as well as the printed circuitry, shall be included in this requirement. Printed circuit layouts shall contain sufficient data to permit any component, module terminal, and junction shown in the schematics to be located. Photographs of printed circuit layouts with sufficient overlaid or otherwise identifiable data shall satisfy this requirement.

* All references to Appendices mean "Appendix to MIL-STD- ".

50.5.1.3.3 Logic Diagrams. Detailed logic diagrams, as described in MIL-STD-806, or as required by the procuring agency, shall be provided for each UUT. Items that are not normally represented by logic diagrams (e.g., receivers) shall be depicted by functional block diagrams as provided in paragraph 50.5.1.4.

50.5.1.4 Functional Block Diagrams. Functional block diagrams shall be provided in accordance with the applicable equipment specification and shall include parameters with associated tolerances of the signals at the external and internal interfaces shown. An example of a functional block diagram is illustrated in Figure 6 of Appendix C.

50.5.1.5 Parts List/Cross Index. The parts list shall be provided which references each component piece part by reference designator and UUT manufacturer part number, cross referenced to the component manufacturer part number and code ident number.

50.5.2 UUT Design Data. The UUT design data section shall consist of the specification of unique UUT environmental requirements for proper and safe operation. It shall include the UUT design data sheet in accordance with Figure 5 of Appendix C and additional sheets as necessary to describe requirements identified on the design data sheet. The UUT design data sheets shall contain page numbers, TRD numbers revision, and date information as described in paragraph 50.1 (a thru d) for the cover sheet. The format for the UUT design data sheets shall be in accordance with Figures 5.1 - 5.11 of Appendix C and shall include the following information:

a. Weight: The weight of the UUT shall be specified.

b. Special tools: The need for special tools (e.g., card extenders, unusual screwdrivers, etc.) shall be identified and the page number in the TRD specified where such requirements are referenced.

c. Handling/maintenance requirements: The need for special handling/maintenance requirements shall be identified and the page number in the TRD specified where such requirements are referenced.

d. Required operating conditions: All conditions required for proper and safe operation shall be specified. These shall include any cooling air, hydraulic pressure, pneumatic source speed drives, fuel reservoirs and/or other auxiliary resources.

e. Safety requirements: Special precautions and instructions regarding personnel and equipment protection in the presence of high voltages, RF radiation, etc., shall be identified and the page number in the TRD specified where such requirements are referenced.

f. Power requirements: All UUT input power source requirements shall be specified, including a-c and d-c voltages and tolerances, maximum load current, frequency and tolerances, ground returns, and ripple limits on d-c voltages. When three-phase power is required, the line-to-line voltage or line-to-neutral voltage shall be identified. Maximum allowable

line-to-line imbalance and percent distortion shall be specified.

50.5.2.1 UUT Failure Data and MTBF Data. The UUT failure data and mean time between failure (MTBF) data, generated as a consequence of the UUT design and development effort, shall be supplied with the TRD. Specifically this data shall be used to qualitatively substantiate that fault isolation test requirements, when developed, are sufficiently comprehensive to effect diagnostic resolution of UUT failures to the ambiguity requirements specified by the procuring agency. Figure 5.11 Appendix C, illustrates the format by which the failure rate data are to be summarized for transmittal with the TRD. Appendix E provides standardized forms which illustrate how these failure rate data can be utilized to validate attainment of the fault isolation design criteria. Implicit in this analysis approach are the assumptions of single, non-interactive failures and the predominant occurrence of catastrophic failure modes as listed in Table I of Appendix E. Inconsequential failures, i.e., those failures which do not manifest themselves as a change in the UUT input/output parameters, shall also be considered in the failure rate data fault isolation ambiguity group analysis but only to the extent specified in Appendix E.

50.5.2.2 Family Tree. The UUT family tree shall be included as part of the UUT source data package and submitted with the TRD. The family tree shall identify each SRA and SSRA of the UUT and shall be utilized to assure proper part number and configuration accountability of all UUT's.

50.5.3 UUT Performance Characteristics. The UUT performance characteristics section shall include the UUT performance specification, theory of operation, operating instructions, and operational constraints as specified herein.

50.5.3.1 Performance Specification. The UUT performance specification shall consist of the applicable product function specification. The product function specification states (1) the complete performance requirements of the product for intended use, and (2) the necessary interface and interchangeability characteristics. It covers form, fit, and function. Complete performance requirements include all essential functional requirements under service environmental conditions oo under conditions simulating the service environment.

50.5.3.2 Theory of Operation. Descriptive data shall be supplied which explains the UUT theory of operation. It shall include those timing diagrams, waveform drawings and other engineering data necessary to describe the operation to enable both a basic and detailed understanding of the operation of the UUT under service environmental conditions.

50.5.3.3 Operating Instructions. Detailed operating instructions shall be provided for those UUTs that require operator interaction as part of functional performance.

50.5.3.4 Operational Constraints. General procedures and special precautions related to UUT operation that are required to assure proper test conditions shall be provided. This data shall include any required initialization and those conditions at the input or output of the UUT which would

compromise the testing integrity of the UUT (e.g., the interruption of a stimulus signal while updating to a new value). This information shall be identified on the UUT general test operating constraints index sheet. The format of the UUT general test operating constraints index sheet shall be in accordance with Figure 5.8 of Appendix C.

50.5.4 Interface Definition. The UUT interface definition shall cover the functional and physical interfaces between the UUT and its next higher level of assembly. The UUT interface definition shall be provided in accordance with Figure 5.9 of Appendix C and shall include mechanical interface data and electrical interface data.

50.5.4.1 Mechanical Interface. Connector and fixture data related to the UUT shall be provided as follows:

a. UUT connector identification: All UUT connectors shall be identified by connector reference designation and UUT manufacturer part number such that all connectors and pin designations on both the schematics and drawings may be identified and correlated. Also included shall be the connector manufacturer name and manufacturer part number for each connector and corresponding mating connector.

b. Mounting, holding, support fixtures: Descriptive data shall be provided for all mounting, holding and support fixtures which are mandatory for proper operation of the UUT.

c. Pneumatic, hydraulic, cooling, speed, position, reference data fixtures: Descriptive data shall be provided for all fittings, fixtures, and adapters required to connect pneumatic, hydraulic, cooling speed and position, reference data sources to the UUT.

Dimensional drawings shall be included when the data necessary to design fixtures are not readily available or apparent on outline and other drawings specified herein. Special materials required for fixtures (e.g., nonmagnetic materials) shall be specified. Specification of a specific test device shall be avoided where possible.

50.5.4.2 Electrical Interface. Every pin of each connector of the UUT shall be listed in accordance with sheet 2 of Figure 5.10 of Appendix C. Data to be provided for each pin shall include the pin designation (e.g., input, output, no connection, etc.), signal name or mnemonic, and descriptive data sufficient to define each signal of the interface. Abbreviated lists may be used when appropriate (e.g., large digital interfaces). Descriptive data shall include the following as applicable:

a. Minimum wire size for mating connection.

b. Maximum wire length for mating connection.

c. Wire or coax type for mating connection.

d. Shielding requirements for mating connection.

e. Detailed definition of signal characteristics including tolerances.

f. Grounding requirements for mating connection.

g. Separation of circuits for mating connection.

h. Twisted pair or twisted multiples requirements for mating connection.

i. Impedence matching/load requirements including allowable VSWR.

j. Other.

Where interfaces differ due to a change in operational mode, the requirements shall be specified in a manner which identifies specific functional interface requirements with each different mode.

50.6 UUT Test Requirements. The data to be supplied as part of the UUT test requirements section of the TRD shall consist of the following or as amended by the governing procurement order:

a. ALTAS test requirements (reference 50.6.1)

b. Acceptance test procedure (reference 50.6.3)

The UUT test requirements section shall be identified with a cover sheet in accordance with Figure 1 of Appendix C. The UUT test requirements section cover sheet shall contain page number, TRD number, revision, and date information as described in paragraph 50.1 (a thru d). In addition, it shall identify the contents of the UUT test requirements section and specify the TRD page location for each item listed. The UUT test requirements shall consist of those data necessary and sufficient to describe the UUT test requirements for validating the performance verification of the UUT including BIT and monitoring functions. The test requirements shall identify the stimulus, response, circuit loading, and any unique/special test equipment or setup requirements essential to validating the performance characteristics of the UUT. Sequential listing of the test requirements is not required except where the sequence of tests is essential to validating specified UUT operating performance.

50.6.1 ATLAS Test Requirements. The ATLAS test requirements shall consist of those tests that determine whether the UUT meets the performance requirements of the applicable product function specification (reference 50.5.3.1). Sufficient data shall be provided for each UUT test to completely describe all input conditions and measurements required to perform the test. All input, output and return connections shall be specified by connector and pin number or test point at the UUT. The test requirements shall be specified independent of any specific test equipment. The test requirements data shall include pin and signal data for all UUT connectors. This includes both functional connectors, test connectors and power connectors.

The ATLAS test requirements shall be written in the Abbreviated Test Language for All Systems (ATLAS) as specified in IEEE-416-1976. The test requirements shall consist of those end-to-end tests that determine whether the UUT meets the performance requirements of the UUT performance specification. Each test requirement shall be described per the format illustrated in Figure 7 Appendix C. A description of some commonly used ATLAS verbs, nouns, statement characteristics, etc., can be found in Appendix D. Note that the ATLAS test requirement description does not include branch statements or procedural directives implying test strategy as opposed to test requirements definition.

50.6.1.1 Minimum Data Requirements. The specification of UUT input/output conditions in the ATLAS test requirements shall include the following minimum data requirements for the type of signal specified. Nothing herein shall restrict the supplier from furnishing such additional data in support of specific UUT requirements as is necessary.

50.6.1.1.1 Power Sources

50.6.1.1.1.1 DC Power Sources

a. Must specify:		Unit
(1)	Nominal voltage (If constant voltage is to be specified)	Volts
(2)	Voltage tolerance (If nominal voltage is specified)	±Volts or %
(3)	Current-maximum (If nominal voltage is specified)	Amperes
(4)	Current-nominal (If constant current is to be specified)	Amperes
(5)	Current tolerance (If nominal current is specified)	±Amperes or %
(6)	Voltage-maximum (If constant current is specified)	Volts
(7)	Load impedance * Note: Significant inductive or capacitive characteristics should be so indicated.	Ohms
b. Specify if critical to UUT		Units
(1)	Ripple	Volts (rms)
(2)	Noise	Volts (pk-to-pk)

* Only one need be specified for a resistive load

c. Specify load changes if not adequately covered above - Critical transient response is typical example.

50.6.1.1.1.2 AC Power Sources

a. Must specify:		Units
(1)	Nominal voltage (If constant ac voltage is to be specified)	Volts
(2)	Voltage tolerance (If nominal voltage is specified)	±Volts or %
(3)	Voltage-maximum (If constant ac current is to be specified)	Volts
(4)	Nominal frequency	Hz
(5)	Frequency tolerance	±Hz or %
(6)	Current-maximum (If nominal voltage is specified)	Amperes
(7)	Current-nominal (If constant ac current is to be specified)	Amperes ac (rms, pk-to-pk, etc.)
(8)	Current tolerance (If nominal current is specified)	± Amperes or %
(9)	Load impedance (At nominal frequency)	Ohms
(10)	Voltage imbalance	Volts or %
(11)	Current imbalance (each phase) (If nominal current is specified)	Amperes or %
(12)	Phase Angle	Degrees

b. Specify if critical to UUT:		Units
(1)	Maximum distortion (total/harmonic)	%
(2)	Phase-to-phase angle	Degrees
(3)	Phase-to-phase angle tolerance	± Degrees or ±%
(4)	Phase-to-reference angle	Degrees
(5)	Phase-to-reference angle tolerance	± Degrees or ±%

50.6.1.1.2 Analog Stimuli

50.6.1.1.2.1 Sinusoidal Stimuli

a. Must specify:	Units
(1) Voltage/power magnitude	Volts, Watts, dBm
(2) Voltage/power magnitude tolerance	± Volts, %, watts
(3) Frequency - nominal	Hz
(4) Frequency tolerance	± Hz or %
(5) Load impedance of UUT at nominal frequency	Ohms
(6) Offset level of average value	Volts

b. Specify if required by UUT

(1) Modulation

(a) Modulation type

(b) Modulation frequency(ies)/rates

(c) Modulation percentage or waveshape

(d) Carrier power/voltage level during modulation on/off ratios

(e) Modulation pulse shapes

(f) Pulse repetition frequency

(g) Modulation index

(2) Noise levels, distortion (total/harmonic)

(3) Maximum VSWR

(4) Phase angle to reference phase

50.6.1.1.2.2 Pulse Stimuli

a. Must specify:	Units
(1) Amplitude	Volts
(2) Amplitude tolerance	± Volts or ±%
(3) Pulse repetition frequency	Hz
(4) Pulse repetition frequency tolerance	± Hz or %

(5)	Pulse width (50% amplitude)	Seconds
(6)	Pulse width tolerance	Seconds or %
(7)	Pulse rise time (10% to 90%)	Seconds
(8)	Pulse rise time tolerance	± Seconds or ±%
(9)	Pulse fall time (90% to 10%)	Seconds
(10)	Pulse fall time tolerance	± Seconds or ± %
(11)	Pulse mode (continuous, single pulse, etc.)	
(12)	Load impedance of UUT (At specified frequency)	Ohms
(13)	Offset of signal value closest to ground	Volts
(14)	Pulse width Jitter	± Seconds or %
(15)	Prf Jitter	± Seconds or %
(16)	Undershoot/overshoot/Jitter	%

b. Specify if required by UUT

(1) Synchronization characteristics stating above parameters for reference signal(s) plus timing data between signals. NOTE: A timing diagram shall be included if more than two signals must be simultaneously synchronized.

(2) Modulation of pulse trains or continuous pulses.

50.6.1.1.2.3 Synchro and Resolver Stimuli

a. Must specify:		Units
(1)	Three wire synchro or four-wire resolver	
(2)	Frequency	Hz
(3)	Frequency tolerance	± Hz or %
(4)	Stator voltage	Volts
(5)	Stator voltage tolerance	± Volts or %
(6)	Angular output	Degrees
(7)	Angular output tolerance	± Degrees or %

(8)	Load impedance of UUT (at specified frequency)	Ohms
(9)	Load imbalance (at specified frequency)	Ohms
(10)	Reference signal	
	(a) Amplitude	Volts (rms)
	(b) Amplitude tolerance	Volts (rms) or %
	(c) Maximum current	Amperes (rms)

b. Specify if critical to UUT

(1)	Maximum quadrature component	%

50.6.1.1.2.4 Waveform stimuli (other than described above)

		Units
a.	Must specify:	
(1)	Wave shape description of type. NOTE: Any waveshape which cannot be specified by an ATLAS signal noun shall be specified by the noun DRAWING and be accompanied by a detailed drawing identifying all required parameters.	
(2)	Amplitude	Volts (pk-to-pk)
(3)	Amplitude tolerance	± Volts or %
(4)	Offset from zero	Volts
(5)	Offset tolerance	± Volts or %
(6)	Required matching impedance	Ohms
(7)	Period	Seconds
(8)	Period tolerance	± Seconds or %
(9)	Duration	Seconds
(10)	Duration tolerance	± Seconds or %

b. Specify if required by UUT

(1) Synchronization

(a) Timing relationships

(b) Reference signal amplitude

(c) Reference signal rise time

(d) Reference signal width

(2) Modulation

(a) Carrier characteristics

(3) Symmetry

(4) Peculiar signal termination requirements

50.6.1.1.2.5 Time Delayed Stimuli

a. Must specify:	Units
(1) Delay period	Seconds
(2) Delay period tolerance	± Seconds or %
(3) Characteristics of time reference signal from UUT or to UUT	
(a) Amplitude	
(b) Rise time	
(c) Width	
(d) Source/load impedance of UUT	
(4) Characteristics of delayed signal to UUT	
(a) Amplitude	
(b) Rise time	
(c) Width	
(d) Load impedance of UUT	

50.6.1.1.3 Digital Stimuli

NOTE: Where practical, real time operating conditions should not be specified when it is possible to perform a comprehensive and adequate test of the UUT under simpler conditions of time, frequency or synchronization.

50.6.1.1.3.1 Serial Data Stimuli

a. Must specify:	Units
(1) Logic '0' voltage	Volts

(2)	Logic '0' voltage tolerance	± Volts or %
(3)	Logic '1' voltage	Volts
(4)	Logic '1' voltage tolerance	± Volts or %
(5)	Minimum current sink requirement	Amperes
(6)	Minimum current source requirement	Amperes
(7)	Characteristic impedance	Ohms
(8)	Pulse class (RZ, NRZ, etc.)	
(9)	Bit prf (clock rate)	Hz
(10)	Bit prf tolerance	± Hz or %
(11)	Bit rise and fall times (min/max)	Seconds
(12)	Word length	Bits
(13)	Pattern of bits required	
(14)	Simultaneity with other serial or parallel digital inputs. NOTE: Include timing diagram if more than 2 simultaneous input channels are required.	
(15)	Synchronization requirements (reference signal from UUT or external source)	
	(a) Amplitude	Volts
	(b) Width	Seconds
	(c) Rise/fall time	Seconds
	(d) Prf	Hz
	(e) Characteristic impedance	Ohms
	(f) Skew	± Seconds or %

50.6.1.1.3.2 Parallel Data Stimuli

a. Must specify: Units

(Same as for serial data stimuli, plus)

(1) Number of words in sequence

50.6.1.1.4 Pressure Stimuli

a. Must specify:		Units
(1)	Absolute pressure	in. Hg
(2)	Absolute pressure stability	
	(a) Short term	in. Hg/min
	(b) Long term	in. Hg/hr
(3)	Absolute pressure tolerance	± in. Hg or %
(4)	Leakage rate	in. Hg/min
(5)	Maximum rate of absolute pressure change	in. Hg/min
(6)	Range of rate of absolute pressure change	in. Hg/min
(7)	Absolute pressure rate tolerance	in. Hg/min
(8)	Absolute pressure range	in. Hg
(9)	Maximum volume to be pressurized (need not be specified in ATLAS)	cu. in.
(10)	Maximum differential pressure allowable	in. Hg
(11)	Maximum reverse change in (Δ) pressure allowable	in. Hg

50.6.1.1.5 Analog Measurement

50.6.1.1.5.1 DC Voltage Measurement

a. Must specify:		Units
(1)	Magnitude and polarity	± Volts
(2)	Magnitude tolerance	± Volts or %
(3)	Impedance of UUT signal source	Ohms
	NOTE: Significant inductive or capacitive characteristics should be so indicated.	
(4)	Offset of return from '0' volts	Volts
	NOTE: For ratios of DC signals, the above	

data shall be provided for each signal plus the nominal expected value of the ratio and its tolerance.

50.6.1.1.5.2 AC Voltage Measurement

a. Must specify:		Units
(1)	Frequency of signal	Hz
(2)	Expected magnitude	Volts (rms or average)
(3)	Allowable tolerance	± Volts or %
(4)	Impedance of UUT signal source	Ohms
(5)	DC offset of average value from '0' volts	Volts
(6)	Distortion	%

NOTE: For ratios of AC signals or AC/DC signals, the above data shall be provided for each signal plus the nominal expected value of the ratio and its tolerance.

50.6.1.1.5.3 Phase Angle Measurement

a. Must specify:		Units
(1)	Frequency	Hz
(2)	Frequency tolerance	± Hz or %
(3)	Amplitude (2 signals)	Volts
(4)	Amplitude tolerance	± Volts or %
(5)	Expected angle	Degrees
(6)	Expected angle tolerance	Degrees
(7)	Source impedance of UUT (2 signals)	Ohms
(8)	DC component(s)	Volts

50.6.1.1.5.4 Frequency Measurement

a. Must specify:		Units
(1)	Expected frequency	Hz
(2)	Expected frequency tolerance	± Hz or %

(3)	Maximum peak voltage	Volts
(4)	Maximum pk-to-pk voltage	Volts
(5)	Impedance of UUT source	Ohms
(6)	Rise time (non-sinusoidal)	Seconds
(7)	Width (non-sinusoidal)	Seconds
(8)	Maximum shunt capacitance, if other than coaxial connection, that is acceptable	pf

50.6.1.1.5.5 Time Period Measurement

a. Must specify:		Units
(1)	Expected time	Seconds
(2)	*Expected time tolerance*	± Seconds or %
(3)	Maximum peak voltage(s)	Volts
(4)	Maximum pk-to-pk voltage(s)	Volts
(5)	Impedance of UUT source(s)	Ohms
(6)	Edge(s) used as reference(s) and slope(s) (leading or trailing)	
(7)	Rise time (non-sinusoidal)	Seconds
(8)	Width (non-sinusoidal)	Seconds
(9)	Maximum shunt capacitance, if other than coaxial connection, that is acceptable	

50.6.1.1.5.6 Power (average rf) Measurement

a. Must specify:		Units
(1)	Amplitude	Watts, dBm, dBW
(2)	Amplitude tolerance	± Watts, %, dBm, dBW
(3)	VSWR (Ratio)	None
(4)	Frequency (nominal)	Hz
(5)	*Impedance of UUT source*	Ohms

(6)	Maximum voltage	Volts
(7)	Maximum pk-to-pk voltage	Volts

50.6.1.1.5.7 Waveform Measurement

NOTE: For complex waveforms, the use of the ATLAS noun DRAWING is recommended.

50.6.1.1.5.7.1 Amplitude Measurements

a.	Must specify:	Units
(1)	Expected amplitude	Volts (pk)
(2)	Expected amplitude tolerance	± Volts or %
(3)	Maximum possible amplitude	Volts
(4)	Maximum pk-to-pk voltage	Volts
(5)	PRF	Hz
(6)	PRF tolerance	± Hz or %
(7)	Required matching impedance	Ohms
(8)	DC offset of lowest value from '0' volts	Volts
(9)	Synchronization signal, if available same data as above for signal to be measured	

50.6.1.1.5.7.2 Rise/Fall Time Measurements

a.	Must specify:	Units
	(Same as for amplitude measurements, plus):	
(1)	Expected rise/fall time (measured from 10% to 90% amplitude or for specified voltage levels)	Seconds
(2)	Tolerance	± Seconds or %
(3)	Slope of measured edge (positive or negative going)	

50.6.1.1.5.7.3 Time Measurements

a.	Must specify:	Units

(Same as for amplitude measurements, plus):

(1)	Expected time	Seconds
(2)	Expected time tolerance (Measured at 10%, 50%, or 90% amplitude or for specified voltage levels)	± Seconds or %

50.6.1.1.5.8 Resistance Measurements

a. Must specify:

		Units
(1)	Expected value	Ohms
(2)	Expected value tolerance	± Ohms or %

b. Specify if required

(1)	Current flow maximum through unkown	Amperes
(2)	Polarity requirements	
(3)	Maximum excitation voltage	Volts

50.6.1.1.5.9 *Distortion Measurement*

a. Must specify:

		Units
(1)	Waveshape	

NOTE: Any waveshape which cannot be specified by an ATLAS statement shall be specified by a detailed drawing.

NOTE: If other than sinusoidal, distortion criteria shall be defined.

(2)	Fundamental frequency	Hz
(3)	Fundamental frequency tolerance	± Hz or %
(4)	Impedance of UUT source	Ohms
(5)	Amplitude - maximum	Volts (rms)
(6)	Amplitude (pk-to-pk)	Volts
(7)	Expected percent distortion	%
(8)	Expected percent distortion tolerance	± %

50.6.1.1.5.10 Synchro/resolver Measurement

a. Must specify:	Units
(1) Identify (synchro/resolver)	
(2) Voltage	Volts
(3) Voltage tolerance	± Volts or %
(4) Frequency	Hz
(5) Frequency tolerance	± Hz or %
(6) Expected angular position	Degrees
(7) Expected angular position tolerance	± Degrees or %
(8) Impedance to UUT source (Line to Line)	Ohms

50.6.1.1.6 Pressure Measurement

a. Must specify:	Units
(1) Static or differential	
(2) Expected value	in. Hg
(3) Expected value tolerance	± in. Hg or %

50.6.1.1.7 Digital Measurement

50.6.1.1.7.1 Serial Measurement

50.6.1.1.7.1.1 Logic Levels Verification

a. Must specify:	Units
(1) Logic '0' voltage	Volts
(2) Logic '0' tolerance	± Volts or %
(3) Logic '1' voltage	Volts
(4) Logic '1' tolerance	± Volts or %
(5) Characteristic impedance of source	Ohms
(6) Current source and sink requirements	Amperes

50.6.1.1.7.1.2 Bit Patterns Evaluation

a. Must specify: Units

(1) Bit rates

(2) Pulse class (RZ, NRZ, etc.)

(3) Bit width

(4) Logic level

(5) Currents source and sink

(6) Synchronization requirements *

(a) Reference signal

(b) Amplitude

(c) Width

(d) Rise time

(e) Pulse repetition frequency

(f) Source impedance

(g) Maximum skew

(7) Expected bit pattern/word - Expressed in '1' or '0' format *

(8) Simultaneous with other UUT outputs *

NOTE: Include timing diagram if more than 2 simultaneous input channels are required.

50.6.1.1.7.1.3 Propagation Delay

a. Must specify: Units

(1) Bit/pulse characteristics as in logic level verification and bit pattern evaluation above.

(2) Expected delay Seconds

(3) Expected delay tolerance

* Normally a separate test of the same data, as required

50.6.1.1.7.2 Parallel Measurement

50.6.1.1.7.2.1 Logic Level Verification

a. Must specify:

(Same as required for serial signal logic level verification)

50.6.1.1.7.2.2 Bit Pattern Evaluation

a. Must specify:

(Same as required for serial signal bit pattern evaluation, except for pulse class)

50.6.1.1.7.2.3 Propagation Delay

a. Must specify:

(Same as required for serial signal propagation delay)

50.6.1.1.8 Impedance Measurement

50.6.1.1.8.1 Electronic Elements

a. Must specify:	Units
(1) Expected impedance	Ohms
(2) Tolerance of impedance	± Ohms
(3) Frequency at which impedance is to be measured	Hz
(4) Power rating - average, peak	Watts, Vars
(5) Nonlinear characteristic, if required (may be specified by DRAWING)	

50.6.1.1.9 Mechanical Measurements

a. Must specify as required:

(1) Angular position

(2) Spatial position

(3) Torque

(4) Angular velocity

(5) Pneumatic/hydraulic factors

(6) Flow rate

(7) Thrust

(8) Temperature

(9) Mass

(10) Stress

(11) Density

(12) Vibration

(13) Others

50.6.2 Test Diagrams. A test diagram shall be prepared as part of the detailed test requirements to illustrate any unique test setup necessary to assure test requirements performance integrity of the UUT. This test diagram shall be provided as part of Figure 7 Appendix C. Sufficient detail shall be provided in the test diagram to illustrate stimulus sources, power supplies, measurement instrumentation, special environmental equipment, or special interfacing equipment to effect a proper test of the UUT. Any procedural constraints shall be noted on this diagram and an appropriate reference made to the UUT test and operating constraints index; Appendix C.

50.6.3 Acceptance Test Procedure. If available, the acceptance test procedure defining the UUT manufacturer's method of acceptance testing shall be provided.

60. QUALITY ASSURANCE PROVISIONS

60.1 Responsibility for Inspection. Unless otherwise specified in the contract, the supplier is responsible for the performance of all inspection/validation requirements as specified herein. Except as otherwise specified, the supplier may use his own or any other inspection facilities and services acceptable to the procuring activity. The procuring activity reserves the right to perform in-process inspections and/or witness any of the inspections/validations specified herein.

60.2 TRD Inspection and Acceptance. All material furnished in accordance with this specification shall be subject to inspection and acceptance by the procuring activity.

60.2.1 Inspection. Inspection shall consist of a review of the TRD to ensure that the information, instructions, and format (textural and illustrative) requirements of this standard are met. The TRD inspections, as a minimum, shall be performed by comparing the ATLAS test procedure with the applicable performance specification to determine that the proper types of testing are defined and that there is a test and appropriate tolerances referenced to each specified performance requirement.

60.2.2 Acceptance. Acceptance of the data required by this standard shall be accomplished by submittal of copy of the validated TRD and validation certificate to the procuring activity. This acceptance, however, is contingent on final review of the delivered materials by the procuring activity. The procuring activity shall notify the TRD supplier of final acceptance of the data required by this specification, and/or revisions required thereto.

60.2.2.1 Acceptance Criteria. Criteria for accepting the TRD shall be:

a. Conformance of the TRD to the format and content requirements outlined in Appendix C and D.

b. Verified UUT performance characteristic/test requirements matrix, Appendix C Figure 10.

c. Availability of UUT source data per the requirements defined in this document.

60.3 Preparation for Delivery. The TRD shall be delivered as specified in the governing procurements order.

APPENDIX B

COMPATIBILITY TASK SCORING DATA

10. SCOPE

This appendix contains checklists applicable to scoring compatibility tasks. The checklists contain questions relating to common ATE compatibility design parameters, and the questions have been ordered in a logical sequence to facilitate scoring. Although 40. Design Data, is not used for directly scoring compatibility performance, it is included because of its importance to test program design. Task scores are obtained by totaling the individual question scores.

20. ATE COMPATIBILITY CHECKLIST

20.1 Functional Modularity. Determine if the WRA is functionally modularized at all levels of assembly/disassembly.

a. Determine:	Score
(1) Each WRA function is contained within a single SRA and each SRA function is contained within a Sub-SRA.	4
(2) The WRA is functionally modularized, but some SRA functions are not modularized within Sub-SRAs.	3
(3) A few WRA functions are contained on more than one SRA, and/or most SRAs are not functionally modularized.	2
(4) Most WRA functions encompass more than one SRA.	0

20.2 Functional Independence. Determine if the WRA and its SRAs are capable of being tested without stimulation by another WRA or SRA and without simulation of another WRA or SRA.

a. Determine:	Score
(1) The WRA and all SRAs are functionally independent.	4
(2) Some SRAs require simulation within the ID using passive and/or simple active elements	2
(3) Stimulation by another WRA or SRA is required, or complex simulation is required.	0

20.3 Adjustments. Determine if adjustments (e.g., trimming, tuning, alignment) must be made while testing on ATE. An adjustment includes any action that changes variable components such as potentiometers, variable capacitors, inductors, transformers, etc., that affect operation of the equipment.

a. Determine:	Score
(1) No adjustments or realignment are necessary on the WRA and its SRAs.	4
(2) A small number of simple non-interactive adjustments are required, but no complex adjustment or realignment is required.	3
(3) One or two SRAs require complex adjustment or realignment.	2
(4) The WRA or more than two SRAs require complex adjustment or alignment.	0

20.4 External Test Equipment. Determine whether external equipment is required to generate a stimulus or to monitor response signals.

a. Determine:	Score
(1) All stimulus generation and response monitoring can be accomplished by the target ATE.	4
(2) Signal generation, synchronization, or waveshaping circuits are required within the ID.	2
(3) External test equipment is required.	0

20.5 Environmental. Determine if the WRA or the SRAs require special environmental considerations during test on the ATE, such as vacuum chambers, oil baths, shock tables, ovens, cooling air, screen rooms, etc.

a. Determine:	Score
(1) No special environment is required	4
(2) Forced air cooling or an electromagnetically shielded enclosure is required.	2
(3) Other special environment conditions are required	0

20.6 Stimulus and Measurement Accuracies. Determine the stimulus and measurement accuracies required for high confidence test.

a. Determine:	Score
(1) All tests can be performed on ATE at high confidence levels: i.e., stimulus is adequate and measurement is at least ten times more accurate than the tolerance on the UUT.	4
(2) Measurement is at least three but less than ten times as accurate than the UUT tolerance.	3
(3) Measurement is between one and three times more accurate than the UUT tolerance.	1
(4) Stimulus and/or measurement accuracy is inadequate.	0

20.7 Test Point Adequacy. Determine if sufficient test points are provided for non-ambiguous fault isolation and for monitoring redundant circuits and BIT circuits.

a. Determine:	Score
(1) Redendant and BIT circuits can be fully tested and test points at the output of each functional circuit permit direct non-ambiguous fault isolation.	4
(2) Indirect (non-signal tracing) trouble-shooting and/or ambiguous fault isolation (within permissible limits per AR-10) is necessary.	3
(3) Redundant and BIT circuits not tested or there is excessive ambiguity.	0

20.8 Test Point Characteristics. Determine test point impedance and voltage levels.

a. Determine:	Score
(1) Voltage is less than 350 VRMS and impedance is compatible with the ATE interface. WRA test points will drive up to ten feet of properly terminated coaxial cable.	4
(2) Voltage dividers and/or passive and simple active impedance transformation are required within the ID.	2

(3)	Waveshaping and/or signal transformation is required.	2

20.9 Test Point Isolation. Determine if damage to a UUT will result from a short circuit between any test point and ground, or if wideband noise impressed on the test point will degrade performance.

a. Determine:		Score
(1)	Test points are insensitive to external disturbance and no damage results from a short circuit.	4
(2)	Test points are sensitive to external disturbance but no damage results from short circuit.	2
(3)	A test point short circuit will damage the UUT.	0

20.10 Power and Load Requirements. Determine the current and voltage required to power the WRA and the loads required to absorb the output power of the WRA.

a. Determine:		Score
(1)	The power and load requirements can be met by standard ATE resources.	4
(2)	The loads can be accommodated in a simple or intermediate ID.	3
(3)	The quantity of loads is such that the ID is complex or ship's power or an external power source must be used.	0

20.11 Warm-Up. Determine if the WRA and/or any SRA requires warm-up on ATE to ensure accurate test.

a. Determine;		Score
(1)	No warm-up is required	4
(2)	Warm-up is less than 5 minutes	2
(3)	Less than 15 minutes	1
(4)	Greater than 15 minutes	0

30. MAINTAINABILITY CHECKLIST

30.1 Access. Determine if internal access is adequate for

visual inspection and manipulative actions.

a. Determine:	Score
(1) Access is adequate for both visual inspection and manipulative tasks in subassembly or unit repair due to internal construction and part location.	4
(2) Access is adequate for visual inspection but not for manipulative tasks.	2
(3) Access is adequate for manipulative tasks, but physical location does not easily permit visual inspection.	2
(4) Access is not adequate for visual inspection or manipulative tasks.	0

30.2 Packaging. Determine accessibility (within subassembly) to failed components or parts.

a. Determine:	Score
(1) Internal access to components and parts can be made within one minute, with no mechanical disassembly.	4
(2) Little disassembly is required (less than three minutes).	2
(3) Considerable disassembly is required (more than three minutes).	0

30.3 Replaceability of Failed Elements. Determine the manner in which failed elements (e.g., assemblies, components, parts) are removed or replaced during maintenance action.

a. Determine:	Score
(1) Units or parts are of plug-in nature with a simple restraining mechanism.	4
(2) Units or parts are of plug-in nature and mechanically held by fasteners that are not of the quick connect/disconnect variety.	2
(3) Units are of solder-in nature so that removal requires unsoldering of part terminations.	2

(4)	Units are of solder-in nature and mechanically held.	0

30.4 Safety (Personnel). Determine if the maintenance action requires personnel to work under hazardous conditions such as close proximity to high voltage, radiation, moving parts, or high-temperature components, etcc.

a. Determine:

		Score
(1)	Task does not require work to be performed in close proximity to hazardous conditions; no precautions necessary.	4
(2)	Delay is encountered because of precautions necessary to neutralize unsafe conditions.	2
(3)	Time is consumed because of special precautions required to avoid hazardous conditions.	0

30.5 Labeling. Determine if elements (e.g., units, assemblies, parts, etc.) associated with the maintenance actions are adequately identified.

a. Determine:

		Score
(1)	All elements are labelled with full identifying information, and all identifying information is clearly visible.	4
(2)	All elements are labelled with full identifying information, but some information is not visible.	2
(3)	All information is visible, but some elements are not fully identified.	2
(4)	Some information is not visible and some elements are not fully identified.	0

30.6 Latches and Fasteners. Determine if screws, clips, fasteners, or latches within the unit require special tools.

a. Determine:

		Score
(1)	Latches and fasteners are: (1) captive, (2) need no special tools, and (3) require only a fraction of a turn for release.	4

(2)	Latches and fasteners meet two of the above three criteria.	2
(3)	Latches and fasterners meet one of the above criteria.	1
(4)	Latches and fasteners meet none of the above criteria.	0

30.7 Connector Standardization. Determine the number of different connector types and sizes used on the WRA and SRAs.

a. Determine:		Score
(1)	MIL-C-81511 connectors are used on the WRA; all SRAs use the same connector.	4
(2)	Quick-disconnect connectors other than MIL-C-81511 are used on the WRA; all SRAs use the same connector.	3
(3)	The WRA has quick-disconnect connectors, but various connectors are used on SRAs.	2
(4)	Connectors are not limited to one type or quick-disconnect types are not used. SRAs are not plug in.	0

30.8 Connector Keying and Accessibility. Determine if WRA connectors are keyed to preclude inserting any connector into the wrong receptacle, and are readily accessible for quick connection and removal.

a. Determine:		Score
(1)	Connectors meet both criteria	4
(2)	Connectors meet one of the above criteria	2
(3)	None of the two criteria are met	0

40. DESIGN DATA CHECKLIST

40.1 General Information Requirements

a. Unit orientation and/or environment non critical.

b. All adjustments points clearly indicated, together with adjustment parameters.

c. No EMI or RFI problem in testing the unit.

d. High voltage warnings or other safety precautions required.

e. Special handling or operational requirements (such as, preoperational warm-up time, matched-set replacement of specific components, adjustment sequence).

f. Failure-rate data and failure mode effects analysis available.

40.2 Electrical Interface and Parameters

a. All functional connections and test points clearly labelled.

b. All grounds, shields, and signal returns indicated.

c. The tolerances or limits of parameters are compatible with field rather than factory requirements.

d. Output impedances clearly stated.

e. Special loading requirements defined.

f. Special requirements for settling time relative to making a measurement.

g. The primary power requirements are clearly indicated, including maximum allowable variations in voltage and frequency.

h. Sequence of the application or removal of power is necessary.

i. Each input signal completely defined.

j. Each output signal completely defined.

k. Each test point signal completely defined.

l. High frequency line-lengths non-critical.

m. Trigger or synchronizing inputs from ATE.

APPENDIX C

PAGE_____OF_____

TRD NO.

REV. DATE

TEST REQUIREMENTS DOCUMENT (TRD)

FOR

_____
(UUT) Name and Nomenclature

SUPPLIER UUT UNIT NO._____

SUPPLIER UUT PART NO._____

AVIONIC SUBSYSTEM _____
(A/N NOMENCLATURE)

PREPARED BY: _____

_____

CONTRACT NO. _____

FIGURE 1. Cover Sheet

PAGE_____OF_____

TRD NO._____

REVISION_____

DATE_____

APPROVALS

_____(SUPPLIER)_____

PREPARED BY_____

APPROVED_____

APPROVED_____

APPROVED_____

FIGURE 2. Approval Sheet

PAGE_____OF_____

TRD NO_____

REVISION_____

DATE_____

REVISION SUMMARY

PAGE NO.	REV. LTR.	APPROVED	DATE	ECP Number and/or REASON FOR CHANGE

FIGURE 3. Revision Index Sheet

PAGE_____ OF_____

TRD NO._____

REVISION_____

DATE_____

CONFIGURATION-RELATED DATA

UUT P/N_____
FED STOCK NO._____
UUT CONFIGURATIONS_____
UUT REFERENCE DESIGNATIONS_____

DATA USED TO PREPARE TRD

ENGINEERING DATA	NUMBER	REV./DATE	REMARKS
*SCHEMATIC DRAWING			
*ASSEMBLY DRAWING			
*OUTLINE DRAWING			
*CONNECTION/WIRING DRAWING			
*ACCEPTANCE TEST SPEC			
*ALIGNMENT PROCEDURE			
*PARTS LIST			
*ECNS AFFECTING UUT			
T.O.s OPERATION MAINTENANCE IPB OVERHAUL MANUAL			
FUNCTIONAL BLOCK DIAGRAMS			
NON-STANDARD PARTS SPEC's			
UUT FAMILY TREE			
THEORY OF OPERATION			
OTHER			

* These items considered essential part of review package

FIGURE 4. Configuration-Related Data Sheet

PAGE_____OF_____

TRD NO._____

REVISION_____

DATE_____

UUT DATA SECTION

Contents Page

FIGURE 5. UUT Data Section Cover Sheet

PAGE_____OF_____

TRD NO._____

REVISION_____

DATE_____

DELIVERABLE UUT DRAWING INDEX
(ATTACHMENT NO. 1 TO TRD)

Item	Drawing Description	Dwg. No.	Dwg. Rev./Date	UUT Config.	Comments
1	Assembly Drawings				
2	Schematic				
3	Logic Diagrams				
4	Functional Block Diagram				
5	Connection/Wiring Diagrams				
6	Parts List				
7	Family Tree				
8	UUT/Subassembly MTBF Data				
9	Acceptance Test Procedure				
10	UUT Maintenance Manual				

FIGURE 5.1 UUT Drawings

PAGE_____OF_____

TRD NO._____

REV._____DATE_____

UUT GENERAL TEST REQUIREMENT DESIGN DATA

WEIGHT_____POUNDS

SPECIAL TOOLS O SEE PAGE_____ O NONE REQUIRED

HANDLING REQUIREMENTS O SEE PAGE_____ O NONE REQUIRED

REQUIRED OPERATING CONDITIONS

SPECIAL FIXTURES REQUIRED:
O NONE
O SEE PAGE_____
O SEE DRAWING_____

COOLING AIR REQUIRED:
O NONE
_____CFM AT_____INLET TEMP.
O USE

HYDRAULIC PRESSURE REQUIRED:
O NONE
_____PSIG AT_____
_____
O USE_____
_____

PNEUMATIC SOURCE REQUIRED:
O NONE
_____
_____
O USE_____
_____

OTHER REQUIRED:
O SEE PAGE_____

SAFETY REQUIREMENTS
O NONE
O SEE PAGE_____

FIGURE 5.2 General Test Requirements Data Sheet (Sheet 1 of 2)

PAGE_____OF_____

TRD NO._____

REV._____DATE_____

UUT GENERAL TEST REQUIREMENT DESIGN DATA

POWER REQUIREMENTS

AC SOURCES	#1	#2	#3	#4
VOLTAGE				
VOLTAGE TOLERANCE				
FREQUENCY				
FREQUENCY TOLERANCE				
CURRENT MAXIMUM				
PHASE & REFERENCE				
CONNECTOR & PIN: INPUT(s)				
: RETURN				

DC SOURCES	#1	#2	#3	#4	#5	#6
VOLTAGE & POLARITY						
VOLTAGE TOLERANCE						
CURRENT						
RIPPLE V (PK-PK)						
CONNECTOR & PIN: DC INPUT						
: DC RETURN						

FIGURE 5.3 General Test Requirements Data Sheet (Sheet 2 of 2)

PAGE_____OF_____

TRD NO._____

REV._____DATE_____

UUT PERFORMANCE CHARACTERISTICS

1. Theory of Operation

   (Functional & Self-Test Modes)

2. Functional Block Diagrams

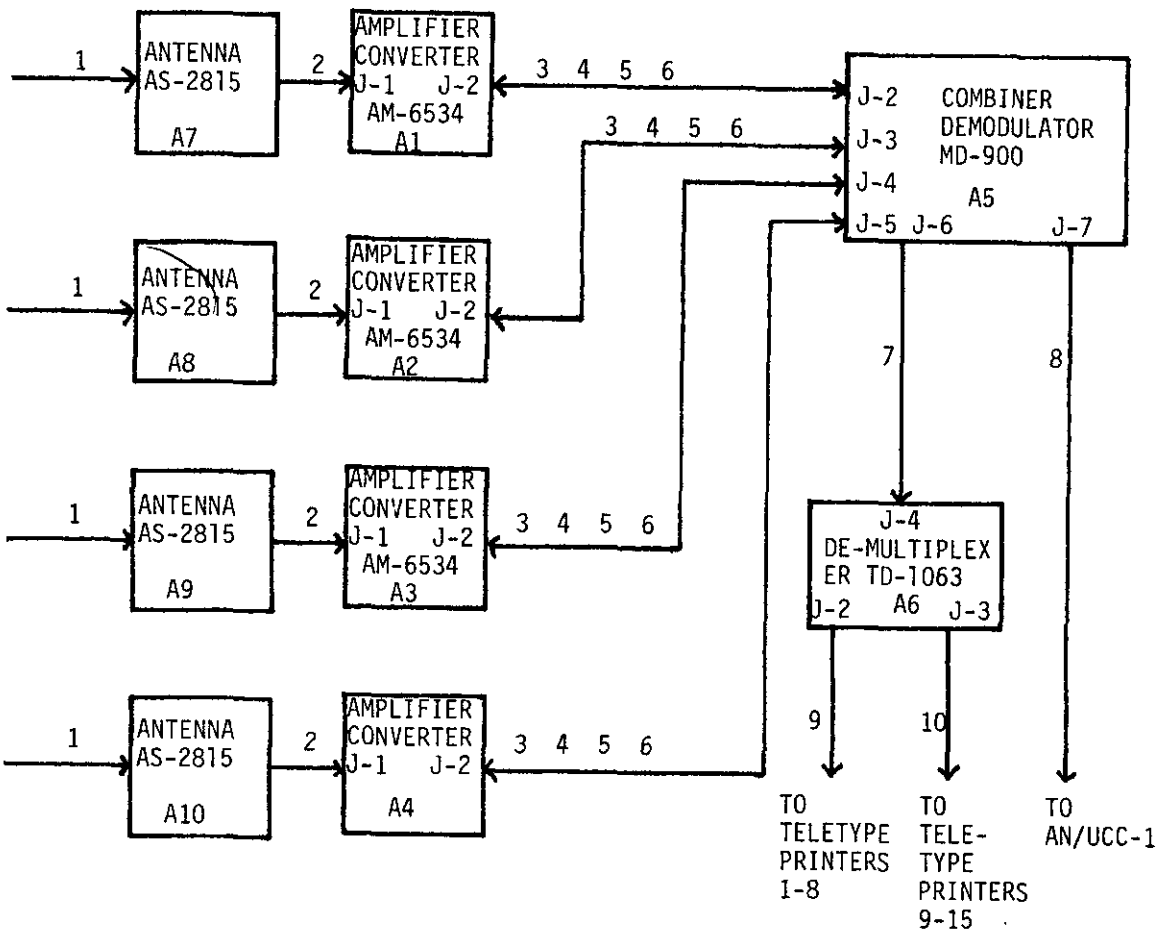
   (Assembly & Subassembly)

3. Operating Instructions

4. Operational Constraints

FIGURE 5.4 UUT Performance Characteristics

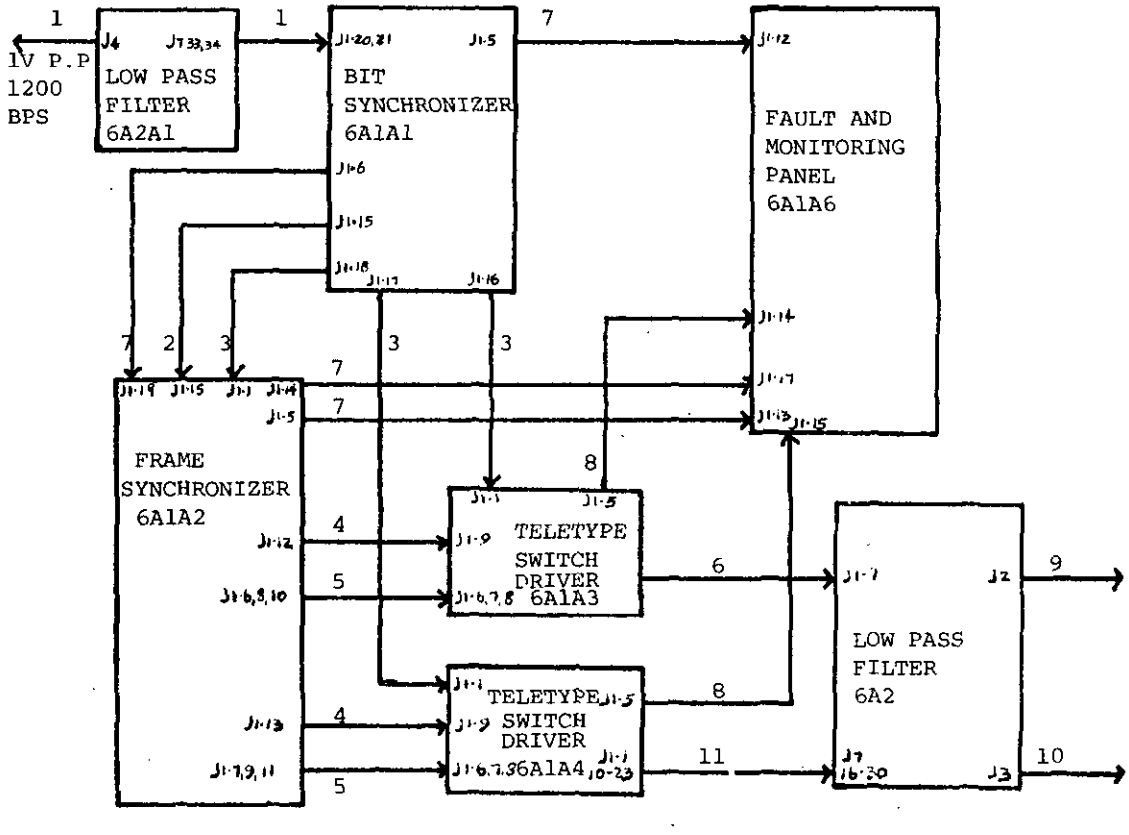
SATELLITE SIGNAL RECEIVING --AN/URR-X



1. SIGNAL FROM SATELLITE, 249-259 MHz. 0.1.3μ V/m
2. 249-259 MHz. -132 dBm to -97 dBm. 50 OHMS
3. 1.6 V L. O. FROM COMBINER, 40 dB MAX. CABLE LOSS
4. 20 MHz 1.F., 9 dB MAX. CABLE LOSS. 7 mV MIN. TO CONVERTER
5. +20 VDC POWER SOURCE TO AMPLIFIER-CONVERTER
6. +12 DVC ANTENNA RELAY CONTROL VOLTAGE TO CONVERTER
7. 16 CHANNELS TIME DIVISION MULTIPLEXED. NAZ CODED DATA, 1V PP. 1200 BPS
8. 16 CHANNELS FREQUENCY DIVISION MULTIPLEXED DATA TO AN/UCC-1 TELEGRAPH TERMINAL. 300-3500 Hz. -25 TO -10 dBm. 600 OHMS
9. 8 CHANNELS, 75 BPS TO TELETYPE PRINTERS. MARK = 150 OHMS MAX. SPACE = 100 K OHMS MIN
10. 7 CHANNELS, 75 BPS TO TELETYPE PRINTERS

Figure 5.5 (Sheet 1)
Example of Unit Functional Block Diagram

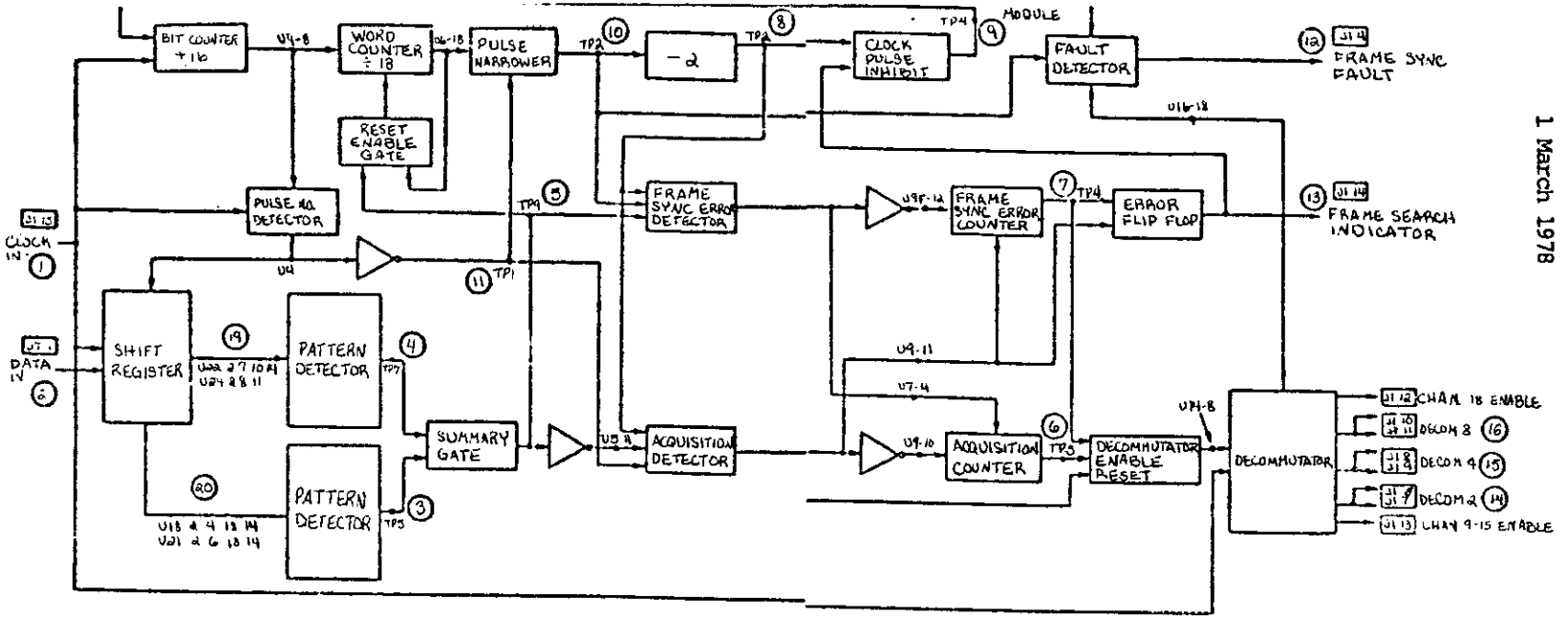
DE-MULTIPLEXER TD 1063/URR-X



1. 16 CHANNLES TIME DIVISION MULTIPLEXED DATA FROM DEMODULATOR A5-J6
2. 1200 Hz CORRECTED CLOCK, 4.5V P.P SQUARE WAVE
3. DECODED DATA, 3.5V P.P
4. ENABLE SIGNAL, 3.5V P.P
5. DECOMMUTATION SIGNALS, 3.5V P.P
6. 8 CHANNELS TELETYPE DATA, SWITCH CLOSURE AT 75 BITS/SEC
7. FAULT INDICATION SIGNAL, FAULT = 3.5VDC. NO FAULT = 0VDC
8. FAULT INDICATION SIGNAL, FAULT = +2 VDC, NO FAULT = 4 VDC
9. 8 CHANNELS TELETYPE DATA, 75 BITS/SEC TO PRINTERS 1-8
10. 7 CHANNELS TELETYPE DATA, 75 BITS/SEC TO PRINTERS 9-15
11. 7 CHANNELS TELETYPE DATA, SWITCH CLOSURE AT 75 BITS/SEC

FIGURE 5.6 (SHEET 2)

EXAMPLE OF ASSEMBLY FUNCTIONAL BLOCK DIAGRAM



NOTE: 1. TP NUMBERS REFER TO TEST POINTS WITHIN THE MODULE SEE SCHEMATIC

2. NOMINAL LOGIC LEVELS ARE +3.6 V = LOGIC "1", +0.48 V = LOGIC "0".

3. ALL JACK NUMBERS FOR THE MODULE INTERCONNECTIONS APPEAR IN SQUARE BLOCKS ADJACENT TO THE ASSEMBLY ON WHICH IT IS MOUNTED. THESE REFERENCE DESIGNATIONS CORRESPOND TO RELEVANT SCHEMATICS AND MUST BE PREFIXED BY THE APPROPRIATE ASSEMBLY REFERENCE DESIGNATIONS

(1) CLOCK IN SIGNAL FREQUENCY = 1000 Hz.

(2) DATA BIT STREAM AT 1000 BPS

(3) WHEN LAST 2 BITS OF THE SYNC WORD APPEAR, TP3 WILL BE A LOGIC "0"

(4) WHEN THE FIRST 7 BITS OF THE SYNC WORD APPEAR, TP7 WILL BE A LOGIC "0"

(5) WHEN THE CORRECT SYNC WORD APPEARS IN THE SHIFT REGISTER, TP5 WILL BE A LOGIC "0"

(6) WHEN THE SYSTEM IS IN FRAME SYNC, TP3 WILL HAVE A BASIC LOGIC 0 PULSE EVERY 900-SEC. WHEN THE SYSTEM IS NOT IN FRAME SYNC, TP3 WILL BE AT A LOGIC "1" CONTINUOUSLY

(7) WHEN THE SYSTEM IS IN FRAME LOCK, TP5 WILL BE AT A LOGIC "1". WHEN THE SYSTEM IS NOT IN FRAME SYNC, THERE WILL BE A 413 m SEC. LOGIC "0" PULSE ONCE EVERY 1.6 SECONDS.

(8) IN AN UNSYNCHRONIZED CONDITION TP4 WILL HAVE A 1m SEC LOGIC "0" PULSE ONCE EVERY 400 m SEC. IN A SYNCED CONDITION TP4 IS IN A CONSTANT LOGIC "1" CONDITION

(9) A SIGNAL AT 2.5 Hz APPEARS AT TP3 IN AN UNSYNCED CONDITION. 5 PPS REPRATE IN A LOCKED CONDITION

(10) A 413 m SEC LOGIC "1" PULSE APPEARS ONCE EVERY 800 m SEC AT TP2 IN EITHER SYNCED OR UNSYNCED CONDITION

(11) A 413 m SEC LOGIC "1" PULSE APPEARS ONCE EVERY 138 m SEC AT TP1 IN EITHER A SYNCED OR UNSYNCED CONDITION

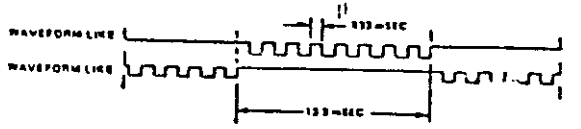
(12) FRAME SYNC FAULT IS "1" FOR A FAULT AND "0" FOR NO FAULT

(13) FRAME SEARCH INDICATOR = "1" FOR AN UNSYNCED CONDITION

(14) FREQUENCY = 500 Hz

(15) FREQUENCY = 300 Hz

(16) FREQUENCY = 150 Hz



(17) 7 TTL LOGIC LEVELS. ALL AT LOGIC "1" WHEN FIRST 7 DIGITS OF CORRECT SYNC WORD APPEARS.

(18) 8 TTL LOGIC LEVELS. ALL AT LOGIC "1" WHEN LAST 9 DIGITS OF CORRECT SYNC WORD APPEARS.

FRAME SYNCHRONIZER DEMULTIPLEXER 6A1A2 BLOCK DIAGRAM

TRD NO._____

REVISION_____

DATE_____

UUT GENERAL TEST OPERATING CONSTRAINTS INDEX SHEET

GENERAL PROCEDURES

	NONE	SEE PAGE
VISUAL INSPECTION INSTRUCTIONS.....	0	_____
RESTART OR RETEST INSTRUCTIONS.....	0	_____
STANDARD MEASUREMENT DELAY REQUIREMENTS.....	0	_____
GENERAL PRECAUTIONS.....	0	_____
PRETEST INSTRUCTIONS.....	0	_____
OPERATIONAL TEST CONSTRAINTS.....	0	_____
ALIGNMENT PROCEDURES.....	0	_____

SPECIAL PRECAUTIONS

	NONE	SEE PAGE
LEAD LENGTH.....	0	_____
SEPARATION.....	0	_____
SHIELDING, GROUNDING.....	0	_____
TRANSIENTS, POWER SEQUENCE.....	0	_____
LOAD MATCHING, VSWR.....	0	_____
RADIATION.....	0	_____
OTHER.....	0	_____

FIGURE 5.8 UUT General Test Operating Constraints Index Sheet

PAGE _____ OF _____

TRD NO. _____

REVISION _____

DATE _____

INTERFACE DEFINITION

CONNECTORS

UUT CONNECTOR REF DESIG-NATION	UUT CONNECTOR PART NO.	MANU-FACTURER	MANU-FACTURER PART NO.	MATING CONNECTOR PART NO.

MOUNTING, HOLDING, SUPPORT FIXTURES

HYDRAULIC PNEUMATIC COOLING FIXTURES

OTHER

FIGURE 5.9 Interface Definition Sheet (Sheet 1 of 2)

PAGE_____OF_____

TRD NO._____

REVISION_____

DATE_____

INTERFACE DEFINITION

UUT

CONN/PIN	PIN DESIGNATION	SIGNAL NAME	DESCRIPTIVE DATA

FIGURE 5.10 Interface Definition Sheet (Sheet 2 of 2)

Failure Rate Data Form Date _____ Sheet No. _____

System _____ Equipment _____ Unit _____ Module _____

Operating Condition _____

PART IDENTIFICATION					4	5	6	7	8	9	10	11	12
1 Assembly or Board Code	2 Sub-Assembly or Board Code	3 Reference Desig. LTRS	CODE Number	LTR	Part Type or Part Drawing Number	Failure Rate Figure	Electrical and/or Mechanical Stress Ratio	Temp (°C)	Failure Ratio Controlled Test Condition	Adjustment Factor	Application K-Factor	Application Failure Rate	NOTES

Fig. 5.11 UUT Failure Data

PAGE_____OF_____

TRD NO._____

REVISION_____

DATE_____

UUT TEST REQUIREMENTS SECTION

Contents Page

FIGURE 6. UUT Test Requirements Section Cover Sheet

DETAILED TEST REQUIREMENT INFORMATION

PAGE ___ OF ___
TRD NO.
REV. ___ DATE ___

TEST REQT. NO.	UUT PERF SPEC PARAM	PARAMETRIC DESCRIPTION			ATLAS DESCRIPTION					SPECIAL REQUIREMENTS			
		TYPE	DESCRIPTION	UUT PIN	MEASURE CHARACTERISTIC	NOUN	EVAL	STATEMENT CHARACTERISTIC	UUT CONNECTION	OPERATING OR PROCEDURAL CONSTRAINT	TEST RESULTS (PART II ONLY) REPLACE	ADJUST	GO TO TEST NO.
1	XXX	POWER											
		STIMULI											
		MEAS											
		OTHER											
2	YYY												
Nth	ZZZ												

☐ PERFORMANCE REQT
☐ DIAGNOSTIC REQT

Figure 7. Itemized Parametric/ATLAS Description of UUT Test Requirements

TEST NO:_____

INPUT ○ SIMULTANEOUS INPUTS ○

OUTPUT○ SIMULTANEOUS OUTPUTS○

SERIAL DATA ○

PARALLEL DATA○

DIGITAL PATTERN DATA

PAGE _____

TRD NO._____

REV:_____ DATE _____

CONTINUATION SHEET ☐

PATTERN NUMBER	DESIGNATION OF SERIAL BIT SIGNIFICANCE OR PARALLEL BIT CONNECTOR PIN 0- time →	RESPONSE		
		DIGITAL GO/NG	ANALOG VALUE	ANALOG TOLERANCE

Figure 8. Digital Pattern Data Sheets (Sheet 1 of 2)

TEST NO._____
UUT _____

DIGITAL PATTERNS NO-GO ACTION
CONTINUATION SHEET

PAGE
TRD NO._____
REV. _____ DATE _____

ACTION				PATTERN NUMBERS																							
SEARCH TO TEST	SEARCH TO PATTERN	ADJUST	REPLACE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

NOTES:

Figure 9. Digital Pattern Data Sheets (Sheet 2 of 2)

UUT TEST REQT DESCRIPTION	UUT PERFORMANCE SPECIFICATION PARAGRAPH								COMMENTS
	$X_1.X_1.X_1.X_1$	$X_2.X_2.X_2.X_2$	⟶	⟶	- - - -	- - - -	⟶	$X_n.X_n.X_n.X_n$	
(A)	TEST REQT NO								
(B)		TEST REQT NO							
(C)			TEST REQT NO					TEST REQT NO	
(D)				TEST REQT NO					
(E)						TEST REQT NO			
(F)									
↓									
Nth			TEST REQT NO						

Figure 10. UUT Test Requirement/Performance Specification Matrix

APPENDIX D

SUMMARY DESCRIPTION OF ATLAS

10. SCOPE

The description of ATLAS in this appendix has been limited to defining and describing ATLAS statement elements which can best describe a UUT test requirement. This approach is focused on ATLAS signal-oriented verbs, corresponding nouns, and noun modifiers. Since the TRD guidelines presented in this document direct themselves toward a description of test requirements as opposed to test procedures and computer program structures, the non-signal-oriented verbs were de-emphasized. For example, no consideration or explanation has been given to branching statement directives such as "GO TO".

Separate tables have been provided which illustrate examples of "sensor" verbs and "source" verbs. Additionally, example illustrations have been provided which clearly describe the structure of the ATLAS elements and should provide sufficient guidance to the TRD writer to permit accurate generation of the detailed ATLAS test requirements (reference Figure 7 Appendix C).

The ATLAS elements and associated descriptions have been derived from the Aeronautical Radio, Inc., ATLAS Specification, "ARINC Specification 416-10". Additional clarification or guidance in the utilization of the ATLAS may be obtained from this document or IEEE ATLAS 1976.

20. GENERAL

ATLAS (Abbreviated Test Language for All Systems) is a standard abbreviated English language used in the preparation and documentation of test requirements or procedures which can be implemented either manually or with automatic or semiautomatic test equipment.

The following are general characteristics of ATLAS:

a. Unit Under Test (UUT) Orientation

The language is dedicated to defining the test requirements of the unit under test (UUT) with no reference to nor dependence upon the test equipment which may be used. The latter may be automatic, manual or of hybrid design.

b. Unambiguous Communication

The selective use of English language terms which are compatible with the description of test requirements and a formal structure of their use (as defined in ARINC Specification 416, Volume I, and this document) constitute an environment to ensure an unambiguous description of the requirements of a test procedure for the UUT designers, developers, users, and maintenance personnel.

ATLAS STATEMENT STRUCTURE AND ELEMENTS

Statement Structure

The ATLAS statement are easily structured and read by man and machine.

The structure of a general ATLAS statement is shown in Figure 1 and the structure of source and sensor type statements in Figures 2 and 3 to describe similarity of ATLAS statements.

All ATLAS statements comprise two principal fields - one fixed and the other variable. The fixed field and all parts of the variable field are terminated by a comma, followed by a space. There is one exception to this, the last part of the variable field is terminated by a currency sign.

Statement Elements

a. Flag Field -

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
          VOLTAGE MAX 10V, CNX HI J1-15 LO J1-10 $
Flag
```

The first field of each statement is the flag field. It is one character in length and is located in the first column of the first row of each statement. The field must be used for one of the following entries or left blank. (Information only - not essential to describe the test requirements.)

C	Comments
E	Entry
B	Branching
M	Measure State (for sensor statements only)

b. Statement Number Field -

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
   VOLTAGE MAX 10V, CNX HI J1-15 LO J1-10 $
Flag
```

The second field is the statement number. It is six characters long and provides a reference designator for each program statement. The first four digits of the number are called "test number" and the remaining two digits are called "step number". Each succeeding program step is assigned to a higher number than the preceding one, but it is not necessary to use the next higher number. (Information only - not essential to describe the test requirements.)

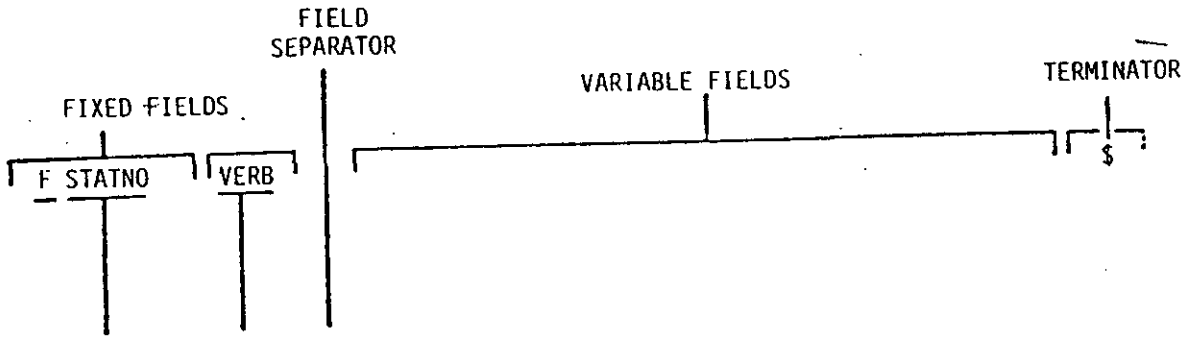


FIGURE 1. General ATLAS Statement Structure

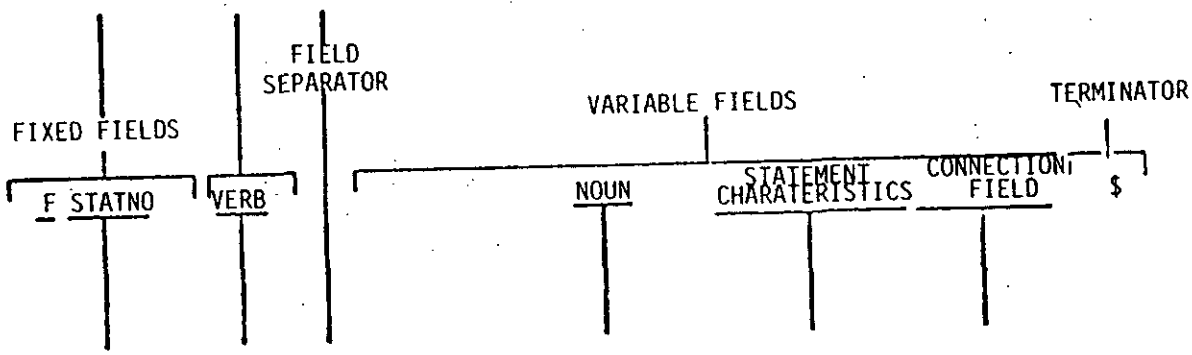
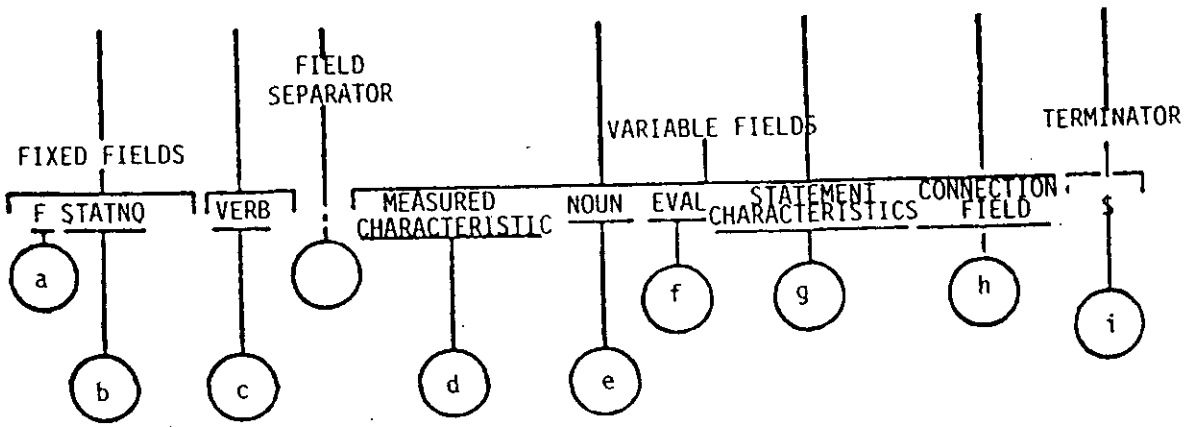


FIGURE 2. Source Type



NOTE: Letters in circles refer to paragraphs describing the statement elements

FIGURE 3. Sensor Type

c. Verb

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
Flag      Verb

                VOLTAGE MAX 10V. CNX HI J1-15 LO J1-10 $
```

The third field is the verb field. Its length is variable depending on the entry to be made. Every ATLAS statement must have an entry in this field. Possible entries are listed in Table 1 and 2.

d. Measured Characteristic -

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
Flag      Verb    Measured
                  Character-
                   istic

                VOLTAGE MAX 10V, CNX HI J1-15 LO J1-10 $
```

A measured characteristic field is included in sensor type statements to specify which of the available characteristics is to be evaluated.

e. Noun

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
Flag      Verb    Measured   Noun
                  Character-
                   istic

                VOLTAGE MAX 10V, CNX HI J1-15 LO J1-10 $
```

The first element of the source, sensor, and load statements is a noun, each of which generally describes an electrical or physical quantity to be measured or applied. Refer to Table 3.

f. Evaluation Field -

```
E  120010 VERIFY, (VOLTAGE), DC SIGNAL, GT 9 V,
Flag      Verb    Measured   Noun       Eval
                  Character-
                   istic

                VOLTAGE MAX 10V, CNX HI J1-15 LO J1-10 $
```

An evaluation field is included in statements such as COMPARE and VERIFY to express the values of some program variable.

TABLE 1. SENSOR SIGNAL ORIENTED VERB DESCRIPTION/FUNCTION

VERB	DESCRIPTION/FUNCTION
MEASURE	Used to acquire and store measurement(s) for future evaluation
MONITOR	Used to acquire and display the present measurement repeatedly until a MANUAL INTERVENTION directs the program to proceed.
VERIFY	Used to acquire, store and compare a measurement for a following GO TO.
TO REACH	Used with a source ADJUST verb to set a source function to a value without pre-knowledge of the required source value by monitoring a sensor function.
TO MAXIMIZE	Used with a source ADJUST verb to set a source function to a peak maximum value without pre-knowledge of the required source value by monitoring a sensor function.
TO MINIMIZE	Used with a source ADJUST verb to set a source function to dip (minimum value without pre-knowledge of the required source value by monitoring a sensor function
REMOVE	Used to OPEN, DISCONNECT and set to a quiescent state the specified sensor/function.
CONNECT	Used to enable the switching path between the LRU interface and the selected sensor instrument (opposite of DISCONNECT).
CLOSE	Used to gate a sensor function to the interface switch (opposite of OPEN).
SETUP	Used to set or adjust a sensor function(s).
READ	Used to acquire the present measured value of a sensor and store that value in the location label 'MEASUREMENT'.
OPEN	Used to remove a sensor function from the interface switch (opposite of CLOSE).
DISCONNECT	Used to disable the switching path between the LRU interface and the selected sensor instrument (opposite of CONNECT)

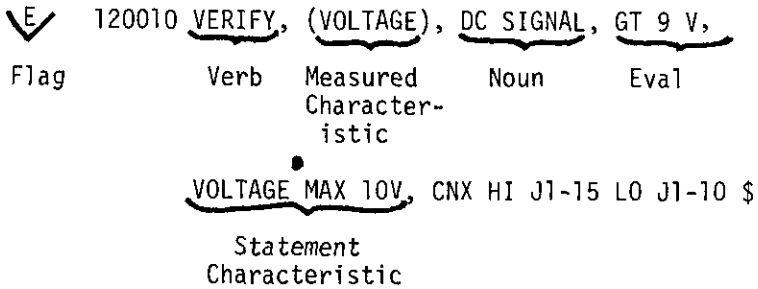
TABLE 2. SOURCE SIGNAL ORIENTED VERB DESCRIPTION/FUNCTION

VERB	DESCRIPTION/FUNCTION
APPLY	Used to accomplish a SETUP, CONNECT, CLOSE sequence for the specified source function.
ADJUST	Used to vary a stimulus function stated in the ADJUST statement until the dependent measurement satisfies the condition in the immediately subsequent TO MINIMIZE, TO MAXIMIZE, TO REACH statement.
REMOVE	Used to OPEN, DISCONNECT and set to a quiescent state the specified stimulus function.
CONNECT	Used to enable the switching path between the LRU interface and the selected instrument (opposite of DISCONNECT).
CLOSE	Used to gate a source function (opposite of OPEN).
SETUP	Used to set or adjust a source function(s).
OPEN	Used to remove a source function from the interface switch (opposite of CLOSE).
DISCONNECT	Used to disable the switching path between the LRU interface and the selected source instrument (opposite of CONNECT).

TABLE 3. ALLOWABLE NOUN DESCRIPTION

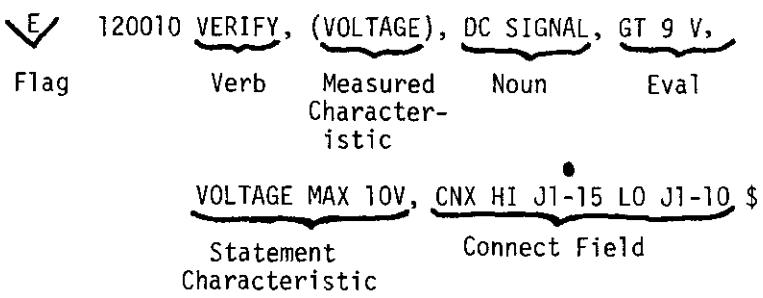
NOUN	DESCRIPTION/FUNCTION
AC SIGNAL	(Alternating Current Signal) A sinusoidal time-varying, electrical potential
DC SIGNAL	(Direct Current Signal) An unvarying electrical potential
IMPEDANCE	An electrical quantity determined by the voltage/current ratio in an electrical circuit.
LOGIC/CONTROL	An analog signal transmitter to or from the UUT over single electric circuit and used to convey control information for digital testing. LOGIC CONTROL signals may be single pulses, pulse trains, or dc levels. They may be used to control the passing, sequencing, or timing of data, including such functions as enable, disable, ready, strobe, data-received, sync, etc.
PULSED DC	(Pulsed Direct Current Signal) An electromagnetic force characterized by short duration periods of positive or negative electrical potential occurring either periodically or nonperiodically in time.
RAMP SIGNAL	A varying electromagnetic force whose wave shape is characterized by a periodic series of alternately positive and negative linear amplitude slopes wherein the ratio of positive to negative slope does not equal one.
RESOLVER	A combination of two, In-phase, ac, sine wave electromagnetic forces whose amplitude relationships describe the various rotational shaft positions of electro-mechanical devices.
SYNCHRO	A combination of three in-phase, ac sine wave electromagnetic forces whose amplitude relationships describe the various rotational shaft positions of electromechanical devices.

g. Statement Characteristics -



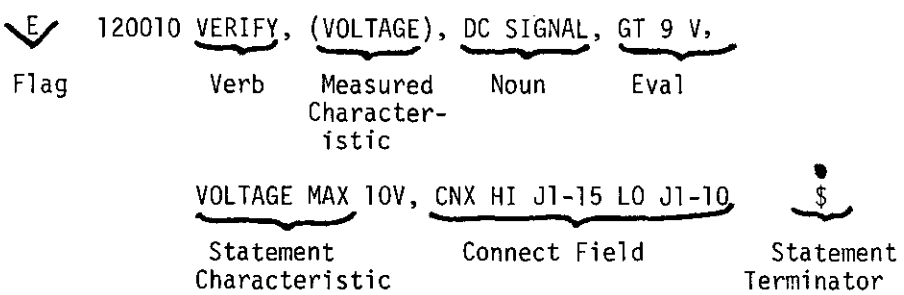
Additional information about the function (noun) is included in the statement characteristics. The allowable statement characteristics are described in noun/measured characteristics syntax diagrams.

h. Connection Field -



The last field in source, sensor, and load statement specifies the UUT points to which the described function is to be attached. The field is separated from preceding fields by a comma and the word CNX. Generally, connector designations assigned by the UUT manufacturer are used to describe the attachment points.

i. Statement Terminator -



The last character of every ATLAS statement is the currency symbol ($)

Statement Elements

The user may construct statements to generate, measure, evaluate and monitor signals by selecting the desired statement elements. The purpose of this section is to provide the user with a description and choice of some of the allowable verbs and the elements of the variable field for describing UUT test requirements.

Verbs. The verbs are categorized according to functional use and are designated as nonsignal-oriented and signal-oriented.

The nonsignal-oriented verbs are associated with the timing and sequencing of ATLAS statements and provide the capabilities of inserting time delays and repeating sequences of statements. These verbs are more "program" oriented as opposed to test requirement oriented and are defined here only for information purposes.

The signal-oriented verbs are grouped according to the resulting effect on the ATE. Single-action verbs cause a simple event, such as the reprogramming of a test instrument parameter Multi-action verbs cause multiple actions, such as the connection of stimulus to the UUT through the switching matrix, the setup of the stimulus to the required mode and output level, and finally the closure of the stimulus output relays (i.e., the APPLY verb). The sequence and description of single action verbs are shown in Figure 4.

The multi-action verbs generate complete test actions (e.g., APPLY, VERIFY, REMOVE) and should be used in lieu of the single action verbs whenever possible. Refer to Tables I and 2 for examples of signal-oriented verb selections and description.

Nouns. The noun is the first element in the variable field in a source statement and is used to describe an electrical or physical quantity. Refer to Table 3 for examples of nouns and their associated description.

Noun Modifiers. The noun modifiers are characters for which a specific value may be assigned and are used to provide additional information to describe the stimulus or sensor signals. Examples of noun modifiers are described with associated verbs and nouns in Tables 4 and 5.

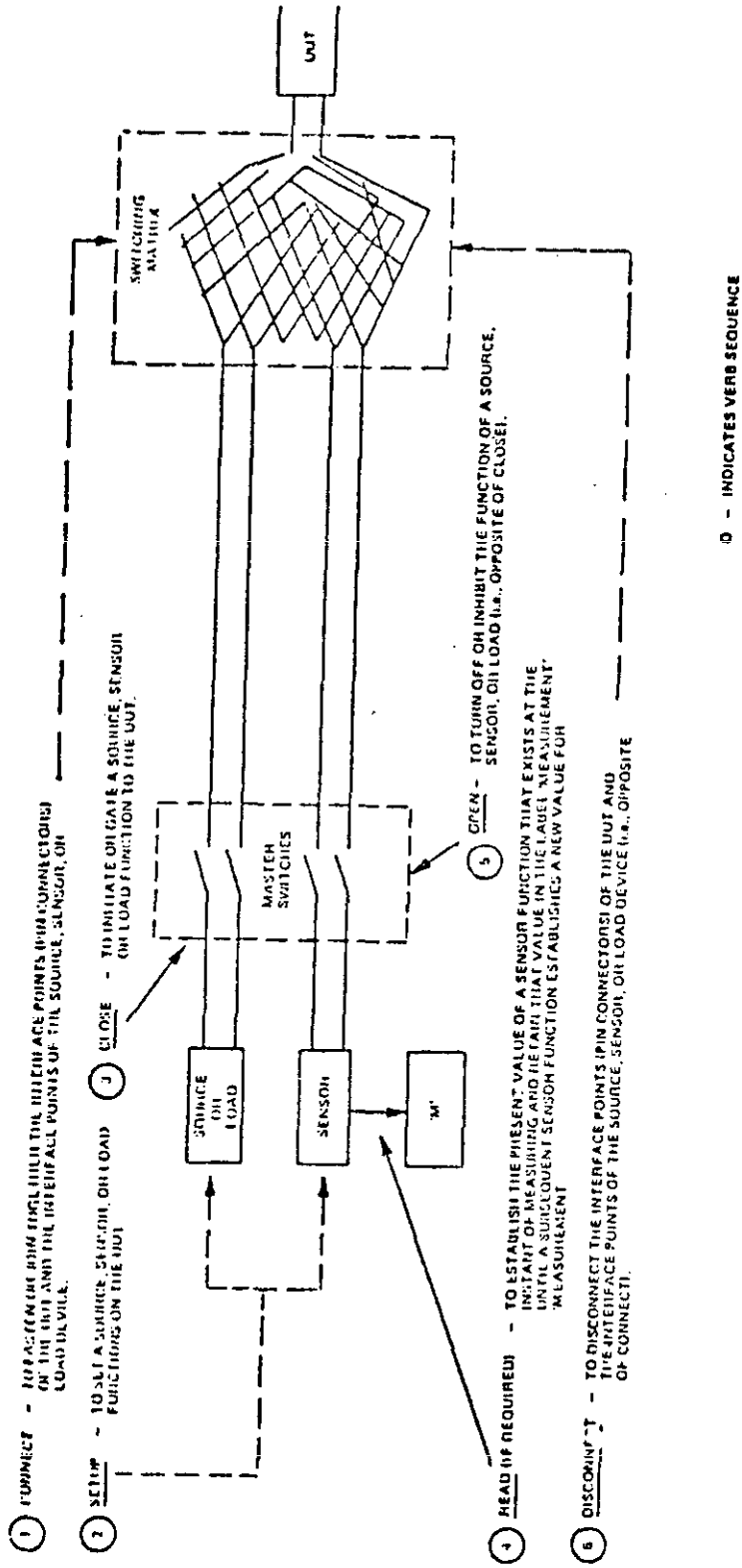


Figure 4. Single Action Verb Description and Sequence

TABLE 4. EXAMPLES OF "SENSOR" VERBS, NOUNS AND NOUN MODIFIERS

APPLICABLE VERBS:

MULTI-ACTION	SINGLE ACTION
MEASURE	CONNECT
MONITOR	CLOSE
VERIFY	SETUP
TO REACH	READ
TO MAX	OPEN
TO MIN	DISCONNECT

NOUN	NOUN MODIFIER(S)
AC SIGNAL	VOLTAGE, AC CURRENT, FREQUENCY
DC SIGNAL	VOLTAGE, DC CURRENT, VOLTAGE RATIO
RAMP SIGNAL	VOLTAGE
PULSED DC	VOLTAGE
SYNCHRO	ANGLE, VOLTAGE, FREQUENCY, IMPEDANCE, REFERENCE INPUT
IMPEDANCE	RESISTANCE

TABLE 5. EXAMPLES OF "SOURCE" VERBS, NOUNS AND NOUN MODIFIERS

APPLICABLE VERBS:

MULTI-ACTION	SINGLE ACTION
APPLY	CONNECT
ADJUST	CLOSE
REMOVE	SETUP
	OPEN
	DISCONNECT

NOUN	NOUN MODIFIER(S)
AC SIGNAL	VOLTAGE, FREQUENCY
DC SIGNAL	VOLTAGE, DC CURRENT
RAMP SIGNAL	VOLTAGE, POSITIVE SLOPE
PULSED DC	PULSED AMPLITUDE
RESOLVER	ANGLE, VOLTAGE, FREQUENCY, IMPEDANCE, REFERENCE INPUT
SYNCHRO	ANGLE, FREQUENCY, VOLTAGE, IMPEDANCE, REFERENCE INPUT, DYNAMIC SLEW, EXTERNAL REFERENCE, INPUT IMPEDANCE

APPENDIX E

APPLICATION OF UUT FAILURE RATE DATA

10. SCOPE

This appendix contains special forms generated for utilization by the TPS Development Engineer to provide accountability of fault diagnostic ambiguity groups vs. FI design criteria defined in the contract.

20. GENERAL

Table I lists the primary component failure modes to be accounted for in the development of the FI test strategy and the determination of the UUT ambiguity groups. Table II provides a standardized format to assure accountability for each of the components and their assigned failure modes, plus their identity as detectable faults which may be simulated by the temporary insertion of actual faults. Examination of this table will reveal a column titled "Group Code", with a definition of three group code categories given as a subscript on the table. The key to utilizing the data provided by this table is to sum the group failure rate for all like groups in a given category; e.g., Group A, and then ratio this sum to the total failure rate of the SRA/module/sub-assembly. A refinement of this ratio may be realized by excluding the failure rate contributed by the components/SRAs which have failure modes non-detectable at the interface. Table III will permit the developers of the test program to immediately ascertain the relative contribution of non-detectable failure modes to the total failure rate of the UUT. In addition, these data provide a focus by which the integration/debug, demonstration, and supplemental data of the UUT test design may be efficiently implemented.

An added feature provided by the format of these tables is the identification of destructive and non-destructive failure modes. This information is essential to preclude damage to the UUT, ATE UUT interface device, or the test station.

The UUT failure rate source data, provided as part of the TRD (Figure 5.11, Appendix C, Reference MIL-HDBK-217), must be reviewed prior to the analysis and generation of the failure mode/ambiguity group accountability data to assure that the UUT failure rate data reflect the configuration of the UUT for which the fault isolation test strategy is to be designed.

The forms described above can be at any level of a system i.e., subsystem, subassembly, module and SRA. It is essential, however, that these reliability source data be available for all levels of the system hierarchy for which test program sets are to be designed. For example, an analysis of an avionic subsystem; i.e., a WRA, requires the failure rate data for the subassembly, the modules and the SRAs resident in the given WRA. These data are required to assure circuit/failure rate traceability from the WRA subsystem level through and including the SRA/component level.

30. FAILURE INDEX

A failure index shall be provided as part of the test requirements.

The failure index shall list the prime failure modes of all inputs and outputs of each next lower level of assembly of the UUT. Each entry shall be identified as a detectable, non-detectable, or non-functional failure mode. Non-detectable and non-functional failure modes shall be identified and justified on the basis that they will not affect in any higher assembly. A non-detectable failure mode is a failure mode that cannot be detected by any functional test. A non-functional failure mode is a failure mode that can be detected by functional testing but no repair action is required as the failure will not affect performance in any higher assembly in any operating mode under specified service environmental conditions. Each detectable failure mode shall be referenced to the appropriate end-to-end test designed to detect that failure. An example of a failure index is illustrated by Figure 1.

PAGE_____OF_____

TRD NO_____

REVISION_____

DATE_____

FAILURE INDEX

REF. DESIGNATION	PIN CONN.	SIGNAL NAME	SIGNAL TYPE	FAILURE MODE	FAILURE TYPE	TEST NUMBER/COMMENT
1A12	23	CLOCK A	OUTPUT	SA1	DETECT.	101200
1A12	23	CLOCK A	OUTPUT	SA0	DETECT.	101200
1A12	24	SYNC	OUTPUT	SA1	DETECT.	151600
1A12	24	SYNC	OUTPUT	SA0	DETECT.	151200
1A12	25	HDG LSB	INPUT	SA1	NON DETECT.	NOT USED
1A12	25	HDG LSB	INPUT	SA0	NON DETECT.	NOT USED

FIGURE 1. Failure Index

TABLE I. PRIMARY FAILURE MODES

COMPONENT	TYPE	PRIME FAILURE MODE
Capacitor	Electrolytic (solid tantalum)	Short or Open
	Ceramic	Short
Resistor, Fixed	Carbon fixed film	Open
	Carbon Composition	Open
	Wire Wound	Open
Resistor, Variable	Composition	Open
	Wire Wound	Open
Transformer	Low Power (< 5 W)	Negative Drift
	Medium Power (≥ 5W; 10 W)	Open or Short
Coils fixed and variable		Open or Short
Diodes (silicon)	General Purpose	Short Open
	Power Rectifier	Short Open
Zener Reference Diodes		Short
Transistor (silicon)		Short Open
Relays (hermetically sealed)	5 amps contacts 1-30 VDC coil	Open contacts
Integrated Circuits	Linear and Digital	Output at permanent high level or at permanent low level

UUT P/N _____ TABLE II DATE _____

FAILURE RATE/FAULT ISOLATION AMBIGUITY GROUP SUMMARY

λ_T (SUM OF THE TOTAL LAMBDA) _____

λ_{TA} (SUM OF THE TOTAL LAMBDA MINUS THE NON-DETECTS) _____

$\frac{\sum \lambda_4}{\lambda_{TA}}$ *(RATIO OF THE SUM OF THE LAMBDA IN AMBIGUITY GROUPS ≤ 4) _____ %

$\frac{\sum \lambda_8}{\lambda_{TA}}$ *(RATIO OF THE SUM OF THE LAMBDA'S IN AMBIGUITY GROUPS > 4 AND ≤ 8) _____ %

$\frac{\sum \lambda_{10}}{\lambda_{TA}}$ *(RATIO OF THE SUM OF THE LAMBDA'S IN AMBIGUITY GROUPS > 8 AND ≤ 10) _____ %

*Fault Isolation Ambiguity Group to be defined by the purchasing agency contract. Numbers used are illustrative only.

TABLE III

PART A - DETECTABLE INSERTABLE FAULTS

PREPARED BY _____ FAULT LIST FOR UUT P/N _____ DATE _____

FAULT NO.	REF. DESIG.	PRIMARY FAILURE MODE	FAILURE RATE λ_i	TEST NO.	COMPONENTS IN AMBIGUITY GROUP	$\frac{\lambda_i}{G}$	$\frac{\lambda_i}{T}$	GROUP CODE	FIELD FAILURES	COMMENTS

λ_i Component Failure Rate
G Group Failure Rate
T UUT Failure Rate

Group Code
$1 \leq A \leq 4$ Failures
$4 < B \leq 8$ Failures
$8 < C \leq 10$ Failures

TABLE III

PART B - DETECTABLE DESTRUCTIVE FAULTS

PREPARED BY _____ FAULT LIST FOR UUT P/N _____ DATE _____

FAULT NO.	REF. DESIG.	PRIMARY FAILURE MODE	FAILURE RATE λ_i	TEST NO.	COMPONENTS IN AMBIGUITY GROUP	$\frac{\lambda_i}{G}$	$\frac{\lambda_i}{T}$	GROUP CODE	FIELD FAILURES	COMMENTS

λ_i Component Failure Rate
G Group Failure Rate
T UUT Failure Rate

Group Code
$1 \leq A \leq 4$ Failures
$4 < B \leq 8$ Failures
$8 < C \leq 10$ Failures

TABLE VII

PART C - NON-DETECTABLE FAULTS

PREPARED BY _____ FAULT LIST FOR UUT P/N _____ DATE _____

FAULT NO.	REF. DESIG.	PRIMARY FAILURE MODE	FAILURE RATE λ	FIELD FAILURES	COMMENTS

APPENDIX F

FAULT ISOLATION (FI) TEST REQUIREMENT
FAULT ISOLATION DATA

10. SCOPE

In those instances where the TRD data is to serve as the sole documentation vehicle for maintenance and repair, or when it is to be used directly for fault isolation in a test procedure, the following data will be required.

It should be noted that the data described in this section should not be included in the TRD for those cases when the TRD is to be used as input data for development of an ATE Test Program Set (TPS); especially in those cases when the developer of the TRD data and the developer of the TPS are different vendors.

The fault isolation requirements section shall consist of that data necessary and sufficient to test the UUT in the most efficient manner possible such that:

a. A good UUT can be correctly identified.

b. A faulty UUT can be correctly identified.

c. The cause of a UUT failure can be correctly identified.

d. The action required to eliminate the cause of a UUT failure can be correctly specified.

A UUT failure is that level of performance at which the UUT, if it were installed in any higher assembly, would cause the equipment to fail to meet its applicable performance requirements. Sufficient data shall be provided for each UUT test to completely describe all input conditions and measurements required to perform the test. All input, output and return connections shall be specified independent of any specific test equipment. The data to be supplied as part of the fault isolation test requirements section of the TRD shall consist of the following or as amended by the governing procurement order.

a. UUT data

b. Functional flow chart

c. Detailed flow chart

d. Detailed test requirement information sheet

e. Test loop diagrams

f. Failure index

The fault isolation test requirements section shall be identified with a cover sheet containing page number, TRD number, revision, and date information.

20. FUNCTIONAL FLOW CHART

The functional flow chart shall graphically illustrate the end-to-end sequence of the ATLAS test procedure (reference 50.6.1). The functional flow chart shall be arranged so as to define the progressive strategy of testing from test procedure initiation to successful completion. Organization of the functional flow chart shall be descriptive in nature, consisting of a series of statements identifying each major test milestone. A major test milestone is defined as that single test, or collection of tests, which establish confidence in a complete or unique function of the UUT (e.g., indicator tests, slew accuracy tests, etc.). Test in each statement block shall identify the function and nature of the test. Stimulus and response characteristics, as well as dynamic aspects of test implementation, shall not be included. Each test block of the functional flow chart shall indicate the test number at which the test is initiated. An example of a functional flow chart is illustrated in Figures 2 & 3.

When non-functional testing of the UUT is utilized, or the test procedure is partitioned to include functional and non-functional testing (e.g., when automatic test program generation is utilized), the functional flow chart shall reflect the arrangement of such tests. In addition, all pertinent data relating to the origination of the non-functional tests (e.g., circuit models, workarounds, etc.) shall be provided as part of this requirement.

30. DETAILED FLOW CHART

The detailed flow chart shall be a complete, detailed, dynamic reflection of the ATLAS test procedure. The logic of the detailed flow chart shall be complete in that all processes, variables, decisions, branches, parallel operations, exits, and subroutines shall be identified. Process statements and symbol notation shall be provided in the detailed flow chart in sufficient detail to define the function tested, test methodology, and the anticipated and required response. Decision paths shall be definitive, with fault exits clearly identified. Response tolerances shall be indicated in accordance with the specified requirements of the UUT. In cases where absolute limits are established (or assumed), the detailed flow chart shall indicate the delimiting required to ensure specified UUT performance. Each functional group of tests shall, to the maximum extent possible, correlate directly to a single test block of the functional flow chart. An example of a detailed flow chart is illustrated in Figures 3 and 4.

40. DETAILED TEST INFORMATION SHEETS

Each test to be conducted on a UUT shall be detailed on a test requirement information sheet. For format of the detailed test requirement information sheet shall be in accordance with Figure 3. Continuation sheets in accordance with Figure 4 shall be used when additional space

ment information sheet shall be in accordance with Figure 4. Continuation sheets, in accordance with Figure 5, shall be used when additional space is required to specify any information. The continuation sheet shall reference the TRD number, TRD revision, test number, and the information being continued. The applicable detailed test requirement information sheet shall reference the continuation sheet(s).

40.1 Detailed Test Requirement Information Data Requirements. Sufficient data shall be provided for each UUT test to completely describe all input conditions and measurements required to perform the test. All input, output, and return connections shall be specified by connector and pin number or test point at the UUT. Where input conditions are identical for a series of UUT tests, these conditions may be specified on the first test and back referenced on each subsequent test. The detailed test requirement information sheets shall contain page, TRD number, revision, and date information. In addition, the detailed test requirement information shall identify the test number which is directly traceable to the ATLAS test procedure (reference 50.6.1) of Appendix A, and the detailed flow chart. For each test the appropriate test loop diagram and test objective shall be identified.

Measurement data shall be identified as being derived either empirically or analytically based on design specifications. The specification of UUT input/output conditions shall include the minimum data requirements described in paragraph 50.6.1.1 of Appendix A.

40.2 Detailed Test Requirement Information Guidelines. All initialization requirements, such as power sequences, warm-up, initialization, conditioning, adjustments, etc. must be specified for each UUT and for each applicable UUT test. UUT tests may rely on initialization by previous test set-ups, if desired. Test procedures which are time consuming should, whenever practical permit independent operation of tests rather than predicate all tests on previous operations.

40.2.1 Diagnostic test shall ignore extremely remote failure modes, e.g., carbon resistors shorting. Failure modes to be considered shall include, but not be limited to, the following:

Component	Prime Failure Mode
Capacitors	Short or Open
Resistors	Open
Transformers	Short or Open
Coils (fixed and variable, including relay coils)	Short or Open
Diodes	Short or Open
Transistors (junction)	Short or Open
Relays	Open Contact Shorted Contacts

Integrated Circuits or Hybrid Circuits	Any terminal at permanent high level or at permanent low level

40.2.1.1 A single fault or failure mode shall be assumed when a no-go is encountered.

40.2.1.2 Standard engineering terms, symbols (per ANSI Y 32.2), abbreviations (per MIL-STD-12) and designations (per ANSI Y-32116) shall be used. Special cases not to be overlooked shall include the meaning of high and low out-of-tolerance conditions for a zero volt measurement and a negative voltage measurement.

40.2.1.3 Stimuli that vary in discrete or incremental steps shall be specified in lieu of continuously variable stimuli if possible. The steps specified shall be as large as is consistent with the minimum test requirement.

40.2.1.4 The addition of external feedback loops to the UUT to simulate the environment in which the UUT normally operates shall be avoided and open loop tests made whenever possible. The external interconnection of elements on the UUT shall be avoided when these elements can be individually tested.

40.2.1.5 All test points specified on the detailed test requirement information sheet shall be identifiable on the UUT schematic.

40.2.1.6 If a test point and a connector pin are electrically common, the connector pin shall be used if it is accessible.

40.2.1.7 The power and stimulus load and measurement device required to perform a test shall be applied during the test. If adherence to this requirement will cause an active device on the UUT to be partially powered or unnecessarily lengthn the test time due to warm-up requirements, it is permissible to add the power necessary to fully power the device.

40.2.1.8 It is understood that some characteristics of the UUT input signals may not be critical, i.e., any value within a specified range can be used for test purposes. An allowable range shall be specified for these non-critical characteristics instead of a specific value. If an output characteristic is a function of an input characteristic for which a range is specified, then the relationship between the input and output characteristics should be specified. An example of the above would be the test of a linear amplifier. The input voltage amplitude is a non-critical characteristic and might be specified as 0-10 volts. The output voltage, since it is a function of the input voltage, would be Vout = (5 $\pm$ .1) Vin (assuming an amplification of 5 $\pm$ 2%).

40.2.1.9 Complex output waveforms shall be avoided whenever possible. The complexity of an output waveform can frequently be reduced by the proper selection of the input signals and still permit adequate testing of the UUT. A number of simple waveform tests is preferable to one complex waveform test.

40.2.1.10 UUT loads shall be specified in terms of impedance required.

40.2.1.11 When a test requires stimuli with tolerances of less than one percent, the possibility of using a ratio (output to input) test shall be considered. If a ratio test could be used, the additional information necessary to conduct a ratio test shall be specified in the supplemental data section.

40.2.1.12 Time or phase-dependent relationships, if applicable, shall be defined using diagrams as needed. If the exact value of an input or output is not known, a range shall be specified.

40.2.1.13 Individual test requirements such as loads and impedance-matching terminations shall include nominal values, power ratings, voltage standing wave ratio (VSWR), etc. Complex loads shall be specified in standard engineering units.

40.2.1.14 All relevant characteristics of each waveform shall be included. Only the characteristic to be checked shall appear in the measured value data section of the "Detailed Test Requirement Information" sheet; all other, in the supplemental data section. Each waveform which cannot be specified by an ATLAS statement shall be described in pictorial illustrations. Non-repetitive waveforms shall be identified.

40.2.1.15 Tolerances for every prime characteristic shall be specified. The upper and lower tolerance limits shall be described in the same units as the characteristic. Such terminology as less than or greater than shall be avoided when significant high or low limits can be specified. The expressions open circuit and short circuit may be used if defined.

40.2.1.16 The UUT output impedance at the test point(s) with respect to the signal return(s) and the impedance seen by the UUT inputs shall be specified for all tests.

40.2.1.17 Any critical or unusual test requirement not self-evident elsewhere shall be defined. Such requirements might include susceptibility to noise or transients, time delays before making measurements, signal and power lead characteristics, etc.

30.2.1.18 All adjustments that may correct a no-go condition or optimize a critical parameter shall be defined.

40.2.1.19 The specification of ac voltages shall include a notation of root-mean-square (rms), peak, or peak-to-peak and shall always include frequency. Percent distortion shall be included when significant.

40.2.1.20 Normally, pulse width measurements shall be specified at the 50 percent amplitude level. When deviation from this is required, the amplitude levels shall be specified.

40.2.1.21 Rise and fall times shall be normally specified between 10 percent and 90 percent levels. When deviation from this is required, the amplitude levels shall be specified.

40.2.1.22 Spikes, overshoots, noise levels, and dc levels shall be identified and illustrated.

40.2.1.23 Waveforms shall include a sync signal reference, if applicable.

40.2.1.24 Resistance measurements involving semiconductor devices shall include polarity requirements and the current at which the semiconductor impedance was determined.

40.2.1.25 Measurements that require longer than the standard measurement delay for stabilization after input insertion or other action shall be so noted on the individual test specification sheets.

40.2.1.26 It is recognized that certain component failure or degradation may not be readily detectable during performance testing, such as failure of power input filters and relay coil noise suppressors. The TRD shall include tests to ensure that all such items are checked.

40.2.1.27 Input/output test requirements shall be specified at the UUT interface.

40.2.1.28 Measurement data shall be identified on the Detailed Test Requirement Information Sheet as being derived either empirically or by calculations based on design specifications.

40.2.1.29 When more than one component is to be identified for possible replacement, they shall be listed in their most probable order of failure.

40.2.1.30 When the UUT is a component of an ATE, the requirement to recalibrate the end item upon repair will be evaluated/stated.

50. VALIDATION

Each chain in the fault isolation section shall be validated by the supplier. Validation shall be accomplished by applying the inputs, loads, etc., specified by the TRD to an acceptable (a certified good) UUT and verifying that the specified values are obtained. A validation certificate shall be provided with each TRD. The validation certificate shall include the following information:

a. A listing of test numbers, with the actual values obtained from the measurements made during validation testing.

b. Complete listing or identification of:

(1) TRD

(2) UUT

(3) Test equipment

(4) Test personnel

(5) Contract number

(6) Supplier

(7) Sub-supplier (where applicable)

c. Date testing was accomplished

d. Signature of test personnel

e. Signature of the procuring activity representative who witnessed or participated in the testing.

60. ACCEPTANCE

Acceptance of the data required by this appendix shall be accomplished by submittal of copy of the validated TRD and validation certificate to the procuring activity. This acceptance, however, is contingent on final review of the delivered materials by the procuring activity. The procuring activity shall notify the TRD supplier of final acceptance of the data required by this appendix.

PAGE_____OF_____

TRD NO.

REV. DATE

TEST REQUIREMENTS DOCUMENT (TRD)

FOR

_____
(UUT) Name and Nomenclature

SUPPLIER UUT UNIT NO._____

SUPPLIER UUT PART NO._____

AVIONIC SUBSYSTEM_____
(A/N NOMENCLATURE)

PREPARED BY:_____

_____

CONTRACT NO.:_____

FIGURE 1. Cover Sheet

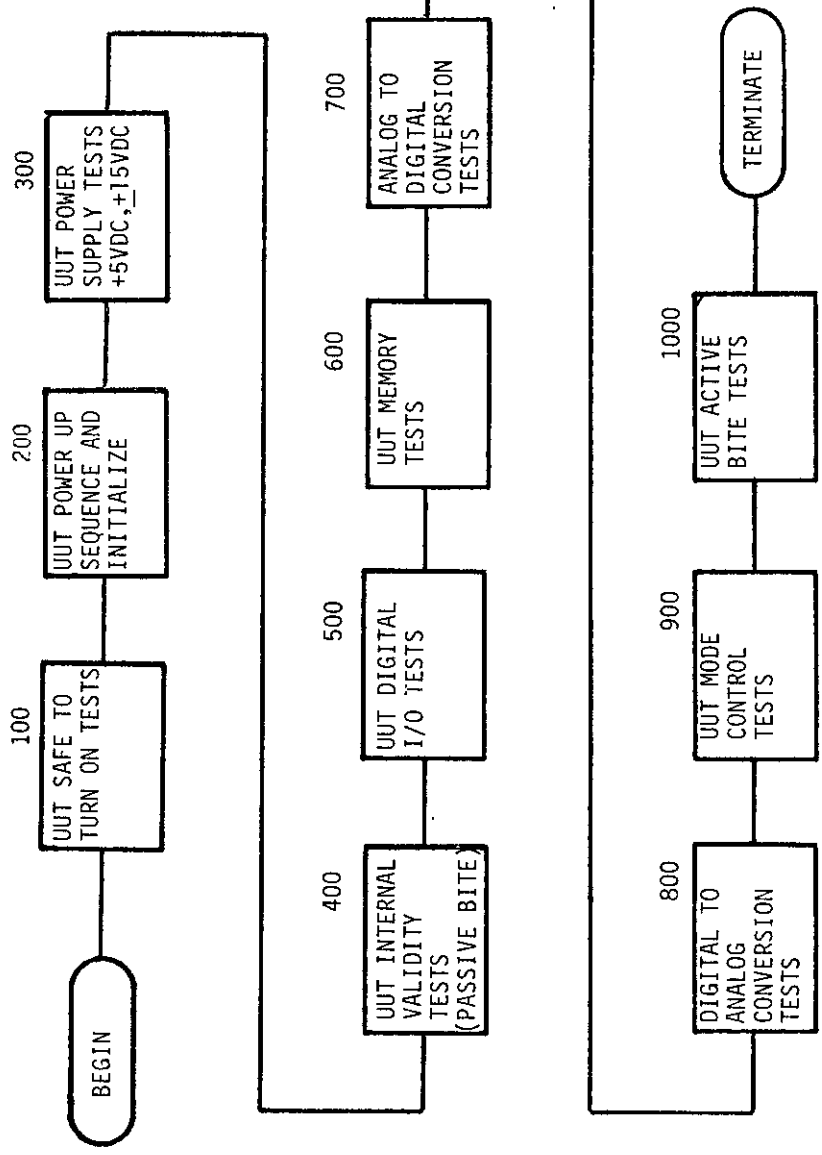


FIGURE 2. Functional Flow Chart

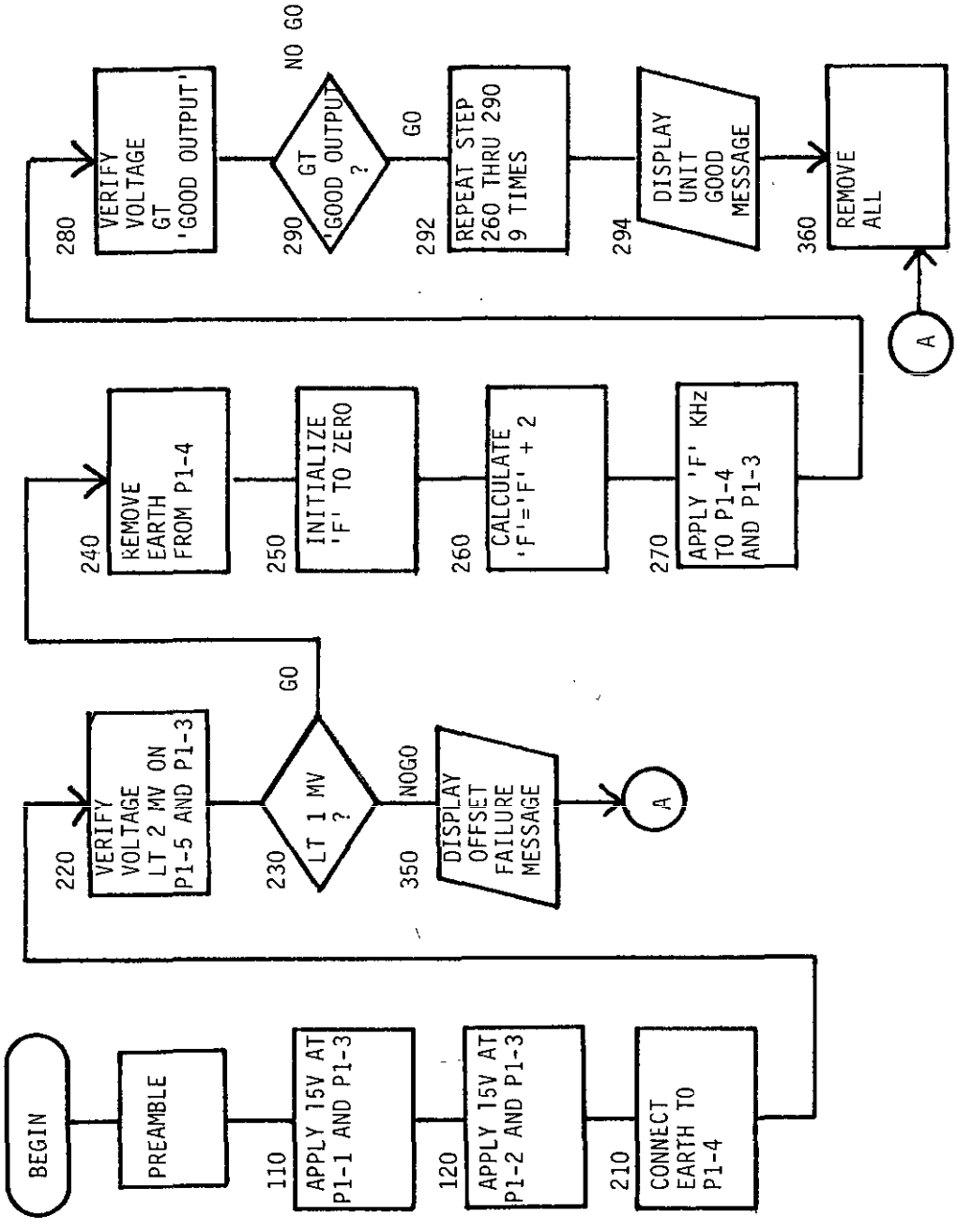


FIGURE 3. Detailed Flow Chart

DETAILED TEST REQUIREMENT INFORMATION

TEST NO._____

LAST EXECUTED TEST NO._____ ☐ PERFORMANCE TEST

TEST LOOP DIAGRAM NO._____

UUT_____ ☐ DIAGNOSTIC TEST

TEST OBJECTIVE_____

INPUT CONDITIONS	CHARACTERISTICS	INPUT Z (OR I)	CONNECTION & RET
INPUT POWER:			
STIMULI:			
OTHER:			

MEASUREMENT DATA _____ TEST POINT_____ SIGNAL RETURN_____ OUTPUT IMPEDANCE_____

MEASURED VALUE_____ HIGH LIMIT_____ LOW LIMIT_____

DERIVED: ☐ EMPIRICALLY SUPPLEMENTAL DATA

☐ ANALYTICALLY

TEST RESULTS	GO TO TEST	ADJUST	REPLACE
IN TOLERANCE			
OUT HIGH			
OUT LOW			
OUT OTHER (EXPLAIN)			

FIGURE 4. Detailed Test Requirement Information Sheet

PAGE_____OF_____

TRD NO_____

REVISION_____

DATE_____

DETAILED TEST REQUIREMENT INFORMATION

CONTINUATION SHEET

TEST NUMBER_____UUT_____

FIGURE 5. Detailed Test Requirement Information Sheet

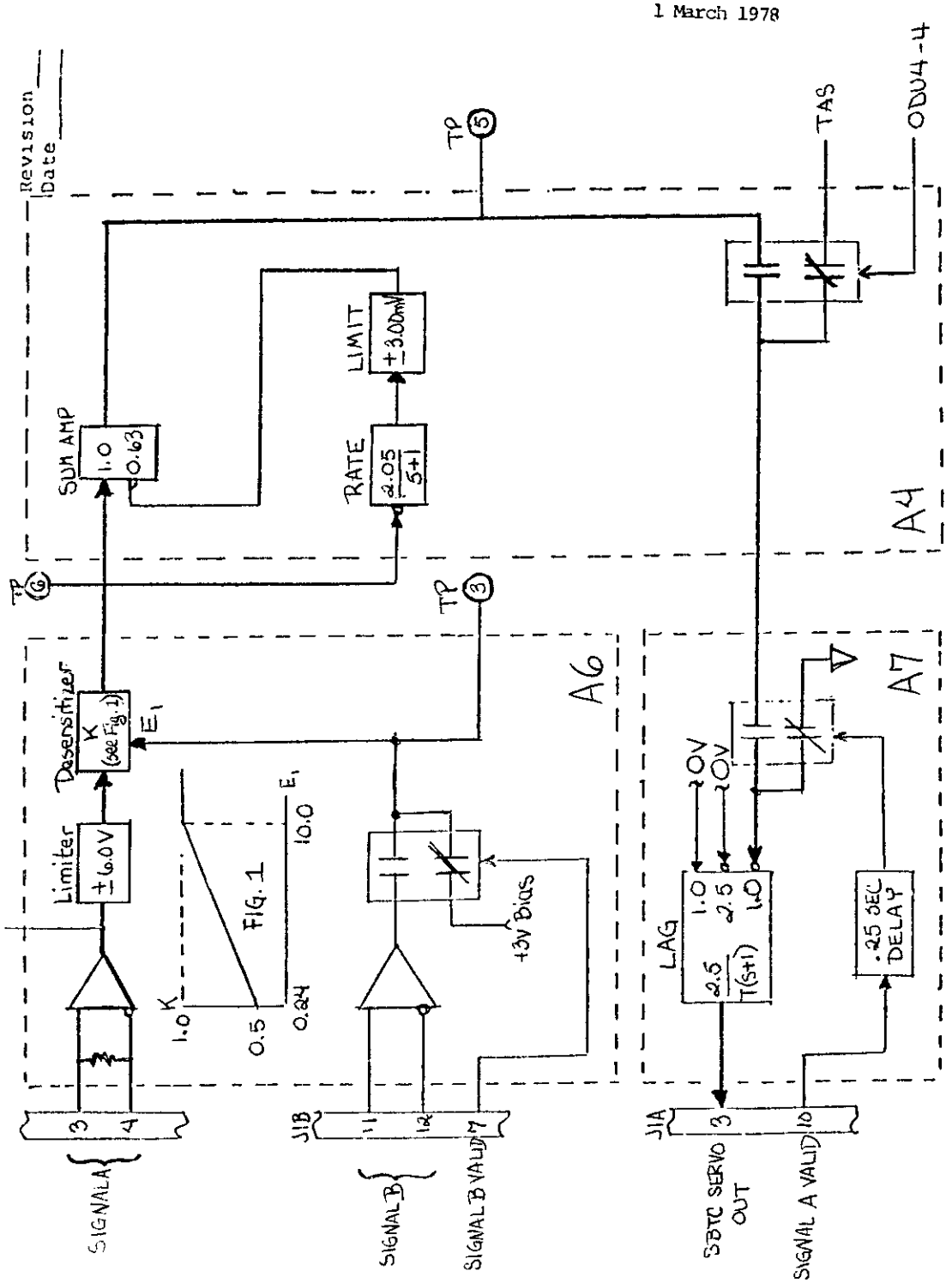


Figure 6 Test Loop Diagram

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commander
Naval Air Systems Command (AIR 51122)
Washington, DC 20361

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions -- Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* — Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* — Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* — Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.