

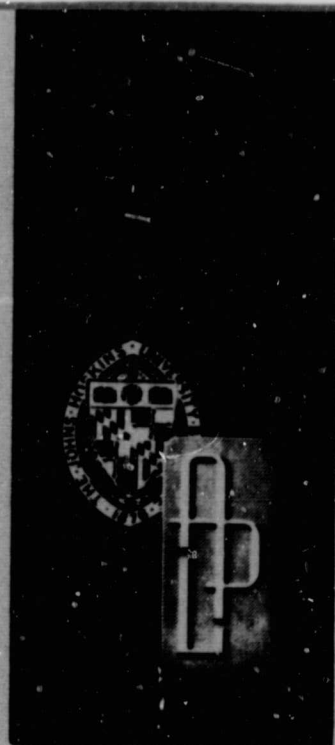
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SOR-70-031
FEBRUARY 1971
REVISION C

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**QUALITY PROGRAM PLAN
FOR THE
ULTRAVIOLET SPECTROMETER EXPERIMENT S169**

T 72-19221

Prepared for
NASA Manned Spacecraft Center
under Contract NAS9-11528
DRL 56, DRD RA-083T

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CHANGE NO. 3

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MSC CONTRACT NAS9-11528
DRL 56, DRD RA-083T

QUALITY PROGRAM PLAN
FOR THE
ULTRAVIOLET SPECTROMETER EXPERIMENT S169



THIS CHANGE NUMBER THREE IS SUBMITTED TO AMEND REVISION C OF THE QUALITY PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169. THE PURPOSE OF THIS REVISION IS TO DELETE REFERENCE TO THE REJECTED OPTICAL TEST EQUIPMENT (OTE) AND INCLUDE PROVISIONS FOR THE CALIBRATION TEST EQUIPMENT (CTE). INSTRUCTIONS FOR INCORPORATING THIS CHANGE INTO THE PLAN ARE AS FOLLOWS:

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3. Replace the present Pages 36, 38 and 39 with the accompanying new Pages 36 and 38.

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JUNE 1971
SOR-70-031



MSC CONTRACT NAS9-11528
DRL 56, DRD RA-083T

QUALITY PROGRAM PLAN
FOR THE
ULTRAVIOLET SPECTROMETER EXPERIMENT S169

THIS CHANGE NUMBER TWO IS SUBMITTED TO AMEND REVISION C OF THE QUALITY PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169. THE PURPOSE OF THIS REVISION IS TO CLARIFY THE LINE OF AUTHORITY IN REGARD TO THE MECHANICAL INSPECTORS. INSTRUCTIONS FOR INCORPORATING THIS CHANGE INTO THE PLAN ARE AS FOLLOWS:

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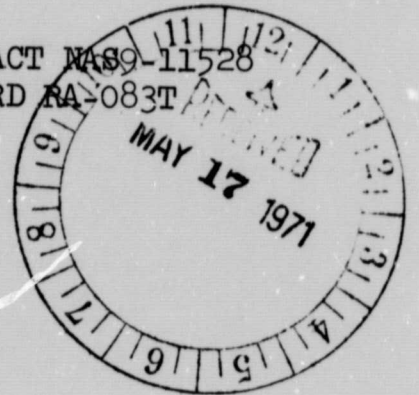
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APRIL 1971
SOR-70-031

MSC CONTRACT NAS9-11528
DRL 56, DRD RA-083T



QUALITY PROGRAM PLAN

FOR THE

ULTRAVIOLET SPECTROMETER EXPERIMENT S169

THIS CHANGE NUMBER ONE IS SUBMITTED TO AMEND REVISION C OF THE QUALITY PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169. INSTRUCTIONS FOR INCORPORATING THIS CHANGE INTO THE PLAN ARE AS FOLLOWS:

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LIST OF EFFECTIVE PAGES

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i	Original	23	Original
ii	Original	24	Original
iii	Original	25	Original
iv	Original	26	Original
v	Original	27	Original
vi	Original	28	Original
1	Original	29	Original
2	Original	30	Original
3	Original	31	Original
4	Original	32	Original
5	Original	33	Original
6	Original	34	Original
7	Original	35	Original
8	Original	36	Three
9	Original	37	One
10	Original	38	Three
11	Original	39	Delete
12	Original	40	Original
13	Original	41	Two
14	One	42	Original
15	Original	43	One
16	Original	44	One
17	Original	45	Original
18	Original	Appendix A	Original
19	Original	Appendix B	Original
20	Original	Appendix C	Original
21	Original		
22	Original		

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REVISION C
CHANGE NUMBER THREE

TABLE OF CONTENTS

	<u>PAGE</u>
1.0 Introduction -----	1
1.1 General -----	1
1.2 Government Quality Assurance Actions -----	1
1.3 Revisions -----	2
2.0 Quality Program Management -----	2
2.1 Organization -----	2
2.2 Quality Assurance Operations -----	2
2.2.1 Flow Charts -----	2
2.3 Quality Status Reporting -----	3
2.4 Relationship with the Reliability Program -----	3
2.5 Quality Documentation Change Control -----	3
2.5.1 General -----	4
2.5.2 Document Distribution Control -----	4
2.5.3 Effectivity -----	5
3.0 Design and Development Control -----	6
3.1 Technical Documents -----	6
3.1.1 Document Review -----	6
3.2 Quality Support to Design Review -----	7
4.0 Identification and Data Retrieval -----	7
4.1 Methods -----	7
4.2 Documentation -----	7

TABLE OF CONTENTS (continued)

	<u>PAGE</u>
4.3 Identification Control -----	8
4.4 Identification List -----	8
4.5 Retrieval of Records -----	8
5.0 Procurement Controls -----	9
5.1 Selection of Procurement Sources -----	9
5.1.1 General -----	9
5.1.2 Records -----	9
5.2 Review -----	9
5.3 Procurement Documents -----	9
5.3.1 Contents -----	9
5.4 Government Source Inspection -----	10
5.5 APL Source Inspection -----	11
5.6 Receiving Inspection -----	11
5.6.1 Acceptance of Material for Receiving Inspection -----	11
5.6.2 APL Lot Code and Serial Number Assignment (Parts other than hardware items) -----	12
5.6.3 100% Receiving Inspection -----	12
5.6.4 Receiving Inspection Records -----	14
5.6.5 Classification of Inspected Parts -----	14
5.6.6 In-House Screening of Semiconductor Devices -----	15

TABLE OF CONTENTS (continued)

	<u>PAGE</u>
5.6.7 Identification -----	15
5.6.8 Failure and Deficiency Feedback -----	16
5.6.9 Supplier Rating and Preferred Source Lists -----	16
5.6.10 Coordination of Contractor-Supplier Measuring and Test Equipment and Standards -	16
6.0 Fabrication Controls -----	16
6.1 Fabrication Operations Controls -----	16
6.2 Article and Material Controls -----	19
6.3 Cleanliness Control -----	19
6.4 Process Control -----	19
6.4.1 Process Control Procedures -----	20
6.4.2 Equipment Certification -----	20
7.0 Inspections and Tests -----	20
7.1 Inspection and Test Planning -----	20
7.1.1 Test Flow Diagrams -----	20
7.1.2 Process Control Cards -----	21
7.2 Inspection and Test Specifications -----	22
7.3 Test Procedures -----	22
7.4 End Item Inspection and Test Specifications and Procedures -----	23
7.5 Inspection and Test Performance -----	23

TABLE OF CONTENTS (continued)

	<u>PAGE</u>
7.5.1 General -----	23
7.5.2 Control of Test Environment and Equipment -	24
7.5.3 Criteria for Reinspection and Retest -----	24
7.5.4 Qualification Test Article -----	25
7.5.5 End Item Inspections and Tests -----	25
7.5.6 Inspection and Test Records and Data -----	25
8.0 Non-Conforming Article and Material Control -----	26
8.1 Non-Conformance Documentation -----	26
8.1.1 General -----	26
8.1.2 Discrepancy Reports -----	26
8.1.3 Other Non-Conformance Documentations -----	27
8.2 Remedial and Preventive Action -----	27
8.3 Initial Review Dispositions -----	28
8.4 Material Review Board -----	28
8.5 Supplier Material Review Board -----	29
9.0 Metrology Controls -----	30
9.1 General -----	30
9.2 Calibration -----	30
9.2.1 Tooling Used for Measuring -----	30
9.3 Calibration Facilities and Standards -----	30
9.4 Evaluation -----	31

TABLE OF CONTENTS (continued)

	<u>PAGE</u>
9.5 Maintenance and Control -----	32
9.6 Quality Assurance Audits -----	32
9.7 Written Procedures -----	33
9.8 Records -----	33
10.0 Inspection Status Stamp Control -----	33
10.1 Inspection Stamp Log -----	33
10.2 Use of Inspection Stamps -----	34
11.0 Handling, Storage, Preservation, Marking, Labelling, Packaging, Packing and Shipping -----	34
11.1 General -----	34
11.2 Handling -----	34
11.3 Storage -----	35
11.4 Preservation -----	35
11.5 Marking and Labelling -----	35
11.6 Packaging and Packing -----	35
11.7 Shipping -----	35
12.0 Sampling Plans, Statistical Planning and Analysis -----	36
12.1 General -----	36
13.0 Control of Sub-Contracted Hardware and of the Optical Test Equipment -----	36
13.1 Subcontracted Hardware -----	36
13.2 Optical Test Equipment -----	38

LIST OF APPENDICES

APPENDIX A	RQAM-8.003, Reliability and Quality Assurance Manual - Receiving Inspection Requirements
APPENDIX B	RQAM-8.002, Reliability and Quality Assurance Manual - Discrepancy Report System
APPENDIX C	RQAM-8.004, Reliability and Quality Assurance Manual - Inspection Procedures for Welded Electronic Modules

LIST OF ILLUSTRATIONS

	<u>PAGE</u>
FIGURE 1 ----- Organization Chart -----	40
FIGURE 1A ---- Quality Assurance Organization ----	41
FIGURE 2A ---- Simplified Fabrication and Flow Chart, Electrical/Electronic Equipment -----	42
Figure 2B ---- Simplified Mechanical Fabrication Flow Chart -----	43
FIGURE 2C ---- Simplified Mechanical Assembly Flow Chart -----	44
FIGURE 2D ---- Simplified Metrology Control Flow Chart -----	45

1.0 INTRODUCTION

1.1 GENERAL

The overall Reliability Plan for the Experiment is contained in the following APL/JHU basic documents:

- a. Experiment Test Plan
- b. Experiment Reliability Program Plan,

SOR-70-028

- c. Experiment Quality Assurance Program Plan,

SOR-70-029.

The Quality Program Plan establishes the requirements for a system of controls to assure compliance with the quality assurance requirements as set forth in NASA Quality Publication, "Quality Program Provisions for Aeronautical and Space System Contractors", NHB 5300.4(1B), April 1969 edition applicable to the Experiment program.

Internal APL/JHU Documents referenced herein form a part of this Quality Program Plan to the extent specified herein. Copies of these referenced documents are available for review by the MSC Experiment Manager or delegated representative. Copies will be sent to the MSC Experiment Manager upon receipt of request by the APL Project Engineer.

1.2 GOVERNMENT QUALITY ASSURANCE ACTIONS

Full cooperation will be extended to the cognizant NASA Quality Assurance Representative. Information, documents,

records, inspection equipment, samples, materials and reasonable facilities and assistance for the safety and convenience of the representative will be provided.

1.3 REVISIONS

Should it become necessary to introduce any significant change in this plan subsequent to NASA approval, the contemplated change will be negotiated with the MSC Experiment Manager prior to implementation.

2.0 QUALITY PROGRAM MANAGEMENT

2.1 ORGANIZATION

The Supervisor of the Satellite Reliability Group reports directly to the Space Development Department Head and is responsible for establishing department-wide controls required to insure the reliability of experiment hardware. A current organization chart showing the organizational relationship of the Satellite Reliability Group and the elements of the department is given in Figure 1. Figure 1A depicts the elements of the Quality Assurance organization applicable to the Ultra-violet Spectrometer Experiment.

2.2 QUALITY ASSURANCE OPERATIONS

2.2.1 Flow Charts

Flow charts depicting the electronic fabrication sequence (Figure 2A), the mechanical fabrication sequence (Figure 2B),

the mechanical assembly sequence (Figure 2C), and the control of Metrology (Figure 2D), applicable to the Ultraviolet Spectrometer Experiment are appended to this plan.

2.3 QUALITY STATUS REPORTING

Quality Program status will be reported as a separate item in the Experiment Monthly Progress Report. The Quality Program status report will include, as required:

- a. Organization and key personnel changes.
- b. Significant program and article or material problems, their solutions, and remedial and preventive actions.
- c. Contractor performance, such as inspection and test activities and procurement activities relative to supplier selections, surveys, and procurement document reviews.
- d. Supplier performance, such as acceptance and rejection rates.

2.4 RELATIONSHIP WITH THE RELIABILITY PROGRAM

The quality program provisions outlined in this plan are designed to support the reliability program through prevention of degradation of the inherent reliability of the design. The details of the implementation of the reliability requirements are contained in the Reliability Program Plan for the Ultraviolet Spectrometer Experiment, SOR-70-030, DRL 65, DRD RA-092T.

2.5 QUALITY DOCUMENTATION CHANGE CONTROL

2.5.1 General

All changes affecting quality documentation, other than those separately identified below, will be controlled by the use of Engineering Change Notices. Formalized procedures and sign-off will be followed, as defined in the APL/JHU Reliability Assurance Standards, Volume I, Section 2. Changes requiring special handling are as follows:

- a. Interface Control Document changes after establishment of the baseline configuration.
- b. Class I changes to the approved baseline configuration.
- c. Changes to approved contract specifications and Acceptance Test Procedures.

Processing and flow of ECN's will be under the control of the Configuration Management Office of the Ultraviolet Spectrometer Experiment Project.

2.5.2 Document Distribution Control

All engineering drawings and test specifications, and all ECN's thereto, will be released simultaneously to:

- a. The responsible fabrication, assembly or test group.
- b. The Quality Assurance Document Control Inspector (DCI).

The DCI, on receipt of each new drawing or specification, will enter the title, number, release date and effectivity

of the document in an Experiment Document Control Log. On receipt of an ECN against a released document, the DCI will:

- a. Enter the revision letter, release date and effectivity of the ECN in the Log.
- b. Check with the affected fabrication, assembly or test group to insure that the ECN has been received and attached to the drawing or specification, and that hardware is being processed to the latest revision of the document.

When the fabrication, assembly or test of any hardware item is completed, the Process Control Card, together with all drawings and ECN's used in processing the item, will be returned to the DCI. The DCI will insure that:

- a. All documentation is complete.
- b. All fabrication, assembly, inspection, test and test verification steps have been completed, as witnessed by the presence of Q.A. Fabrication or inspection stamps.

- c. That all applicable ECN's have been incorporated.

When a drawing or specification having an incorporated change is received, the DCI will also insure that the obsolete drawing is physically removed from the affected area with the specified effectivity.

2.5.3 Effectivity

The effectivity point of all changes which affect material, fabrication or performance will be defined in the ECN.

Records on the implementation of ECN's, including retest or re-inspection as required, will be included in the manufacturing and inspection records.

3.0 DESIGN AND DEVELOPMENT CONTROL

3.1 TECHNICAL DOCUMENTS

Technical documents will be developed as required by the applicable DRD's, including specifications, procedures, drawings, fabrication and planning documents, and standard processes. These documents will include, as applicable, the following information:

- a. Characteristics and design criteria necessary for procurement, fabrication, (including assembly), and inspection and test operations.
- b. Characteristic tolerances.
- c. Identification to which procurement, fabrication, processing, inspection, test and operating records can be related and to serve as means for locating articles.

3.1.1 Document Review

Technical documents, and changes thereto, developed on the Ultraviolet Spectrometer Experiment program will be reviewed by Quality Assurance personnel. These documents will include, but not be limited to: Engineering fabrication and assembly drawings, specifications, specification control drawings, procurement instructions, test plans and procedures, process control procedures, and

Quality Control inspection procedures. These reviews will insure that all necessary information has been included and the requirements are clear and unambiguous. A listing of all documents reviewed and action taken will be maintained. Deficiencies in the documents will be noted and reported to the responsible personnel. Quality Assurance will follow up to insure that all deficiencies are corrected prior to document release.

3.2 QUALITY SUPPORT TO DESIGN REVIEW

Quality Assurance personnel will participate in design review to insure that designs permit and facilitate producibility, repeatability and inspectability and that related quality considerations are obtained.

4.0 IDENTIFICATION AND DATA RETRIEVAL

4.1 METHODS

Each article and material will be identified by a unique part or type number. Where control of individual articles or lots of articles or materials is required, date or lot codes or serial numbers will be used. Paint dot codes will be used to identify EEE piece parts which have undergone incoming inspection and inhouse screening.

4.2 DOCUMENTATION

The method and location of part or type numbers and detailed identification on articles will be indicated on technical documents.

4.3 IDENTIFICATION CONTROL

Detailed identification numbers for individual articles and materials or lots thereof will be assigned in a consecutive manner. Records for articles and materials will indicate the applicable part or type numbers and associated detailed identification, to provide traceability. Serial or lot numbers of scrapped articles will not be used for other similar articles or materials.

4.4 IDENTIFICATION LIST

A computerized Identification List will be developed for the program which will list all articles and materials used in the fabrication of the completed experiment and their associated identification numbers. The list will be broken down from the top assembly drawing through sub-assemblies to modules to individual parts and materials.

4.5 RETRIEVAL OF RECORDS

Articles and material procurement, fabrication, processing, inspection and test records will be related to the articles and materials specified on the Identification List. Engineering Drawings, procurement documents, specifications, test procedures, process control cards and module kit records will be so related. Records and the related articles and materials will be retrievable in the event verification of, or removal of articles or materials becomes necessary.

5.0 PROCUREMENT CONTROLS

5.1 SELECTION OF PROCUREMENT SOURCES

5.1.1 General

Source selection will be based upon the supplier's past history as reflected by the APL-vendor experience. Where no previous quality records are available, a product assurance survey of the supplier's facilities and quality control system may be made to determine the extent to which APL controls are needed to assure acceptable supplier performance.

5.1.2 Records

Records on the quality history of the subcontractors and suppliers are maintained by the Satellite Reliability Group and will be continued on the UVS Experiment Program.

5.2 REVIEW

All procurement documents will be reviewed by the Satellite Reliability Group prior to release for adequacy of quality requirements.

5.3 PROCUREMENT DOCUMENTS

5.3.1 Contents

Procurement documents (control drawings, procurement instructions, and equipment specifications) contain a clear description of the parts and materials ordered and make provision for the following as applicable:

- a. Performance characteristics and limits.
- b. Configuration and dimensional tolerances.
- c. Reliability and quality assurance requirements.

Sub-contracts for flight systems, sub-systems and related services will invoke NHB 5300.4(1B) or applicable portions thereof.

- d. Data to be supplied.
- e. Government or APL source inspection.
- f. Certificate of compliance signed by an authorized officer of the manufacturer to certify that the parts delivered meet all the requirements of the procurement document.
- g. Sole approved supplier.
- h. Special inspection and screening requirements, including burn-in with delta criteria.
- i. Marking with APL proprietary part number to signify compliance with all the requirements of the control drawing.
- j. Specification of lead material.
- k. Manufacturer's lot and/or date code, serialization (traceability requirements).
- l. Pre-cap inspection by the vendor, whenever possible, for transistors and integrated circuits.
- m. Notification of changes.
- n. Equipment records.
- o. Inspection and test records.

5.4

GOVERNMENT SOURCE INSPECTION

GSI will be used when required by MSC.

5.5 APL SOURCE INSPECTION

When source inspection at a supplier's facility is necessary, the inspection will be performed by a representative of the Satellite Reliability Group. The extent of this source inspection depends on product complexity, ability to inspect after receipt at APL, and the effect of the vendor's processes on quality and reliability. Special attention will be given to potted components. In those cases where source inspection is not performed, objective evidence that the supplier has complied with applicable documents will be in the form of a Certificate of Compliance, in addition to inspection and test records.

5.6 RECEIVING INSPECTION

5.6.1 Acceptance of Material for Receiving Inspection

Upon receipt of material in the Satellite Reliability Group Material Control Office, the following requirements must be satisfied before acceptance for receiving inspection:

- a. The material is undamaged and is as described in the procurement document(s) as regards quantity, marking and packaging.
- b. The shipment is accompanied by a properly executed certificate of compliance, where required.
- c. Data required by the procurement document(s) has been supplied.
- d. All special requirements (e.g. independent laboratory reports for materials, where required) have been satisfied.

5.6.2 APL Lot Code and Serial Number Assignment (Parts other than hardware items)

After initial acceptance, the Quality Assurance Project of the Satellite Reliability Group will identify the parts as follows:

a. Each shipment will receive an APL lot code, traceable to the purchase order. Lot code numbers will be serially assigned, and a log relating the lot code number to the part number, the purchase documentation and the inspection history of the parts in the lot will be maintained.

b. Critical parts (typically semiconductor devices, bearings and relays) will also be assigned an APL serial number.

5.6.3 100% Receiving Inspection

a. General

Inspection and test equipment, drawings, specifications and instructions will be available to perform the necessary tests and inspections on purchased parts and hardware.

b. Hardware Items (nuts, bolts, rivets, screws, etc.)

Hardware items will be subjected to incoming visual inspection under binocular microscopes. In addition, stainless steel hardware will be verified as to series (e.g. 300 or 400) at incoming inspection.

c. EEE and Non-Hardware Mechanical Parts

The Satellite Reliability Group will subject all non-hardware parts to 100% receiving inspection. This inspection

will entail typically the following items:

1. A rigid visual inspection will be performed using binocular microscopes (typically 3X to 30X) for workmanship, quality and material per RQAM 8.003, Receiving Inspection Requirements. (See Appendix A.)
2. An inspection of dimensions will be performed on all mechanical parts with the exception of hardware items as defined in 5.6.3b, above.
3. Transistors will be electrically tested using a Teradyne T-241 automatic programmable semiconductor tester and the data will be recorded using an ASR-33 Teleprinter.
4. Electrical tests will be performed on passive parts. Existing Quality Control Inspection Instructions (QCIIIs) will be used. In cases where no QCII exists for the part, one will be prepared.
5. Veeco fine leak/gross leak hermeticity tests.
6. A dynamic X-ray TV inspection, i.e., the part will be observed internally as it revolves about an axis with a closed circuit X-ray TV system providing a 30X magnification to inspect for loose particles and frit, extraneous wires, voids, poorly shaped or excessively long internal leads, poorly shaped bonds, and the like. The details of the inspection procedures will be determined on a case-by-case basis by the Satellite Reliability Group utilizing existing Quality Control Inspection Instructions.

5.6.1 Receiving Inspection Records

Receiving Inspection Records will consist of the following documents:

- a. Receiving Inspection Log.
- b. Receiving Inspection Reports.
- c. Variables data records for electrical test of critical parts.
- d. Attributes data records for electrical test of non-critical parts.
- e. X-ray TV inspection reports.
- f. Process control cards.

5.6.5 Classification of Inspected Parts

As a result of 100% receiving inspection, parts will be classified as follows:

- a. Flight Qualified - Parts purchased with screening which pass receiving inspection.
- b. Accepted - Unscreened parts which fulfill the requirements of the purchase order but must pass a screening inspection performed by the Satellite Reliability Group to become flight qualified.
- c. Rejected - To be returned to the vendor with reasons for rejection for replacement or credit.
- d. Withheld - Parts which fulfill the requirements of the purchase order but which the Satellite Reliability Group will not accept for use in flight hardware due to minor or suspected defects. Withheld parts shall be controlled per RQAM 8.008, "Handling of Scrap and 'Withheld' Parts".

5.6.6 In-House Screening of Semiconductor Devices

For transistors, diodes, and integrated circuits which cannot be purchased with screening by the manufacturer, the Satellite Reliability Group will perform a 100% screening inspection. The screening procedure will be controlled by process control cards and will include typically the following:

- a. Temperature cycling (-55° to $+125^{\circ}\text{C}$).
- b. 20,000 g centrifuge in Y_1 axis for transistors and integrated circuits.
- c. Stabilization bake (may be with delta criteria).
- d. Burn-in for 168 hours at 25°C at rated power with variables data or equivalent.
- e. X-ray television inspection.
- f. Veeco fine leak/gross leak hermeticity tests.
- g. Final visual inspection.

5.6.7 Identification

All procured material inspected and accepted by the Satellite Reliability Group will be identified as described above and stored in a segregated controlled area until such time as it is withdrawn for production, processing, or fabrication. All material in the controlled storage area retains sufficient identification at all times to permit the positive traceability required for NASA.

5.6.8 Failure and Deficiency Feedback

Reporting to suppliers of deficiencies is accomplished by a Material Discrepancy Report which is prepared for rejected procured material. Follow-up where needed to assure accomplishment of corrective actions, will be by vendor consultation in house, or by a visit to the vendor's facilities.

5.6.9 Supplier Rating and Preferred Source Lists

APL vendor selection takes into account the suppliers' past quality experience along with other performance factors.

5.6.10 Coordination of Contractor-Supplier Measuring and Test Equipment and Standards

Coordination of inspection, measuring, and test equipment and correlation of inspection and test procedures will be instituted with the suppliers when APL test results differ significantly from supplier test results.

6.0 FABRICATION CONTROLS

6.1 FABRICATION OPERATIONS CONTROLS

Fabrication operations will be controlled by the use of the following documents:

- a. Engineering fabrication drawings, which will include or reference:
 1. Nomenclature and identification of article to be fabricated.
 2. Tooling, jigs, fixtures and other fabrication equipment to be utilized.

3. Characteristics and tolerances to be maintained.
 4. Special conditions to be maintained (e.g. environmental conditions, precautions, etc.).
 5. Applicable standard processes or process sheets.
- b. Process Control Cards, which will include:
1. Nomenclature and identification of the article to be fabricated.
 2. Check points for each fabrication step (including drawing of material and parts) and inspection, with description of each step or inspection and space for the Q.A. Inspection stamp for each inspection. The inspector will be responsible for insuring that the fabricated article is in strict conformance with the requirements of the applicable technical document(s) at each inspection point, i.e., that:
 - (a) proper materials have been used,
 - (b) dimensions are within the specified tolerance(s),
 - (c) workmanship standards have been maintained,
 - (d) all steps shown on the process control card since the last previous inspection point have indeed been completed.
 3. Provision for documentation of control of non-conforming articles, including rework, retest and reinspection, with or without MRB action. Each instance of the failure of an

article to conform to the applicable technical document(s) will be annotated on the reverse side of the Process Control Card. The Inspector will indicate, by the use of the Inspection Stamp, that he has reviewed the discrepancy (or has initiated such review by higher authority) and will note the actions taken, including all remedial and preventive action (see sections 8.2 and 8.3). Rework, retest and reinspection actions are subject to the approval of the Inspector, as indicated by the use of the inspection stamp.

c. Process Control Documents (Standard Processes and Process Sheets), which include:

1. Nomenclature and identification of the process.
2. Detailed procedures for accomplishing the process.
3. Process inspection requirements, including such items as the control of specific gravity and temperature of plating solutions, pull test of printed circuit board coupons, etc. The Q.A. Inspector will be responsible for all inspections required by the process and will indicate their completion by use of the inspection stamp on the Process Control Card.

d. "Module Kit" records for electronic hardware to insure EEE parts traceability. These records include:

1. Nomenclature and identification of the article to be fabricated (including serial number).

2. APL lot code (traceable to incoming inspection records and manufacturer's lot/date code) for each part installed in each position in the module.

3. (For serialized parts) The serial number of each part installed in each position in the module.

The Q.A. Inspector will use the Inspection Stamp on the Module Kit records to signify that the Kit has been properly assembled in accordance with the controlling electronic parts list.

6.2 ARTICLE AND MATERIAL CONTROLS

The Quality Assurance Document Control Inspector will monitor all Process Control Cards to insure that only conforming articles and materials are released, and that those not required for the operation involved are removed from work areas. Engineering drawings for articles and materials required to be fabricated or processed in a controlled environment will require that inspections or tests be conducted in a similar environment, to the extent necessary to prevent quality degradation.

6.3 CLEANLINESS CONTROL

Cleanliness control will be accomplished as specified in the Contamination Control Plan for the Ultraviolet Spectrometer Experiment.

6.4 PROCESS CONTROL

Process controls will be implemented for those processes where uniform high quality cannot be assured by inspection of articles alone.

6.4.1 Process Control Procedures

Process control procedures are contained in APL Reliability Assurance Standards, Volume V, Standard Fabrication Processes. The development of these procedures is a continuing effort under the cognizance of the APL Fabrication Groups subject to the approval of the Satellite Reliability Group. When APL Reliability Assurance Standards are used, reference will be made to them by number. Additional process control procedures will be developed as required for the Ultraviolet Spectrometer Experiment.

6.4.2 Equipment Certification

Equipment used in conjunction with processes will be controlled in accordance with Section 9, Metrology Controls. When calibration is not required, a system of preventive maintenance will be employed.

7.0 INSPECTIONS AND TESTS

7.1 INSPECTION AND TEST PLANNING

7.1.1 Test Flow Diagrams

Test flow diagrams will be prepared for:

1. Each major sub-assembly of the equipment, showing each test or inspection point in the manufacturing sequence.
2. The final assembly of the Ultraviolet Spectrometer, showing each test or inspection point.
3. The calibration of the Ultraviolet Spectrometer.

4. The environmental test of the Spectrometer.

5. The qualification test of the Spectrometer.

Test Flow Diagrams will also delineate points at which special handling, cleaning, or packaging is required, as defined by the Experiment Contamination Control Plan.

The test flow diagrams will be reviewed by Q.A. personnel to insure that all required tests, inspections, and contamination control measures are delineated. The NASA Resident Quality Representative will also review these diagrams and will establish Mandatory Inspection Points (M.I.P.) at which both APL Q.A. and NASA inspection and approval are required prior to proceeding.

7.1.2 Process Control Cards

As each fabrication drawing, assembly drawing and test specification (or change thereto) is released, it will be reviewed by Space Fabrication and Test Group or Mechanical Fabrication Group personnel. A Process Control Card will be prepared to define each step in the process (fabrication, assembly or test). The Process Control Card will delineate points at which inspections, measurements and tests are to be made or verified. Each Process Control Card will be reviewed by Q.A. personnel to insure that all required inspections, tests and contamination control measures are included, and that NASA M.I.P.'s are properly annotated. Special instructions or standards will be initiated at this stage. Inspectors will verify, at each inspection point, that all fabrication

steps occurring since the last inspection (or since the initiation of the Process Control Card, as applicable) have been properly listed and performed. Q.A. Inspection Stamps will be applied to the Process Control Card to indicate step or inspection completion.

7.2 INSPECTION AND TEST SPECIFICATIONS

Inspection and Test Specifications for Acceptance Qualification and Pre-Installation Tests will be prepared by Design Engineering. These specifications will include: test item nomenclature and identification, test objectives, quantity to be tested, test parameters and tolerances, accept/reject criteria, environmental conditions, allowable repair, rework, adjustment or maintenance operations, requirements for data recording, analysis, retests and reporting of test results, and disposition of test articles.

7.3 TEST PROCEDURES

A test procedure will be prepared for each test specification, to include:

- a. Nomenclature and identification of the test article.
- b. Characteristics and design criteria to be inspected or tested, including accept/reject criteria.
- c. Detail steps and operations to be taken in sequence, including verifications to be made before proceeding.
- d. Test data sheets, listing all required measurements and limits (tolerances) and providing space for the Quality Assurance Inspection Stamp for each measurement and for each change in test environment or condition.

e. Measuring equipment to be used, specifying type and range.

f. Details or instructions for the operation of special data recording equipment or other automated test equipment.

g. Layout and interconnection of test equipment and articles.

h. Precautions to comply with established safety requirements, insure safety of personnel, and to prevent damage or degradation of articles and measuring equipment.

i. Environments and other conditions to be maintained.

j. Workmanship standards.

k. Constraints on inspection or testing.

l. Special instructions for non-conformance, anomalous occurrences or results.

7.4 END ITEM INSPECTION AND TEST SPECIFICATIONS AND PROCEDURES

Separate inspection and test specifications (see paragraphs 7.2 and 7.3) will be prepared and utilized for each end item.

7.5 INSPECTION AND TEST PERFORMANCE

7.5.1 General

Inspections and tests will be performed and controlled by the applicable technical documents. No adjustment, modification, repair, rework or replacement will be allowed except as specified

in the established documents. Failures or discrepancies occurring during qualification or end item tests will be documented by the use of MSC FIAR forms.

7.5.2 Control of Test Environment and Equipment

a. Environments will be controlled to prevent compromising the quality of the article.

b. Equipment will be controlled, maintained, and calibrated as specified in procedures for each equipment.

7.5.3 Criteria for Reinspection and Retest

Reinspection and retest may be required (after accomplishment of remedial and preventive action) whenever:

a. The article or material does not meet the contract or APL specification requirements, or

b. The inspection or test performed is not in accordance with test specifications or inspection and test procedures, or

c. Equipment malfunctions occur, or

d. Modifications, repairs, replacements, or rework of the article or material occur after the start of inspection or testing, or

e. The article is subject to drift or degradation during storage and handling, or

f. Specified by Material Review Board (MRB)*. Retest shall be limited by consideration of the remaining useful life and operating time.

*Not applicable to qualification and end-item tests.

7.5.4 Qualification Test Article

Qualification tests will be performed on one qualification test model, in accordance with the MSC approved Qualification Test Plan and Procedure.

7.5.5 End Item Inspections and Tests

End item inspections and tests will be performed in accordance with the MSC approved End Item Test Plans and Acceptance Test Plans and Procedures.

7.5.6 Inspection and Test Records and Data

Records and data for each end item will be maintained, and will include the following items:

- a. Equipment Log, documenting the cumulative operating time of the equipment and all adjustments, calibrations, maintenance, rework, repair and malfunctions of the end item.
- b. Process Control Cards for all fabrication, assembly, inspection and test operations performed on the equipment or any sub-unit thereof, to include all fabrication and assembly history, non-conformances, initial review of non-conformances, test and inspection, and retest and reinspection.
- c. Configuration data: Parts lists, drawings, specifications, changes, and identification data.
- d. Inspection and test records: Specifications, procedures, results, variables data.
- e. Discrepancy reports and FIAR's, MRB reports, Contracting Officer approvals.

f. Acceptance Test Report.

g. Qualification Report.

The Document Control Inspector will be responsible for insuring that the Process Control Cards for each fabrication and assembly operation, inspection and test and all required data sheets are present in the end item data package. He will also insure that all required operations, measurements and tests have been properly verified by the presence of the Quality Assurance Inspector's stamps. Running logs of all required Process Control Cards and data will be maintained.

8.0 NON-CONFORMING ARTICLE AND MATERIAL CONTROL

8.1 NON-CONFORMANCE DOCUMENTATION

8.1.1 General

Each non-conformance discovered by APL, its sub-contractors and the MSC designated quality representative will be documented.

8.1.2 Discrepancy Reports

A discrepancy report (see RQAM 8.002 - Discrepancy Reporting System, Appendix B of this plan) will be prepared for each non-conformance and will be followed up by Quality Assurance personnel to insure that all discrepancies are resolved prior to release of the article or material for further processing.

8.1.3 Other Non-Conformance Documentations

Other non-conformance documentation will consist of:

- a. Annotation of the Process Control Card for each non-conformance uncovered in fabrication, processing or test operations.
- b. MSC Failure Investigation Action Reports (FIAR's), as required by the contract.
- c. Test Analysis Reports (see Para. 6.1, RQAM 8.002, Appendix B of this plan).
- d. Corrective Action Reports (see Para. 6.2, RQAM 8.002).
- e. Failure Analysis Reports (see Para 6.4, RQAM 8.002).

8.2 REMEDIAL AND PREVENTIVE ACTION

APL will conduct appropriate analysis and examination of non-conforming articles, materials, or conditions to determine the cause or reason for the non-conformance. Non-conforming articles or materials will be forwarded to MSC as requested by the NASA Contracting Officer.

Remedial and preventive actions will be taken to insure correction of the article or material and to prevent recurrence of the non-conformance. Satellite Reliability Group personnel will be responsible for notification of the affected groups of non-conformances and for follow-up of all remedial and preventive actions to insure accomplishment. The Experiment Reliability Engineer will be responsible for documenting all failures in the form of FIAR's to be submitted to MSC.

8.3 INITIAL REVIEW DISPOSITIONS

Non-conforming articles or materials will be reviewed initially by APL Quality Assurance personnel and shall be subjected to one of the following dispositions:

- a. Return for rework or completion of operations.

Such rework will require resubmittal of the article or material to normal inspection and test operations.

- b. Scrap. Disposition of scrap will be controlled by a written procedure.

- c. Return to supplier with non-conformance information and assistance, as necessary, to permit remedial and preventive action.

- d. Submit to MRB for disposition.

8.4 MATERIAL REVIEW BOARD

All non-conformances submitted under para 8.3,d.(above) will be evaluated and disposition determined by a Material Review Board consisting of the following:

The APL UVS Experiment Project Engineer.

The APL UVS Experiment Reliability Engineer.

A NASA representative.

Consultation with the UVS Experiment Principal Investigator will be initiated as required. The MRB will also draw upon the various laboratory skill centers as needed. A report will be prepared on each MRB action, and will include information on remedial

and preventive actions taken and APL recommendations concerning dispositions requiring the approval of the NASA Contracting Officer.

All articles and materials submitted for MRB action will be subjected to one of the dispositions listed below. Any disposition, other than scrap, will require unanimous agreement of the board members.

a. Repair. Procedures will be established or approved by the MRB to effect the repair and will include appropriate inspections and test to verify repair acceptability.

b. Scrap. Disposition of scrap will be controlled by a written procedure.

c. Use as is. The MRB report must contain specific justification for all "use as is" actions.

d. Request NASA Contracting Officer approval (applicable wherever safety, reliability, durability, performance, weight or basic contract objectives are in any way affected).

8.5 SUPPLIER MATERIAL REVIEW BOARD

When suppliers are delegated MRB responsibility, they will be required to have a system of control consistent with the contractual requirements imposed upon APL. In all delegations, APL reserves the right to disapprove the subcontractor's MRB decisions.

9.0 METROLOGY CONTROLS

9.1 GENERAL

All measurement and test equipment used to make measurements to establish conformance with specification and drawing requirements will be initially and periodically calibrated and certified to verify its accuracy and compliance with requirements. This will be accomplished in a manner which establishes traceability for all measurements to the National Bureau of Standards.

9.2 CALIBRATION

Before starting any test or inspection operation to demonstrate compliance with specification requirements, it will be the responsibility of the operator to assure that the test equipment is within a current calibration period.

9.2.1 Tooling Used for Measuring

Tools, gages, jigs, and fixtures which measure dimensions, contours, or locations affecting quality characteristics will be initially checked for accuracy to working standards prior to use. Periodic checks and recalibration will be made to insure their continued accuracy.

9.3 CALIBRATION FACILITIES AND STANDARDS

Calibration of all EEE measuring and testing equipment will be performed by the Laboratory's Instrument Loan and Repair facility. This facility maintains the necessary standards and have documented traceability to the National Bureau of Standards for each standard. This facility provides the maintenance and

calibration services for the measuring and testing equipment utilized. In the primary calibration area, temperature is maintained between 70°F and 75°F, and relative humidity is maintained below 55%.

The Laboratory Instrument Loan and Repair Facility maintains working standards for the calibration of mechanical mensuration equipment and shop tools. These standards are returned, on a periodic recall basis, to an outside standards laboratory for calibration and certification against primary standards traceable to NBS.

9.4 EVALUATION

Test equipment will be inspected, evaluated, and calibrated prior to initial use and at periodic intervals. Recalibration schedules will be determined in accordance with past history and present needs to assure continued accuracy of measuring and test equipment involved in product evaluation or in establishment of product conformance.

a. General purpose and/or commercially available test equipment for which APL has accumulated information relating to accuracy, stability, and repeatability will not be subjected to evaluation tests. This type of equipment will be utilized in a manner consistent with its intended applications.

b. Special test equipment will be evaluated to verify that it meets all function and accuracy requirements.

9.5 MAINTENANCE AND CONTROL

All Satellite Reliability Group instruments are returned for calibration in accordance with an automatic recall system. A Laboratory-wide automatic recall system is in the planning stage, but until it is implemented it will be the responsibility of the Experiment Reliability Engineer assigned to the Experiment to insure that only calibrated instruments and tools are used for acceptance tests* and inspections. Immediate impounding and removal will be effected on all equipment observed to be beyond the valid use interval, or where the continued accuracy is doubtful. Such equipment will be immediately recalibrated, and if found to be within the specified tolerances, no action will be taken with regard to the articles or materials being measured/tested.

9.6 QUALITY ASSURANCE AUDITS

A metrology inspector will be assigned by Quality Assurance to perform the following functions:

- a. Audit, on a periodic basis, each area where measurement equipment is being used in quality control functions for the Ultraviolet Spectrometer program. This audit will

*Acceptance tests here refers to any inspection or test, at any level, at which the item (part, etc.) is accepted as meeting the requirements of the applicable technical documents, i.e., at any point at which the inspection stamp is required.

determine that all instruments in use are within the specified calibration period.

b. Notify the Experiment Reliability Engineer of any out-of-calibration instruments found during the audit, so that such equipment may be immediately impounded.

9.7 WRITTEN PROCEDURES

Written calibration procedures will be utilized for all measuring and testing equipment and standards used to assure the accuracy of measurements involved in establishing product conformance.

9.8 RECORDS

A record of all calibration and maintenance actions will be maintained on each device, including mechanical measuring equipment and shop tools. Records for special test equipment, fabrication tools, jigs, and fixtures used as media of inspection or control, will indicate the inspections and approvals performed prior to release for use.

10.0 INSPECTION STATUS STAMP CONTROL

10.1 INSPECTION STAMP LOG

An inspection stamp log will be used to maintain traceability to the individual responsible for the use of each specific stamp.

10.2 USE OF INSPECTION STAMPS

Inspection stamps will be used to identify that articles and materials have undergone source and receiving inspection, in-process inspection, end-item inspection, and test. Stamps will be applied to records, including test flow cards, data sheets, process control cards and "module kit" records identified with the individual article or material. In the case of process and flow cards the stamp will be applied to signify completion of each individual step listed on the record.

11.0 HANDLING, STORAGE, PRESERVATION, MARKING, LABELING, PACKAGING, PACKING AND SHIPPING

11.1 GENERAL

APL will provide procedures for preservation, packaging, handling, storage, and shipping to prevent damage, loss, deterioration, degradation, and substitution. These procedures will take into consideration any problems unique to the Experiment.

11.2 HANDLING

Any article subject to damage due to handling during fabrication or processing will be provided with special fixtures, handling containers, and the like. Special handling instructions, where required, will be forwarded to the receiving activities.

11.3 STORAGE

APL will provide procedures that will provide protection for all articles that require storage at the component level up to a completed Experiment. The Satellite Reliability Group will monitor the operation to assure compliance with the appropriate procedure.

11.4 PRESERVATION

APL will provide procedures designed to protect during fabrication or storage, any items that are subject to deterioration from air, moisture, or other elements.

11.5 MARKING AND LABELLING

Appropriate marking and labelling will be provided for packaging, shipping and storage of articles and materials, as required by specification or contractual requirements.

11.6 PACKAGING AND PACKING

APL will provide procedures for packaging that will protect the articles being shipped from damage or deterioration. These procedures will provide for any problems unique to the Experiment. Cushioning, blocking, bracing or bolting, as applicable will be used to prevent damage due to free movement within containers, rupture of flexible barriers, etc.

11.7 SHIPPING

APL will provide control of hardware to be shipped in accordance with APL/JHU Practices and Procedures Manual, Section XV-I, dated 10/24/66.

12.0 SAMPLING PLANS, STATISTICAL PLANNING AND ANALYSIS

12.1 GENERAL

The limited quantities of parts and materials required on this program give little likelihood that statistical quality control techniques can be applied which will produce any meaningful results. APL plans to use the extensive receiving inspection on parts and materials supplemented by stringent inspection during fabrication and thorough subsequent testing in an effort to achieve the high degree of reliability required by the program.

Analysis of receiving inspection accept/reject records and procurement and delivery history statistics are used by APL in the rating and selection of suppliers.

13.0 CONTROL OF SUBCONTRACTED HARDWARE AND OF THE CALIBRATION TESTS

13.1 SUBCONTRACTED HARDWARE

APL will control the operations of the subcontractors for the Main Housing Assembly in all design and fabrication operations. This control will include:

- a. Review and approval, by APL Engineering and Q.A. personnel, of all engineering drawings defining the subcontracted portions of the flight spectrometer.

REVISION C
CHANGE NUMBER THREE

- b. Preparation by the Subcontractor and review and approval by APL Q.A. personnel of Process Control Cards for all flight hardware to be fabricated by sub-contractors, including insertion of appropriate test and inspection points.
- c. Inspection of each fabricated mechanical part, including dimensions as per the engineering documentation, and of each assembly.
- d. Review and approval of purchased materials documentation.
- e. Preparation and review (by APL Q.A. personnel) of Process Control Procedures, where required by NASA for special processes.
- f. Performance of Alodine, Anodize, and plating operations at APL facilities, using APL Standard Processes.
- g. Review and approval by APL Engineering and Q. A. personnel of all test procedures and test Process Control Cards.
- h. Witnessing of all test and alignment operations conducted by the subcontractors.
- i. Collection of (an submittal of, where required) all documentation necessary to meet APL contractual obligations.
- j. Preparation of contamination control procedures, including packaging of flight hardware for transport or shipment.

13.2

COMPONENT AND UVS CALIBRATION AND TEST

APL will monitor the operation of the Calibration Test Equipment (CTE). This monitoring will include:

- a. Witnessing of the Acceptance Test of the CTE by APL Q.A. personnel.
- b. Witnessing of Acceptance Testing of phototubes, gratings, and mirrors for Prototype, Qualification and two Flight Spectrometers.
- c. Witnessing of the optical verification and calibration of Prototype, Qualification and Flight Spectrometers in the CTE.
- d. Responsibility for contamination control procedures including packaging of UVS hardware for transport or shipment.

REVISION C

CHANGE NUMBER THREE

i. Witnessing of the calibration of Qualification and Flight Spectrometers in the OTE.

j. Preparation of contamination control procedures, including packaging of flight hardware for transport or shipment.

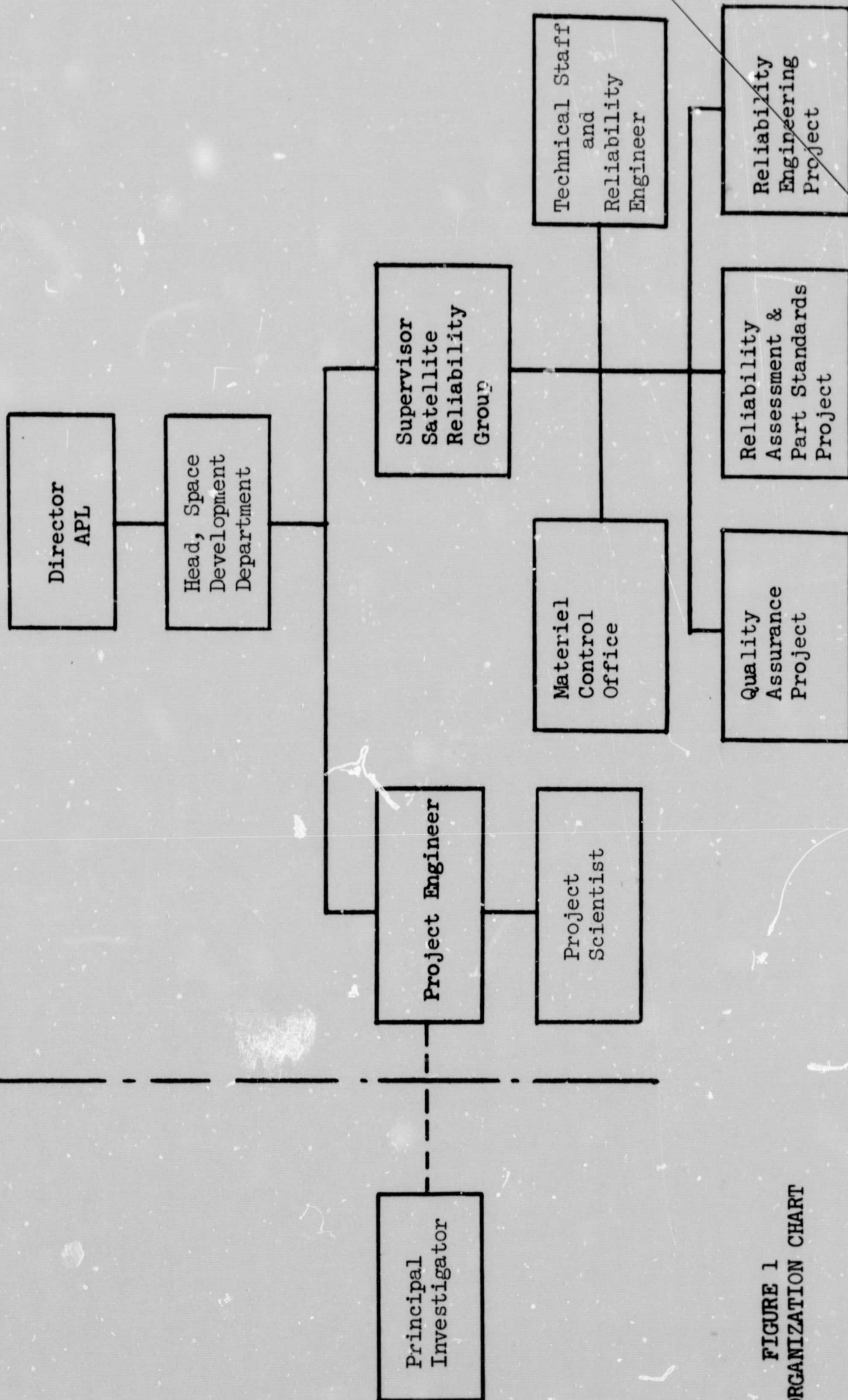
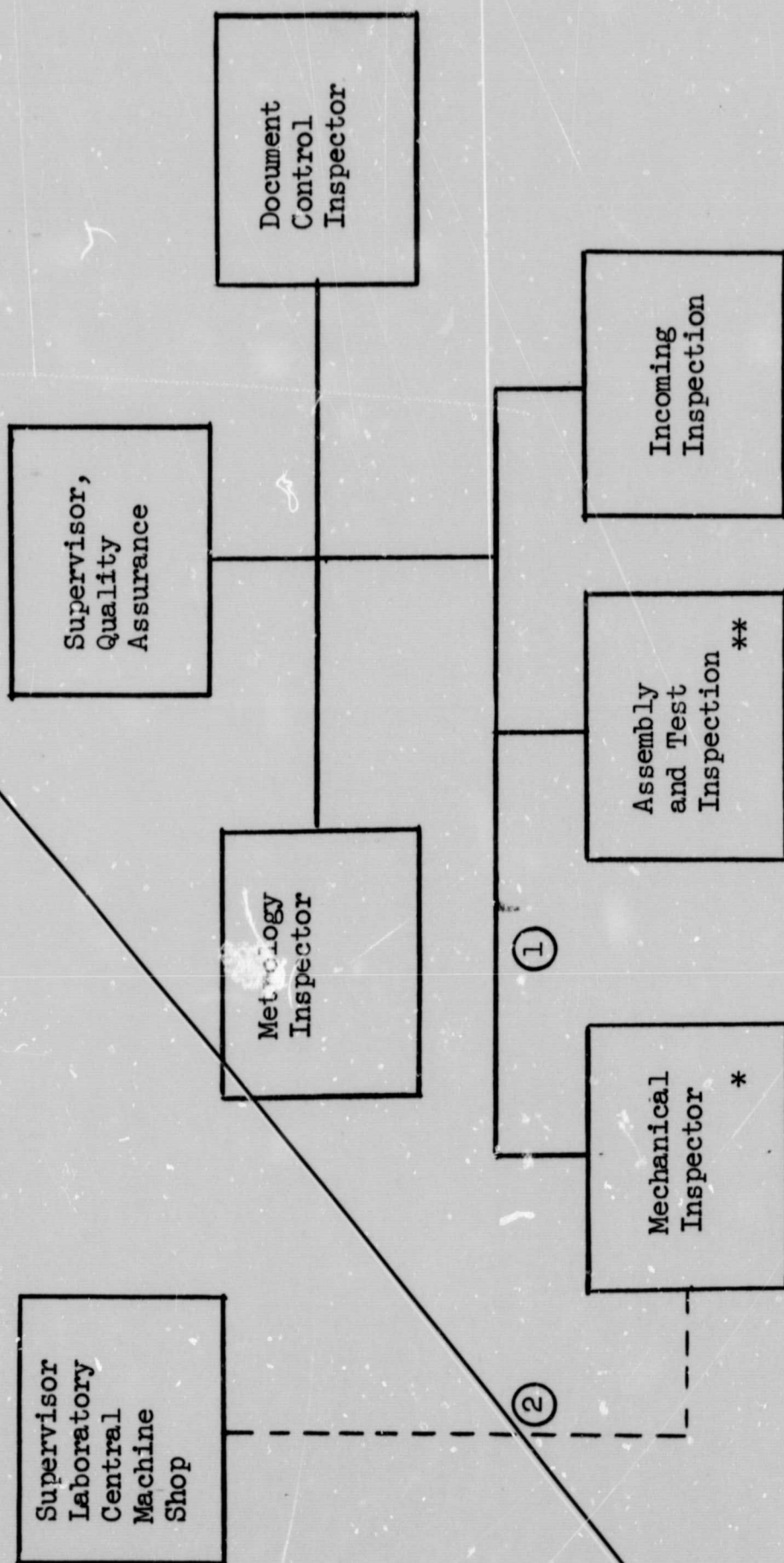


FIGURE 1
ORGANIZATION CHART



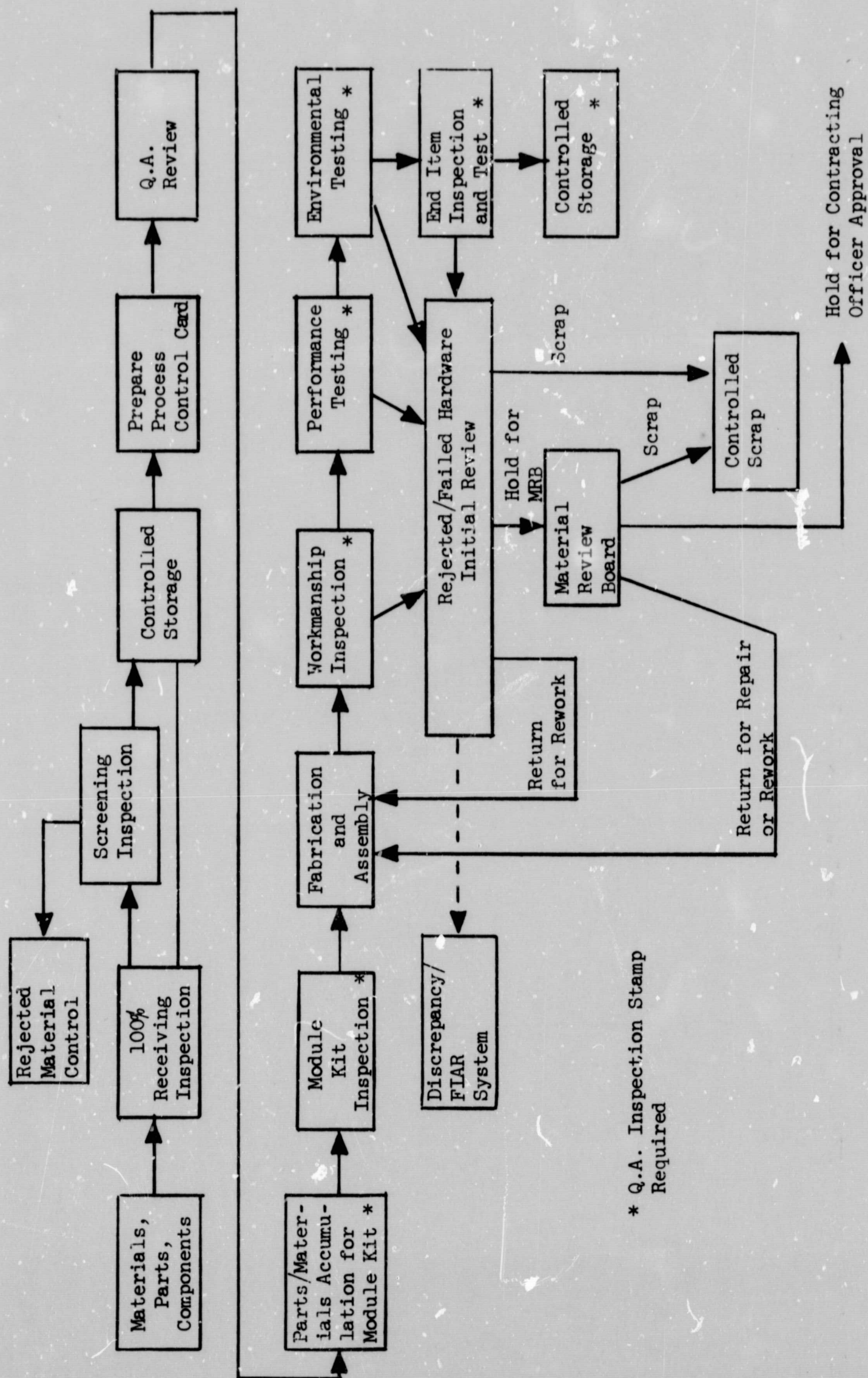
* Function: Dimensional measurement of each fabricated mechanical part to drawing requirements.

** Functions Include:

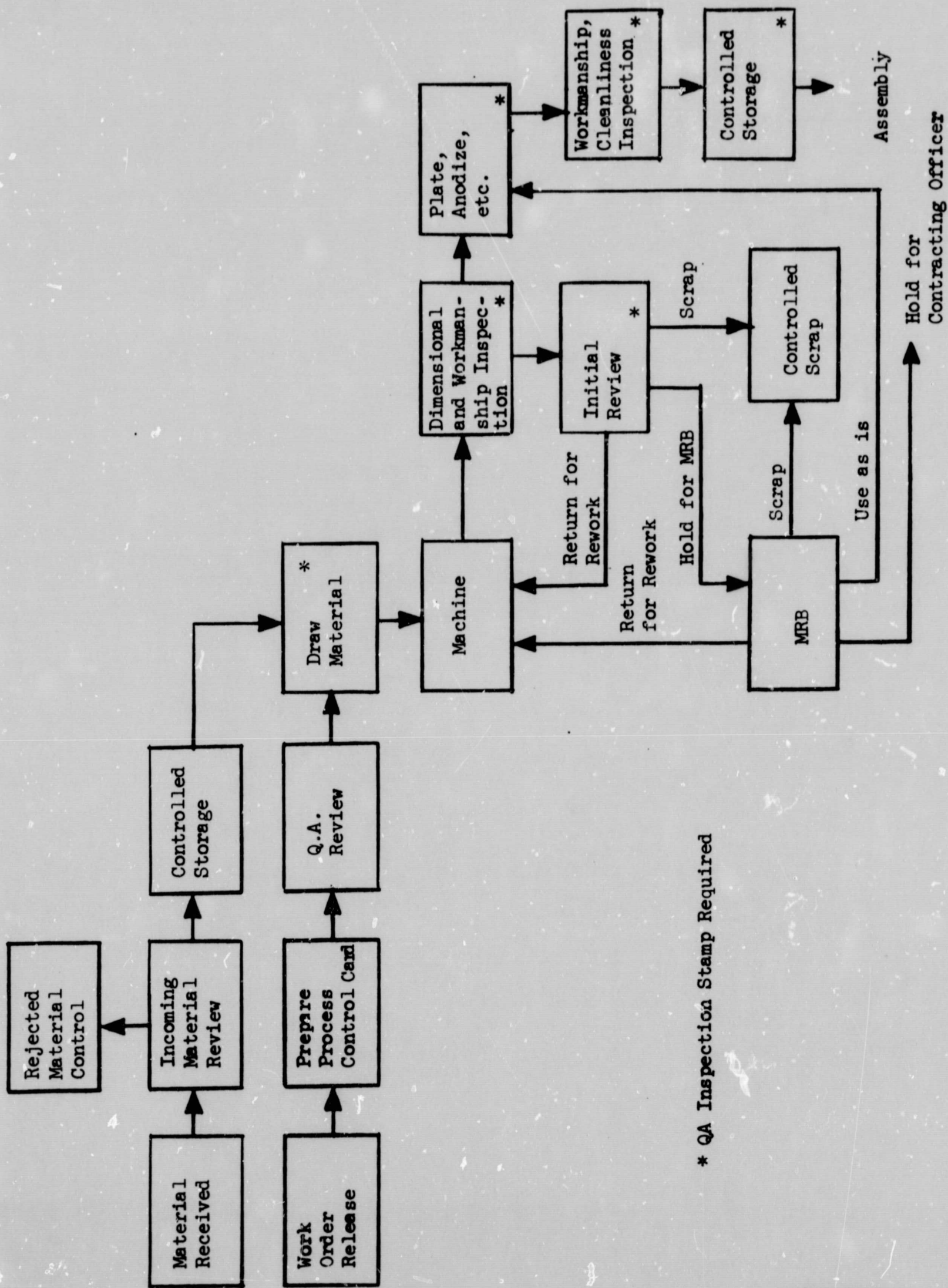
1. Electronic Assembly Inspection.
 2. Workmanship and cleanliness inspection of fabricated and purchased mechanical parts. Cleaning and packaging per Contamination Control Plan prior to sending to controlled stock.
 3. Electromechanical and Mechanical Assembly Inspection.
 4. Test witnessing, Calibration witnessing, Test verification.
- ① Mechanical Inspectors will be under the supervision of the Supervisor, Quality Assurance in all technical matters.
- ② Mechanical Inspectors will report "Administratively only" to the Supervisor, Laboratory Central Machine Shop.

REVISION C
CHANGE NUMBER TWO

QUALITY ASSURANCE ORGANIZATION
FIGURE 1A (Revision 1)

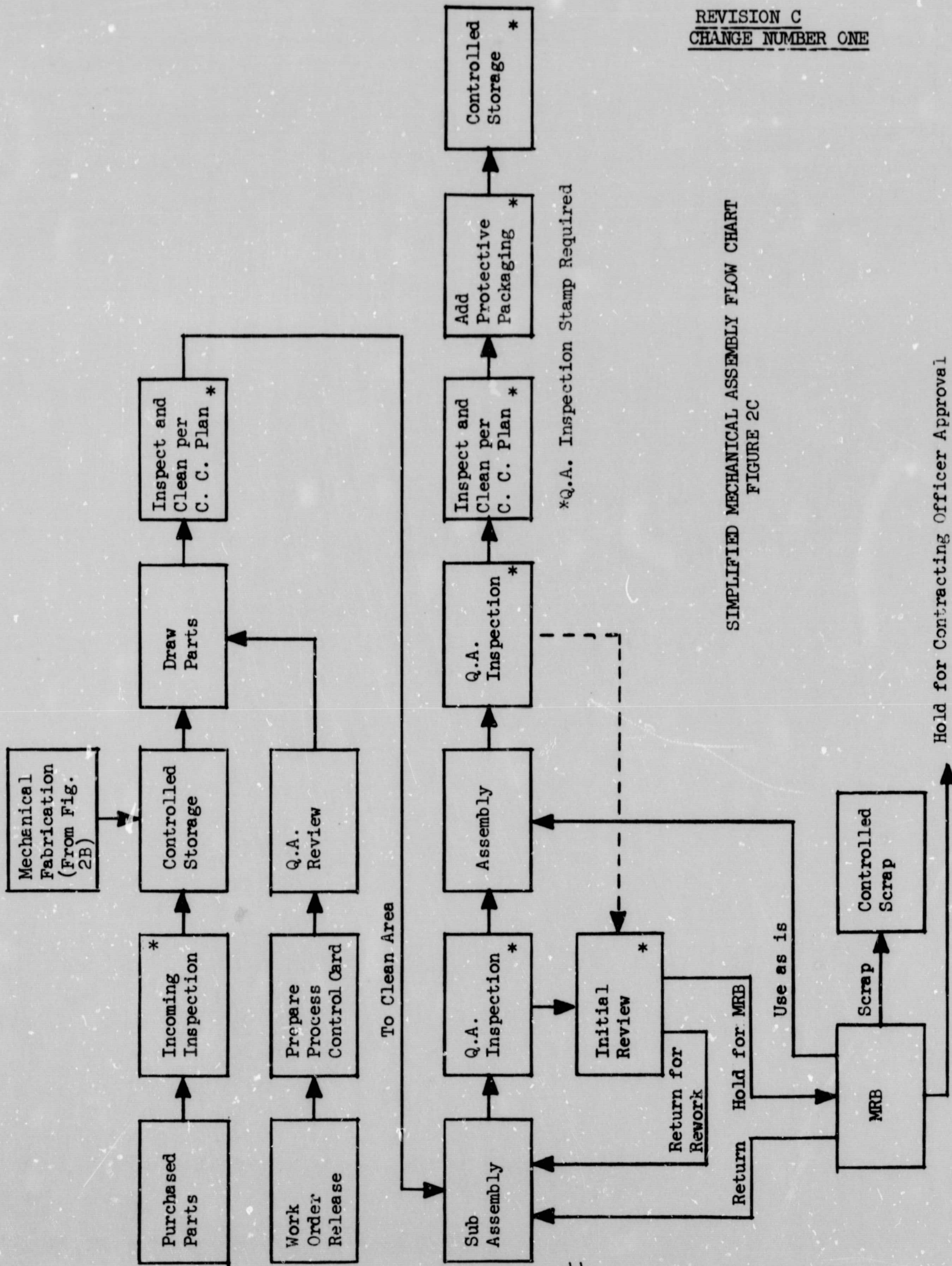


SIMPLIFIED FABRICATION AND FLOW CHART, ELECTRICAL/ELECTRONIC EQUIPMENT
FIGURE 2A



* QA Inspection Stamp Required

SIMPLIFIED MECHANICAL FABRICATION FLOW CHART - FIGURE 2B



APPENDIX A

RQAM - 8.003

RELIABILITY AND QUALITY ASSURANCE MANUAL

RECEIVING INSPECTION REQUIREMENTS

REVISIONS				
ISSUE	BY & DATE	DESCRIPTION	CHECK	APPROVED & DATE
B	DBG 12/28/70	1. Changed Spec. Reference, Items 2.0 and 4.1 from NPC-200-4 to NHB 5300.4(3A) 2. Added sentence to Item 7.0: "Dimensions will be measured per the applicable technical document(s)." S. J. G. 1/3/71		

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY
 8621 GEORGIA AVENUE SILVER SPRING, MARYLAND

Reliability and Quality Assurance Manual

RECEIVING INSPECTION
 REQUIREMENTS

J. J. Munn 12/25/67
P. Mastracci 12/28/67
R. W. Cole 1/2/68

RELIABILITY	DATE	CODE IDENT NO.	SIZE	ISSUE
		88898	A	B
			RQAM - 8.003 DO NOT SCALE PRINT	PAGE 1 OF 9

INDEX

1.0	PURPOSE
2.0	SCOPE
3.0	RESPONSIBILITIES
4.0	VISUAL INSPECTION
4.1	Soldering Inspection
4.2	Lead Inspection
4.2.1	Foreign Material
4.2.2	Plating
4.2.3	Lead Material
4.2.4	Lead Condition
4.2.5	Lead Dimensions
4.2.6	Examination
4.3	Case or Body Inspection
4.3.1	Mechanical Damage
4.3.2	Insulation
4.3.3	Hermetic Seals
4.3.4	Case or Body Dimensions
4.3.5	Appearance
4.3.6	Glass to Metal Seals
4.3.7	Terminals and Lugs
4.4	Tuning Adjustment Feed Thru's, Shafts, etc.
4.4.1	Operation
4.4.2	Seals
4.4.3	Mechanical Fit
4.5	Connector Inspection
4.6	Feed Thru Capacitor Inspection
4.6.1	Insulation
4.6.2	Body
4.7	Weld Inspection
4.8	General Workmanship
5.0	MATERIAL CHARACTERISTICS
5.1	Limited Life Materials
6.0	DIMENSIONS AND TOLERANCES
7.0	MECHANICAL COMPONENTS
7.1	Unit Components
7.2	Assembled Components
8.0	TEST REQUIREMENTS

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.003	ISSUE B
SCALE	DO NOT SCALE PRINT	PAGE	2 of 9

1.0 PURPOSE

This procedure establishes the methods to be used and the accept/reject criteria to be applied by the Reliability Group during the receiving inspection of all parts and components destined for flight use to assure the consistently high quality workmanship required of spacecraft hardware.

2.0 SCOPE

It is intended that this procedure will satisfy the applicable requirements of NASA Quality Publications NPC-200-3, "Inspection System Provisions for Suppliers of Space Materials, Parts, Components, and Services" dated April 1962; NHB 5300.4(3A), "Requirements for soldered Electrical Connections, May 1968 Edition.

3.0 RESPONSIBILITIES

It is the responsibility of the APL Reliability Group, within the Space Department, to perform these inspections using thoroughly trained personnel to make the accept/reject decisions.

4.0 VISUAL INSPECTION

All incoming parts and components to be used in the fabrication of satellite hardware shall be inspected visually and tested as indicated in these procedures. When magnification is required during visual inspection, a binocular microscope shall be used with the magnification usually set between 5X and 30X.

4.1 Soldering Inspection

NASA's NHB 5300.4(3A) shall be used as a guide. Each solder joint shall be inspected to the requirements below.

4.1.1 The surface of the solder shall have a smooth, bright appearance. A gray, crystalline or contaminated appearance shall be cause for rejection, except that solder on gold plate or high temperature solder may appear gray in which case the Control Drawing or purchase order must be checked to verify that high temperature solder is specified.

4.1.2 Only enough solder shall be used so that the parts are covered. The outline of the leads shall be plainly visible. Excess or insufficient solder shall be cause for rejection.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.003		ISSUE B
SCALE	DO NOT SCALE PRINT		PAGE	3 of 9

4.1.3 The solder shall exhibit good wetting adherence, with no porosity, to all parts of the completed connection.

4.1.4 The solder shall wet all surfaces and display a complete fillet around the soldered connection.

4.1.5 No evidence of charring, burning, or other damage from the heat of soldering shall be present.

4.1.6 There shall be no evidence of splattering of flux or solder.

4.1.7 Wicking of solder up to the point of insulation termination is not desirable but is permitted. Solder shall not obscure wire to prevent inspection for nicks and cuts to wire strands.

4.1.8 Wires having an insulation outside diameter of $1/32$ inch or greater shall have a minimum clearance of $1/32$ inch between the insulation and terminal/pad to which the wire is soldered and a maximum clearance equal to the insulation outside diameter plus $1/32$ inch. Wires having an insulation diameter less than $1/32$ inch shall have a minimum clearance equal to the insulation outside diameter and a maximum clearance of $1/32$ inch. Nicked, cut, or "bird caged" strands of wire shall be cause for rejection.

4.1.9 The following defects are among the most common causes for rejection of solder joints and shall be a part of the visual incoming inspection.

No solder
Insufficient solder
Solder bridge (electrical)
Excess solder
Cold soldered connection
Rosin soldered connection
Disturbed solder connection
Excess wicking
Solder peaks or points
Flux residue

Damaged wires
Broken wires
Broken strands
Poor mechanical wrap
Burned or damaged insulation
Insulation in the solder connection
Insulation too far from or too close to terminal/pad
Leads under tension
Excess lead length
Excess pigtail

4.2 Lead Inspection

Each part lead shall be inspected to the requirements of the control drawing specifications and the requirements below.

4.2.1 Foreign Material

Carefully inspect all leads for the presence of any foreign materials such as paint, dirt, or any substance that would inhibit proper welding or soldering.

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.003	ISSUE B
SCALE	DO NOT SCALE PRINT		PAGE 4 of 9

4.2.2 Plating

Plating shall be of the type specified by the control drawing or purchase order. Plating shall be continuous and smooth and there shall be no evidence of peeling or flaking, or build up in whiskers or balling. Tinned leads shall have no evidence of globs of solder. Electrolysis tin plating shall be bright and shall not have a white appearance. Evidence of plating over foreign material shall not be allowed.

4.2.3 Lead Material

Lead material shall be as specified by control drawing or purchase order. Magnetic material shall be checked by use of a magnet, except where prohibited by drawing.

4.2.4 Lead Condition

All leads shall be inspected for physical damage. There shall be no sharp bends, kinks, nicks, thin spots, or any damage that will so weaken a lead that it may break or fatigue in the assembly process.

4.2.5 Lead Dimensions

Lead dimensions shall be as specified in the control drawing or purchase order.

4.2.6 Examination

Where applicable inspect for proper color, contour, support, bend radius, clearance, code markings, etc.

4.3 Case or Body Inspection

The case or body of each part shall be inspected to the requirements of the control drawing specifications and the requirements below.

4.3.1 Mechanical Damage

Inspect for dents, scratches, cuts, cracks, voids, bubbles, or any shipping or handling damage.

4.3.2 Insulation

If item is insulated inspect for holes, voids, or cracks in insulation. Any of these or any other defect which may result in a short shall be cause for rejection.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.003		ISSUE B
SCALE		DO NOT SCALE PRINT		PAGE 5 of 9

4.3.3 Hermetic Seals

- a. Inspect all seals for visual appearance (see 4.3.6). Where solder is used to provide the seal, perform a meticulous inspection as per paragraph 4.1.
- b. Perform a gross leak check by pressurization under alcohol or freon liquid, then submerging in hot glycerine or water. Evidence of bubbles indicates gross leaks and shall be cause for rejection.
- c. Perform a fine leak test using the VEECO leak detector. Fine leak rates in excess of purchase order requirements shall be cause for rejection.

4.3.4 Case or Body Dimensions

Inspect case or body dimensions against the control drawing or purchase order requirements.

4.3.5 Appearance

Inspect paint, color and appearance, decals, part numbers, etc. Parts with missing or illegible marking shall be rejected.

4.3.6 Glass to Metal Seals

Inspect glass for evidence of strain, cracks, holes, or physical damage.

4.3.7 Terminals and Lugs

Inspect terminals and lugs for cuts, poor plating, nicks, dirt, and other contamination. Any defect that would prevent proper soldering wetting or welding, attachment of leads or contribute to mechanical breakage shall be cause for rejection.

4.4 Tuning Adjustment Feed Thru's, Shafts, etc.

Inspect the tuning adjustment feed thru's, shafts, etc. to the requirements of the control drawing specifications and the requirements below.

4.4.1 Operation

Inspect feed thru's for correct operation. Observe any operating restrictions specified by control drawing or purchase order.

4.4.2 Seals

If a shaft seal is used, inspect seal for proper fit.

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.003	ISSUE B
SCALE	DO NOT SCALE PRINT		PAGE 6 of 9

4.4.3 Mechanical Fit

Shafts shall be as specified by purchase order or control drawing. If not specified, shafts, etc. shall fit snugly and operate smoothly.

4.5 Connector Inspection

Connector shall be inspected to the requirements of the control drawing specifications and the requirements below.

4.5.1 Examine pins and sockets for misaligned or bent pins, evidence of corrosion, peeling of plating and any other contamination. Any evidence of these conditions shall be cause for rejection.

4.5.2 Insulation shall be free from dirt, metal particles, voids, and cracks. The insulation shall be as specified in purchase order requisition and shall have uniform thickness.

4.5.3 Cases shall be inspected for quality of plating when plated. Carefully examine threaded areas for bad threads, burrs, and metal particles.

4.5.4 Solder caps shall show no evidence of corrosion, dirt, or any condition that would prevent a satisfactory solder joint.

4.5.5 Mechanical Configuration

Connectors shall be inspected against specification drawings or purchase order to determine that connector type, polarization, plating, finish, pins, etc. are correct.

4.6 Feed Thru Capacitor Inspection

Feed thru capacitors shall be inspected to the requirements of the control drawing specification and the requirements below.

4.6.1 Insulation

There shall be no voids, cracks, pits, etc. in the capacitor insulation.

4.6.2 Body

There shall be no solder, paint, or other contamination on any metallic surface that may be used as a welding or soldering surface. Check control drawings or purchase order for correct dimensions and finish (both mechanical and plating).

CODE IDENT NO. 88898	SIZE A	RQAM - 8.003	ISSUE B
SCALE	DO NOT SCALE PRINT		PAGE 7 of 9

4.7 Weld Inspection

Each weld shall be inspected and meet the requirements below.

4.7.1 If possible each weld shall be tugged. Any welds that separate shall be cause for rejection.

4.7.2 Any weld splatters or balls that may be dislodged shall be cause for rejection.

4.7.3 Any weak appearing, or excessively deformed welds shall be cause for rejection.

4.7.4 Holes burned in weld area or supporting material shall be cause for rejection.

4.8 General Workmanship

Each part and component shall be visually inspected for general workmanship. All items showing evidence of foreign materials, cuts, dents, burrs, damage, shall be rejected.

5.0 MATERIAL CHARACTERISTICS

In those cases when specific materials characteristics are called out in the purchase order, receiving inspection shall verify that the purchased articles contain the specified materials without substitution. This shall be accomplished by requiring a certificate of compliance, signed by the manufacturer's representative, attesting to the material characteristics or by testing the material characteristics at APL when possible, as in the case of non-magnetic properties, for instance. Non-conforming material shall be rejected.

5.1 Limited Life Materials

Parts and components with limited life characteristics will be identified during receiving inspection. Expiration of lifetime or insufficient lifetime remaining to accommodate program requirements shall be cause for rejection. The Materiel Control Office will maintain a log book of limited life items. This log will be reviewed periodically and over age items withdrawn from stock.

6.0 DIMENSIONS AND TOLERANCES

Part and component dimensions shall be as specified by the purchase order or control drawing. Out of tolerance dimensions shall be cause for rejection.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.003		ISSUE B
SCALE		DO NOT SCALE PRINT		PAGE 8 of 9

7.0 MECHANICAL COMPONENTS

Applicable inspections shall be performed in accordance with Sections 4, 5 and 6 above. Dimensions will be measured per the applicable technical document(s).

7.1 Unit Components

Parts and components which are of single unit construction such as cast, stamped, machined, or drawn material shall be inspected in accordance with Sections 4, 5 and 6 as applicable.

7.2 Assembled Components

Parts and components which are received as assemblies shall be inspected in accordance with Sections 4, 5 and 6 as applicable and the requirements below.

7.2.1 Inspect joints both mechanical and electrical for cracks, separations, poorly seated rivets, inadequate weldments, lack of adhesive bonds, and the like. Structural defects which may cause stress concentrations or adversely affect operation are cause for rejection.

7.2.2 Inspect components for operability when relative motion between parts is required. Interference or misalignment are cause for rejection.

8.0 TEST REQUIREMENTS

All electrical parts and mechanical parts shall be tested to the purchase order requirements. Failure to meet purchase order requirements shall be cause for rejection.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.003	ISSUE B
SCALE	DO NOT SCALE PRINT	PAGE 9 of 9	

APPENDIX B

RQAM - 8.002

RELIABILITY AND QUALITY ASSURANCE MANUAL

DISCREPANCY REPORT SYSTEM

REVISIONS				
ISSUE	BY & DATE	DESCRIPTION	CHECK	APPROVED & DATE

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY
 8321 GEORGIA AVENUE SILVER SPRING MARYLAND

Reliability and Quality Assurance Manual
 DISCREPANCY REPORT
 SYSTEM

[Signature] 1/11/66
[Signature] 1/11/66
 SINATOR DATE

[Signature] 1/11/65
 DATE

CODE IDENT NO. 88898	SIZE A	RQAM - 8.002	ISSUE A
DO NOT SCALE PRINT		PAGE 1	OF 17

INDEX

1.0	PURPOSE
2.0	SCOPE
3.0	THE DISCREPANCY REPORT (D.R.)
4.0	CRITERIA FOR ISSUING A DISCREPANCY REPORT
5.0	ROUTING OF THE DISCREPANCY REPORT
6.0	ASSOCIATED REPORTS ON MALFUNCTIONS
6.1	Test Analysis Reports (TAR's)
6.2	Corrective Action Reports
6.3	Reliability Long Life (RLL) Memo
6.4	Failure Analysis Reports (FAR's)
6.5	D.R. Listings

CODE IDENT NO. 88898	SIZE A	RQAM - 8.002	ISSUE A
SCALE	DO NOT SCALE PRINT	PAGE 2 of 17	

1.0

PURPOSE

The following procedure provides a means for reporting discrepancies (mechanical or electrical) for the purpose of investigation, analysis, and correction of malfunctions. It provides also the mechanism of part traceability, a means of communicating repair, modification, and tailoring instructions to the shops, and a documentation of ECN and inspection notes.

2.0

SCOPE

The term Discrepancy Reporting is used here to denote reporting a deviation from the routine processing, where routine refers to hardware construction and testing without recycling the hardware back through the system. Thus the discrepancy report is used to document the recycling of hardware through the shop for modification and design changes, malfunction repairs, installation of tailoring components, etc.

3.0

THE DISCREPANCY REPORT (D.R.)

The Discrepancy Report (Figures 1A and 1B) has been designed to document essential information on deviations and malfunctions. It consists of three removable data sheets and a hardback copy. Figure 1A is an illustration of the face of the Discrepancy Report Form and Figure 1B illustrates the reverse side of the hardback copy. The Discrepancy Report can be subdivided into five parts (Figure 1A) described below:

3.1

The first line of the D.R. (Line A) consists of general data pertaining to the discovery of the failure. The data required for coding is available on the back of the D.R. Form (see Fig. 1B). This line is to be completed by the initiator of the discrepancy report.

3.2

Location of Discrepancy - consists of eleven lines for data which locates the major unit assembly (when applicable) and the specific module, submodule, etc. in which the discrepancy was discovered.

This section provides space for recording discrepancy details and giving instructions to the shop. It includes a space for correlating the discrepancy with an engineering change notice (ECN) when applicable. Also included in this section is a space for the initiator to define what he thinks is the cause of the discrepancy. The discrepancy cause codes for this are on the back of the form (Figure 1B). The initiator is required to fill out this section and sign it.

CODE IDENT. NO.	SIZE		
88898	A	RQAM - 8.002	ISSUE A
SCALE	DO NOT SCALE PRINT		PAGE 3 of 17

3.3

Part Data Below to be Completed by Reliability - consists of two lines of data on part code, quantity failed, lot code, part failure code, and description of part failure. (See Figures 5 through 7B) Three additional lines provide cross reference to test analysis reports (TAR's) and space for reliability notations.

3.4

Shop Complete - consists of space for noting disposition of the hardware, addition or removal of parts, part traceability information, and repair and inspection sign-offs. For those programs which have a Material Review Board (MRB) designated, the disposition of discrepancies will be in accordance with MRB requirements, when MRB action is not a requirement this information is completed by the shops and a Reliability Q.C. inspector.

3.5

Designer Sign-off Copy - is a section appearing on the white and hardback copies of the D.R. Its purpose is to provide a space for the designer to sign verifying that appropriate corrective action was taken and the work has been satisfactorily completed. The designer is requested to remove the white copy at this point and return it to Reliability Engineering as an indication that the work involving a particular D.R. has been successfully completed.

3.6

Additional Notes:

3.6.1

This Discrepancy Report Form has been designed to be compatible with the fabrication procedures and techniques used by APL/Space Department. It requires a minimum of time and effort to prepare correctly.

3.6.2

The D.R. includes information for part traceability and instructions to the shop and serves more than for malfunction reporting.

3.6.3

The hardback copy provides a permanent record along with process control cards for a given piece of hardware.

4.0

CRITERIA FOR ISSUING A DISCREPANCY REPORT

Any inspector, designer, tester or other personnel involved with the spacecraft hardware shall issue a Discrepancy Report when any discrepancy occurs after kit inspection and during or subsequent to first level assembly, regardless of the conditions of the test (environmental included) such as:

- a. Welding or soldering discrepancies
- b. Workmanship problems
- c. A catastrophic (short or open) part failure
- d. An out-of-specification part condition (out-of-tolerance)
- e. Modification or design changes
- f. Tailoring component changes
- g. An assembly exhibiting outputs or requiring adjustments not included in the assembly test specification.

The conditions for filing a report are not limited to the above.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.002	A
SCALE	DO NOT SCALE PRINT	PAGE 4 of 17	

5.0

ROUTING OF THE DISCREPANCY REPORT

The D.R. (three copies and original) when initiated and processed by the MRB if required will accompany the unit of hardware back to the shop for modification, repair or rework. The shop will perform this work, filling in the appropriate information. Any parts removed will be kept with the hardware and identified as to its relation to the D.R. (i.e. part type, circuit symbol, module, submodule, etc. as required) so that part traceability is maintained. The reliability Q.C. inspector will inspect the hardware, sign the D.R., remove the top (pink) copy with part or parts and deliver them to the Reliability Engineering Project Office. (As an alternative the Reliability Engineering Project Office representative may collect the D.R. pink slips and parts from the inspector at his station.)

The yellow copy is to be removed for shop records, while the white and hardback copies continue with the hardware.

After the unit has passed its electrical tests the designer or tester shall sign-off the white copy and return it to Reliability. At this time the Material Review Board may generate a close-out report on malfunction repairs if required. The hardback copy is retained with the process control cards.

The pink copy of a D.R. and the removed parts (if parts are involved) are received and logged in by Reliability Engineering. At this point the D.R.'s involving malfunctions are separated from those involving tailor points and inspection problems. The latter are recorded on IBM cards and filed. The former are written up on a test analysis report (TAR) form. (See Section 6.0 - Associated Reports.) The TAR number is referenced on the D.R. and the results of the TAR are fed back to complete the information under Part Data Below to be Completed by Reliability.

This completes the information on the D.R. The coded information is then recorded on IBM cards and the report is filed.

6.0

ASSOCIATED REPORTS ON MALFUNCTIONS

The following reports may be generated by the Reliability Engineering Project and associated with discrepancy reports:

6.1

Test Analysis Reports (TAR's) (Figure 2) - these are forms designed to provide for documentation data on any parts which may be tested. The information recorded on them includes lot numbers, serial numbers, manufacturer's part type, D.R. numbers, instructions for analysis, and a summary of results. At this point designers, testers, and others may request a failed part for correlation testing in their special set-up. They must however sign for the part and TAR and are required to document on the TAR all work they do on the part. This form is used as a data record for the file.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.002	A
SCALE	DO NOT SCALE PRINT	PAGE	5 of 17

6.2

Corrective Action Reports (Figure 3) - this is a simple form that provides a hand written documentation of verbal instruction, comments, etc. These are generally initiated as the result of findings associated with a discrepancy report in which a broad area is not involved.

The report seldom consists of more than the original and two or three copies. The distribution is to the immediate parties concerned (design engineer, shop, reliability) and to file.

6.3

Reliability Long Life (RLL) Memo - this type of memo serves a broad purpose of distributing information affecting reliability throughout the APL/Space Department. It includes but is not limited to information obtained from TAR's and D.R.'s. It is directed to the attention of those in the immediate areas affected and can be prepared and distributed more quickly than a detailed report.

6.4

Failure Analysis Reports (FAR's) - these are more detailed reports. They are, however, intentionally kept brief and to the point so that a minimal time is required for engineers, designers and fabricators to read them. They are given Department-wide distribution so that as many people as possible are made aware of problem areas. Thus, many problems can be avoided before they get to the hardware building stage.

The Failure Analysis Reports are generally published by the Reliability Group and usually pertain to part failures and analysis. These components come mostly from the malfunctions reported on D.R.'s. System or modular component failures and those associated with sub-contracted sub-systems are ordinarily analyzed and documented by the design engineer with assistance provided on request by the Reliability Group. The FAR format is available for their use in writing their report if they desire. In any case Reliability follow through is required to complete information on the D.R.'s.

6.5

D.R. Listings - the coded data on D.R.'s is recorded on IBM cards (See Figure 4). Periodically this information is listed for use in internal housekeeping of records. A sample page of the listing is shown in Figure 5.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.002	A
SCALE	DO NOT SCALE PRINT		PAGE 6 of 17

APL DISCREPANCY REPORT						PLEASE WRITE LEGIBLY AND FIRMLY		
1. DATE 		7. TEST OR INSP. LEVEL 		10. ENV. TEST CONDITION 		14. D.R. NO. 15188		
LOCATION OF DISCREPANCY								
HIGHEN ASSY. DRAWING NO. 				ECN, ASSY. OR BOGA NO. 				
20. MODULE, SUBMODULE OR P.C.B. DWS. NO. 				29. MOD., SUBMOD. OR P.C.B. S/N 				
30. PART NUMBER 				40. CKT SYMBOL 		34. DISC. CAUSE CODE 		
DISCREPANCY DETAILS/NOTES TO SHOP - 								
ECN WRITTEN YES ☐ NO ☐		ECN NO. 		DISC. REPORTED BY 				
PART DATA BELOW TO BE COMPLETED BY RELIABILITY								
PART S/P: 		56. LOT CODE 		61. PART CODE 		65 QTY. FAILED 		
67-10 DIGIT NARRATIVE OF PART FAILURE 					79. PART FAILURE CODE 			
RELIABILITY ANALYSIS OF PART FAILURE (DETAILS) 								
						TARD		
SHOP COMPLETE								
WHAT IS TO BE DONE TO CORRECT DISCREPANCY (CHECK)								
REPLACE ☐		REPAIR ☐		MODIFY ☐		NON-REPAIRABLE ☐		
PARTS WERE ADDED ☐ REMOVED ☐			PARTS ADDED					
REPAIRED BY DATE			CKT SYMBOL		LOT#		S/N	
INSPECTED BY DATE								
INSPECTED BY DATE								
SOR COPY								
RETURN TO SOR WITH DISC. PARTS								
SHOP COPY								
KEEP FOR SHOP RECORDS								
DESIGNER SIGN-OFF COPY								
TESTED/APPROVED DATE					RETURN TO SOR AFTER DESIGNER SIGN-OFF			
HARDWARE COPY								
TESTED/APPROVED DATE					ATTACH TO HARDWARE			

Figure 1A

7. TEST OR INSPECTION LEVEL	
Level	Code
COMPONENT TESTING	00
KIT LEVEL	10
Part Withdrawn From Stock	1A
Kit Make-Up Process	1B
While Building Kit (Includes Soldering, Welding, Etc.)	1C
SUBMODULE LEVEL	20
Inspection After Welding/Soldering	2A
Pre Pot Electrical Test	2B
Shop Rework/Inspection	2C
Potting Process	2D
Post Potting & Environmental Testing	2E
MODULE LEVEL	30
Assembly of Submodules	3A
Inspection After Welding/Soldering	3B
Prepot Electrical Tests	3C
Shop Rework/Inspection	3D
Potting Process	3E
Post Potting & Environmental Testing	3F
BOOK/SUBSYSTEM LEVEL	40
Bookbase Assembly/Inspection	4A
Module Assembly to Book/Sub-Assembly	4B
Book/Sub-System Inspection/Test	4C
Potting Process	4D
Post Potting & Environmental Testing	4E
SYSTEM LEVEL	50
Assembly/Inspection	5A
Electrical Test (Lids Off)	5B
Environmental Test (Lids On)	5C
FIELD LEVEL	60

10. ENVIRONMENTAL TEST CONDITION	
Condition	Code
AMBIENT	A
ACCELERATION	B
HIGH TEMP	C
HUMIDITY	D
LOW TEMP	E
NOISE	F
SHOCK	G
TEMP. CYCLING	H
THERMAL SHOCK	I
VACUUM	J
VIBRATION	K
RADIATION	L
* MISCELLANEOUS	M
* EXPLAIN UNDER DETAILS	

34. DISCREPANCY CAUSE CODE	
Cause	Code
ASSEMBLY ERROR	1
ASSOCIATED FAILURE	2
HANDLING	3
MECHANICAL DISCREPANCY	4
PART DISCREPANCY	5
TEST ERROR	6
DRAWING ERROR	7
DESIGN CHANGE	8
* CAUSE UNKNOWN	9
TROUBLESHOOTING	A
CONNECTING SUB-ASSEMBLIES	B
TAILORING PROCESS	T
* EXPLAIN UNDER DETAILS	

Figure 1B

SATELLITE RELIABILITY TEST ANALYSIS REPORT

REPORT NO.

DATE

DATE	(IF APPLICABLE) DISCREPANCY REPORT NO. _____	LOT NO. _____ S/N	QTY	PART NO. _____ MFG
------	--	-------------------------	-----	--------------------------

DESCRIPTION OF TEST TO BE PERFORMED:	
	ROUTINE ELECTRICAL TEST ☐
	BISECT SPECIMEN ☐
	DISASSEMBLE SPECIMEN ☐
	VISUAL INSPECTION ☐
	PHOTOGRAPH ☐
	LEAK TEST ☐
	X-RAY ☐

TESTED FOR GROUP _____	TESTED BY NAME _____	QCII	MEETS ☐	DOES NOT MEET ☐
NAME _____	EXT. _____	MFG.SPECS.	☐	
EXT. _____	DATE COMP. _____	QCII NOT APPLICABLE		☐
BUDGET _____				

[illegible]

Figure 2

CORRECTIVE ACTION FORM

CORRECTIVE ACTION TAKEN ☐

DATE

CORRECTIVE ACTION REQUESTED ☐

INITIATED BY

DISCREPANCY REPORT NO.
(WHEN APPLICABLE)

Prepared By

Figure 3

DISCREPANCY REPORT LISTING

BASD ON PINK SLIPS RECEIVED
JUNE 1, 1967

INFORMATION COMPLETE

DATE	TL	ENV	D.R.	SYS	ASSY	MCD	D	PART NUMBER	CKT	LCT	PRT	Q	DESCRIPTION	FL
IL	CON	NO.	CD.	CODE	ASSY	C			SYMBOL	CODE	CD.	F	OF FAILURE	CD
12214	2B	A	CO12	211	6200	6220	3	NA	NA	NA	OCC	0	HANCLING	A
03195	5A	A	CO14	212	3651	1030	5	CD3016-1	R6	C440	RCD	0	NAP TAILOR	71
03195	5A	A	CO21	212	3651	1030	5	CD3016-1	R6	C440	CCC	0	NAP TAILOR	71
03195	5A	A	CO22	212	3651	1030	5	CD3016-1	R9	366B	RCD	0	NAP TAILOR	71
03195	4B	A	CO23	211	4540	102	5	CMR01C180J1T	C415	2310	CCC	1	NAF WRNGVAL	5
04025	4B	A	CO27	210	4540	103	T	CD3005-2	C415	NAV	CAO	0	NAP TAILOR	54
11204	5A	A	CO30	212	3551	368	5	NAV	Q6	NAV	GTO	1	LL BETA	C
11134	5A	A	CO31	212	3550	NAV	T	CD3005-1	C21	NAV	CAO	0	TAILORING	71
11124	5A	A	CO32	212	3550	1030	5	V1V-0	L3	NAV	ICD	0	WRONG PART	5
12175	4A	A	CO35	211	4510	104	1	NA	R103	NA	RFU	0	NAP REWORK	5
02175	4A	A	CO36	211	4510	NAP	1	NAP	NAP	NAP	CLL	0	WIRE ERROR	55
12185	4B	A	CO37	211	4500	104	5	CD5225-16	W304	8520	QTC	1	ELE FAIL	CB
12304	2A	E	CO40	211	3700	102A	5	2N2905A	Q2	C99C	QTC	1	EXCESS IE	8
11184	5A	A	CO41	212	3551	368	5	CD3005-2	C27-M	NAP	CTG	0	NAP TAILOR	54
01145	5A	A	CO42	212	3601	1020	5	CD3005-3	C29	NAV	CAO	0	NAP MODIFY	54
11205	5A	A	CO46	212	3601	366	5	CD3022-22	R9	NAV	RCD	1	OUT OF RANG	E
11194	5A	A	CO47	212	3551	368	1	CD3005-2	C27--M	NAV	CAO	0	NAP TAILOR	54
12044	5A	A	CO48	212	3600	----	5	2N3118	Q4	5010	QTC	1	TS REPLACE	A
11174	5A	A	CO49	212	3551	368	5	CD3005-2	C25-M	NAP	CTC	0	NAP TAILOR	54
03155	5A	A	CO52	212	3651	1030	3	PC-115	C25	3000	WVO	1	CRACKED CIG	G
03175	10	C	CO53	210	7210	101A	2	NA	NA	NA	NA	0	NAP REWORK	6
03175	10	A	CO54A	210	4631	101A	2	CD5310-14	Z123	1840	QIG	1	ASSY ERROR	GL
03175	10	A	CO54B	210	4631	101A	8	CD3016-1	NAV	NA	OCC	0	NAP ECN	44
03175	10	C	CO55	210	4661	101A	5	CD3016-1	R106	530B	GTO	1	FACTORY QC	1M
01065	2A	A	CO56	210	8000	104	5	NAV	NAV	NA	ICC	1	ASY ER RECD	55
03175	2A	A	CO59	205	7380	NAV	9	NAV	T8	NAV	ZCO	1	OPEN WINDING	B
05125	4C	A	CO75	210	6208	101	1	NONE	NONE	NONE	OCC	0	WIRE MISSING	55
07135	2A	A	CO76	211	6260	104	1	NONE	NONE	NONE	OCC	1	WRONG PIN	P
03195	2B	A	CO77B	210	4433	101	1	SN518	Z1	NAV	GIC	1	WIRED WRONG	A
03195	4B	A	CO78	211	4500	104	8	CD3012-3	L101	NAV	ICC	0	NAP ECN	54
03195	4B	A	CO79	211	4510	104	8	CD3005-2	C102	NAV	CAO	0	NAP ECN	54
03195	4B	A	CO80	211	4510	104	8	CD3005-2	C104	NAV	CAO	0	NAP ECN	54
03195	4B	A	CO81	211	4510	104	8	1N3070	NAV	NAV	CUC	0	NAP CEZCHNG	44
03195	4B	A	CO90	211	4510	104	8	CD3005-2	C105	NAV	CAO	0	NAP ECN	54
03315	1A	A	CO91A	211	4761	102		CD3016-1	R-16-M	530B	RCC	0	NAP ECN	44
03315	1A	A	CO91B	211	4761	102	8	CD3016-1	R-20-M	6030	RCD	0	NAP ECN	44
03315	1A	A	CO91C	211	4761	102	8	CD3016-1	R-17-M	3450	RCD	0	NAP ECN	44
01045	2A	A	CO92A	211	5330	1020		CD3016-1	NAV	8810	RCC	2	NAP ECN	44
01045	2A	A	CO92B	211	5330	1020	T	CD3004	NAV	6080	CCU	1	NO FAILURE	2
04055	2A	A	CO93A	211	5330	1028	8	CD3016-1	NAV	5090	RCD	1	NAP ECN	44
04055	2A	A	CO93B	211	5330	1028		CD3004	NAV	1370	CCC	1	NAP ECN	54
04055	2A	A	CO94	211	4761	102	7	NAP	NAP	NAP	UCU	0	WRNG LAYOUT	52
04065	5A	A1	CO95	205	4801	111	1	NAP	NAP	NAP	OCO	0	ASSY ERROR	55
04075	5A	2A	CO96	211	7814	103	1	NA	NA	NA	OCC	0	ASSY PRGB	55
04075	5A	A	CO97	211	7814	102	1	NA	NA	NA	OCC	0	ASSY PRGB	55
04095	2A	A	CO98	210	4471	101	A	NAP	NAP	NAP	OCO	0	TEST POINT	5
04075	26	A	CO99	210	8120	101	7	NONE	NONE	NONE	OCO	0	POT CHECK	2
04025	5A	A	U100	212	3651	1030	T	CD3016-1	R9	370B	RCC	0	NAP TAILOR	71
13004	4A	A	C101	205	3500	107	5	CD5005-05	CR3	NAV	QDO	1	HANCLING	GM

Figure 5

DISCREPANCY REPORT PART CODE BREAK DOWN
DR BLOCK/IBM COLUMN NO. 61

ADO ANTENNAS
 AAO ANTENNAS ACCESSORIES

 BOO BATTERIES
 BLO BATTERIES LEAD ACID
 BL1 BATTERIES LEAD ACID 0'5 V
 BL2 BATTERIES LEAD ACID GREATER THAN 5'10 V
 BL4 BATTERIES LEAD ACID GREATER THAN
 BL3 BATTERIES LEAD ACID GREATER THAN 10'20 V
 BL4 BATTERIES LEAD ACID GREATER THAN 20'36 V
 BL5 BATTERIES LEAD ACID GREATER THAN 36'50 V
 BL6 BATTERIES LEAD ACID GREATER THAN 50'75 V
 BL7 BATTERIES LEAD ACID GREATER THAN 75'100 V
 BL8 BATTERIES LEAD ACID GREATER THAN 100'200 V
 BL9 BATTERIES LEAD ACID GREATER THAN 200 V
 BNO BATTERIES NICLE'CADIMUM
 BSO BATTERIES SILVER'ZINK

 COO CAPACITORS
 CAO CAPACITORS AIR DIELECTRIC
 CCO CAPACITORS CERAMIC DIELECTRIC
 CCA CAPACITORS CERAMIC DIELECTRIC ACCESSORIES
 CCB CAPACITORS CERAMIC DIELECTRIC FEED THRU
 CCF CAPACITORS CERAMIC DIELECTRIC FIXED
 CCL CAPACITORS CERAMIC DIELECTRIC LAYER
 CCN CAPACITORS CERAMIC DIELECTRIC NON'INDUCTIVE
 CCS CAPACITORS CERAMIC DIELECTRIC HERMETICALLY SEALED
 CCT CAPACITORS CERAMIC DIELECTRIC TRIMMER
 CCV CAPACITORS CERAMIC DIELECTRIC VARIABLE
 CCW CAPACITORS CERAMIC DIELECTRIC COIL WRAPPED
 CEO CAPACITORS ELECTROLYTIC
 CFO CAPACITORS METAL FILM
 CHO CAPACITORS HARDWARE
 CMO CAPACITORS MYLAR
 CPO CAPACITORS POLYSTYRENE
 CTO CAPACITORS TANALYTIC

 DCO CONNECTORS, COAXIAL
 DOO CONNECTORS, TERMINALS

 EOO ELECTRONIC TUBES
 EHS ELECTRONIC TUBES HARDWARE SHIELDS

 FOO SERVOMECHANISMS DEVICES

 GOO END INSTRUMENTS
 GAO END INSTRUMENTS ACCELEROMETERS
 GGO END INSTRUMENTS GYRO3

 HOO HARDWARE

 IOO INDUCTORS
 ICO INDUCTORS CHOKES
 ICA INDUCTORS CHOKES ASSY
 ICF INDUCTORS CHOKES FORMS

Figure 6A

ICT INDUCTORS CHOKES TOROIDAL
 ICV INDUCTORS CHOKES VARIABLE
 IMO INDUCTORS MAGNETIC AMPLIFIERS
 ITO INDUCTORS TRANSFORMERS

 JOO INSULATORS

 KOO RELAYS, SOLENOIDS (REEDS, THERMAL INC.)
 KML RELAYS, MAGNETIC LATCHING
 KTM RELAY, THERMAL MERCURY

 LOO LAMPS (PILOT, ETC.)

 MOO MOTORS, ROTATING COMPONENTS

 NOO METERS AND DEVICES

 OOO NO COMMENT

 POO PRINTED CIRCUIT BOARDS

 QOO SEMICONDUCTORS
 QAO SEMICONDUCTORS ACCESSORIES AND HARDWARE
 QDO SEMICONDUCTORS DIODES
 QDS SEMICONDUCTORS DIODES SILICON SWITCHING
 QDT SEMICONDUCTORS DIODES SILICON TUNNEL
 QDZ SEMICONDUCTORS DIODES SILICON ZENER
 QER SEMICONDUCTORS DIODES GERMANIUM RECTIFIERS
 QFO SEMICONDUCTORS F E T SILICON
 QGO SEMICONDUCTORS S C R
 QIO SEMICONDUCTORS INTEGRATED CIRCUITS
 QJO SEMICONDUCTORS INTEGRATED CIRCUITS
 QKO SEMICONDUCTORS INTEGRATED CIRCUITS
 QLO SEMICONDUCTORS LIGHT SENSITIVE CELLS SILICON
 QMO SEMICONDUCTORS LIGHT SENSITIVE CELLS CADMIUM
 QNO SEMICONDUCTORS LIGHT SENSITIVE CELLS OTHER
 QTF SEMICONDUCTORS TRANSISTOR, SILICON FIELD EFFECT
 QTO SEMICONDUCTORS TRANSISTOR SILICON
 QTS SEMICONDUCTORS TRANSISTOR SILICON SWITCHING
 QUO SEMICONDUCTORS TRANSISTOR GERMANIUM
 QVO SEMICONDUCTORS VARACTOR
 QWO SEMI CONDUCTORS THYRECTOR

 ROO RESISTORS
 RCO RESISTORS CARBON
 RFF RESISTORS FILM, CARBON FIXED
 RFO RESISTORS FILM, CARBON
 RMO RESISTORS FILM, METAL
 RMA RESISTORS FILM, METAL ACCESSORIES
 RMF RESISTORS FILM, METAL FIXED
 RMN RESISTORS FILM, METAL NON INDUCTIVE
 RMP RESISTORS FILM, METAL POWER
 RMS RESISTORS FILM, METAL HERMETICALLY SEALED
 RMT RESISTORS FILM, METAL TRIMMER
 RMV RESISTORS FILM, METAL VARIABLE
 RPO RESISTORS POWER
 RRO RESISTORS RIBBON WOUND
 RWO RESISTORS WIRE WOUND

 SOO SWITCHES
 SMB SWITCHES MINATURE SPOT

Figure 6 B

TOO TIMER, DEVICES

UOO FILTERS

VOO VIBRATION DEVICES

WOO WIRE, CABLES

XOO CRYSTALS

YOO FRAMES, MOLDS, JIGS, ETC.

ZOO SPECIAL ITEMS REQUIRING A DESCRIPTION OF THE ITEM

END OF RUN

Figure 6C

DISCREPANCY REPORT PART FAILURE CODE
DR BLOCK/IBM COLUMN NO. 79

AL BUSH
EX 2469

- 1 FAILURE NOT DETERMINED
- 2 NO EVIDENCE OF FAILURE
- 21 NO EVIDENCE OF FAILURE ELECTRICAL
- 22 NO EVIDENCE OF FAILURE MECHANICAL
- 3 NOT A PART FAILURE NO COMMENT
- 4 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING
- 41 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING NO PART INVOLVED
- 42 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING ARTWORK ERROR
- 43 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING SCHEMATIC ERROR
- 44 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING ENGR MODIFICATIONS
- 45 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING ASSEMBLY ERROR
- 46 CORRECTIVE REWORK NOT A PART FAILURE ECN PENDING PART INSERTED WRONG
- 5 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED
- 51 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED NO PART INVOLVED
- 52 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED ARTWORK ERROR
- 53 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED SCHEMATIC ERROR
- 54 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED ENGR MODIFICATIONS
- 55 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED ASSEMBLY ERROR
- 56 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED PART INSERTED WRONG
- 57 CORRECTIVE REWORK NOT A PART FAILURE ECN NOT MENTIONED PART TEST ERROR
- 6 REWORK ASSOCIATED WITH TROUBLE SHOOTING
- 61 REWORK ASSOCIATED WITH TROUBLE SHOOTING TEST POINTS CONNECTED OR REMOVED
- 7 REWORK ASSOCIATED WITH MODIFICATION OF UNIT
- 71 REWORK ASSOCIATED WITH MODIFICATION OF UNIT TAILORING COMPONENTS INSTALLED
- 72 REWORK ASSOCIATED WITH MODIFICATION OF UNIT CONNECTING SUB-ASSEMBLIES
- 73 REWORK ASSOCIATED WITH MODIFICATION OF UNIT PUT IN MORE RELIABLE PART
- A ELECT FAIL/SHORT
- AT ELECT FAIL/SHORT TEST ERROR
- B ELECT FAIL/OPEN
- C ELECT FAIL/LARGE SHIFT CHAR
- CB ELECT FAIL/LARGE SHIFT CHAR BETA HIGH
- CD ELECT FAIL/LARGE SHIFT CHAR BETA LOW
- CR ELECT FAIL/LARGE SHIFT CHAR RADIATION CAUSED
- CT ELECT FAIL/LARGE SHIFT CHAR TEMPERATURE SENSITIVE
- CV ELECT FAIL/LARGE SHIFT CHAR BVCB LOW
- D ELECT FAIL/SMALL SHIFT CHAR
- E ELECT FAIL/MISCEL
- F MECH FAIL/DENTED OR BENT PART
- FC MECH FAIL/DENTED OR BENT PART CASE
- FH MECH FAIL/DENTED OR BENT PART HANDLING
- G MECH FAIL/BROKEN PART
- GH MECH FAIL/BROKEN PART HANDLING
- GL MECH FAIL/BROKEN PART LEAD
- H MECH FAIL/POOR JOINING OF PARTS

Figure 7A

HW MECH FAIL/POOR JOINING OF PARTS WELDING BAD
 HD MECH FAIL/POOR JOINING OF PARTS WRONG DIMENSIONS
 HS MECH FAIL/POOR JOINING OF PARTS SURFACE TREATMENT PROBLEM
 HV MECH FAIL/POOR JOINING OF PARTS SOLDERING BAD

 I PART PROCESSING PROBLEM
 IH PART PROCESSING PROBLEM - POOR JOINING OF PARTS
 IM PART PROCESSING PROBLEM - ASSEMBLY ERROR
 IP PART PROCESSING PROBLEM-POOR PLATING

 L ELECT FAIL/SHORT-MECH FAIL/DENTED OR BENT PART
 LH ELECT FAIL/SHORT-MECH FAIL/DENTED OR BENT PART HANDLING PROBLEM
 LP ELECT FAIL/SHORT-MECH FAIL/DENTED OR BENT PART TOTTING PROBLEM
 M ELECT FAIL/OPEN-MECH FAIL/DENTED OR BENT PART
 N ELECT FAIL/LARGE SHIFT CHAR-MECH FAIL/DENTED OR BENT PART
 O ELECT FAIL/SMALL SHIFT CHARMECH FAIL/DENTED OR BENT PART
 P ELECT FAIL/MISCEL-MECH FAIL/DENTED OR BENT PART

 Q ELECT FAIL/SHORT-MECH/BROKEN PART
 R ELECT FAIL/OPEN-MECH/BROKEN PART
 RL ELECT FAIL/OPEN-MECH/BROKEN PART LEAD
 S ELECT FAIL/LARGE SHIFT CHAR-MECH/BROKEN PART
 T ELECT FAIL/SMALL SHIFT CHAR-MECH/BROKEN PART
 U ELECT FAIL/MISCEL-MECH/BROKEN PART

 V ELECT FAIL/SHORT-MECH/POOR JOINING OF PARTS
 VM ELECT FAIL/SHORT - MECH
 W ELECT FAIL/OPEN-MECH/POOR JOINING OF PARTS
 X ELECT FAIL/SMALL SHIFT CHAR-MECH/POOR JOINING OF PARTS
 Y ELECT FAIL/LARGE SHIFT CHAR-MECH/POOR JOINING OF PARTS
 Z ELECT FAIL/MISCEL-MECH/POOR JOINING OF PARTS
 END OF RUN

Figure 7B

APPENDIX C

RQAM - 8.004

RELIABILITY AND QUALITY ASSURANCE MANUAL

INSPECTION PROCEDURES

FOR

WELDED ELECTRONIC MODULES

REVISIONS				
ISS.	BY & DATE	DESCRIPTION	CHECK	APPROVED & DATE

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY
 8621 GEORGIA AVENUE SILVER SPRING MARYLAND

Reliability and Quality Assurance Manual
 INSPECTION PROCEDURES
 FOR
 WELDED ELECTRONIC MODULES

John F. Adams for 4/27/68
ORIGINATOR
in Wamagh 4/23/68

RELIABILITY	DATE	CODE IDENT NO	SIZE		ISSUE
<i>R.W. Cole</i>	<i>7/28/68</i>	88898	A	RQAM - 8.004	A
		DO NOT SCALE PRINT		PAGE 1	OF 13

TABLE OF CONTENTS

1.0	PURPOSE
2.0	SCOPE
3.0	RESPONSIBILITY
4.0	INSPECTION
4.1	General Procedures, Definitions and Instructions
4.2	Matrix Welds
4.2.1	Visual Inspection No. 1
4.2.2	Short Check, Inspection No. 2
4.2.3	Visual and Mark, Inspection No. 3
4.2.4	Rework Inspection
4.3	Flagged Components, Headers, Connectors, etc.
4.3.1	Pre-Installation Inspection
4.3.2	Circuit Check, Inspection No. 1
4.3.3	Visual and Clip, Inspection No. 2
4.3.4	Visual and Mark, Inspection No. 3
4.4	Component Inspection
4.4.1	Transistors
4.4.2	Other Components
4.5	Component Leads to Matrix Welds
4.5.1	Visual and Clip, Inspection No. 1
4.5.2	Visual and Mark, Inspection No. 2
4.5.3	Components and Component Centering, Inspection No. 3
4.6	Header Flags to Matrix Wires
4.6.1	Visual and Circuit, Inspection No. 1
4.6.2	Visual and Mark, Inspection No. 2
4.7	Pre-Encapsulation Component and Weld Inspection
4.7.1	Inspection No. 1
4.7.2	Inspection No. 2
4.7.3	Assembly for Encapsulation
4.8	Book Base Mold with Matrix and Header Welded
4.8.1	Inspection No. 1, Mechanical
4.8.2	Inspection No. 2, Visual
4.8.3	Inspection No. 3, Visual and Mark
4.8.4	Inspection No. 4, Circuit Short Check
4.9	Integrated Circuits - After Welding into a Support Structure
4.9.1	Inspection No. 1
4.9.2	Inspection No. 2
4.9.3	Inspection No. 3

CODE IDENT NO. 88898	SIZE A	RQAM - 8.004		ISSUE A
SCALE		DO NOT SCALE PRINT		PAGE 2 of 13

1.0 PURPOSE

This procedure establishes the methods to be used and the accept/reject criteria to be applied by the Reliability Group during the inspection of all welded electronic components destined for flight use to assure the consistently high quality workmanship required of spacecraft hardware.

2.0 SCOPE

The procedure described herein covers the inspection of all welded electronic components used in spacecraft fabricated by APL.

3.0 RESPONSIBILITY

It is the responsibility of the APL Reliability Group, within the Space Department, to perform these inspections using thoroughly trained personnel to make the accept/reject decisions.

4.0 INSPECTION

4.1 General Procedures, Definitions and Instructions

4.1.1 A minimum of two inspectors are required. The following two procedures are never performed by the same inspector:

1. Visual and clip
2. Visual and mark

4.1.2 Every welded unit received for inspection will be accompanied by two specimens of each type of weld in the unit. (Weld specimens, referred to as the Weld Standards for the unit, made with the proper materials and the welder set to the proper current and time settings, are prepared in advance for every type weld to be inspected.)

4.1.3 Definitions:

Visual - to visually inspect each weld for its physical characteristics such as:

compression (deformation)
extrusion of metal around weld area
discoloration
distortion
angle between welded wires (should be 90°)

Clip - to clip flush with the wiring matrix the 1/16" excess component lead left by the weld operator. (Clipping is used to indicate which welds have been inspected.)

CODE IDENT NO. 88898	SIZE A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT	PAGE	3 of 13

4.1.3(Cont'd)

Mark - to mark or paint each weld with an ultra-violet ink as it is inspected. (Periodically and as the final step in the inspection, the unit will be placed under an ultra-violet light to locate welds that have been missed. Marked welds will fluoresce.)

4.1.4

Visual component inspection is performed to detect any physical damage to, or irregularity of, the component body, leads, lead material, or positioning of the component in the package.

4.1.5

All basic inspecting is performed with a binocular microscope set to a magnification of 12X to 15X. Questionable welds or components are re-inspected with the magnification set to 30X.

4.1.6

Corrective measures that can be performed by the inspector without leaving the inspection station should be performed.

4.1.7

All work is to be returned to the fabrication area via the fabrication supervisor. The only time an inspector may go directly to the technician responsible for the fabrication of a particular unit, is when the supervisor has given the inspector special permission in that instance. Blanket approval of this type will not be given.

4.1.8

The welding supervisor is to be informed of any negligence in fabrication so that corrective action may be taken.

4.2

Matrix Welds

4.2.1

Visual Inspection No. 1

1. Using a 12X to 15X microscope visually inspect every weld. Using a pair of tweezers, physically tug on every weld that has a questionable amount of compression and melting. If in doubt compare welds with the Weld Standard specimens that came with the unit.
2. Any weld in the matrix that does not have the same physical characteristics as the Weld Standard specimen should be measured for deformation. If the weld measures within the specified parameters of the approved weld schedule, it is acceptable; if it does not measure within the specified parameters it is a questionable weld.
3. Mark questionable welds with a red pencil on the matrix film next to the weld, and return to fabrication for rework.
4. If the wire cutting mistakes are few the inspector may cut them out; otherwise return to fabrication for rework.
5. Note the work performed, initial and date on the Process Control card. Give the assembly to next inspector, para. 4.2.2.

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT		PAGE 4 of 13

4.2.2 Short Check, Inspection No. 2

1. Short check each matrix using the correct short check film and an ohmmeter set at RX 100K.
2. Simple errors may be corrected by the inspector, otherwise return to fabrication for rework.
3. Note the work performed, initial and date the Process Control card. Give the assembly to the next inspector, para. 4.2.3.

4.2.3 Visual and Mark, Inspection No. 3

1. Using a 12X to 15X microscope, visually inspect and mark every weld in matrix with ultraviolet dye.
2. Observe the matrix under an ultraviolet lamp to check for welds not inspected. Inspect and mark any welds that were previously missed.
3. Note the work performed, initial, and date on the Process Control card.
4. The matrix inspection is now completed; matrix should be filed until needed by module assembly section.

4.2.4 Rework will be inspected by repeating steps in paragraphs 4.2.1 through 4.2.3.

4.3 Flagged Components, Headers, Connectors, etc.

4.3.1 All flagged components, headers, connectors, etc. will have their pins, leads and welds inspected before they are installed into or connected to a module.

4.3.2 Circuit Check, Inspection No. 1

1. Check the unit against the assembly drawing for proper flagging.
2. Note the work performed, initial, and date the Process Control card. Send to the next inspector, para. 4.3.3.

4.3.3 Visual and Clip, Inspection No. 2

1. Each weld will be visually examined under a 12X to 15X microscope and the flags clipped flush with the weld as it is inspected. Inspect first, then clip. Inspect only one weld at a time.
2. Return to fabrication for cutout and repair of any questionable welds.
3. Note the work performed, initial and date the Process Control card. Send to the next inspection, para. 4.3.4.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.004	A
SCALE	DO NOT SCALE PRINT	PAGE	5 of 13

4.3.4 Visual and Mark, Inspection No. 3

1. Visually inspect each weld under a 12X to 15X microscope and mark each weld with an ultraviolet dye.
2. Observe the component, connectors, headers, etc. under the ultraviolet light and check for missed welds. Repeat step 1 for any weld that has not been previously inspected and marked.
3. Return to fabrication for cutout and repair of any questionable welds.
4. Note the work performed, initial and date the Process Control card. File the component, connectors, headers, etc. until required for module.

4.4 Component Inspection

4.4.1 Transistors, Relays, and Transformers

1. Transistors are installed in the top and bottom of the film before all other components and inspected first. The inspection covers the type, position, installation and physical condition.
2. Start the inspection in an area where the component position numbers are the lowest. As each component is inspected, check it off on the parts list.
3. Verify that the tab on each transistor lines up with the tab outline on the film and that the leads are not criss-crossed under the film.
4. Verify that all transistors in a TO-18 package are wrapped in teflon tape and have a transi-pad installed on each.
5. Do not push the transistor all the way down to the positioning film following inspection. This will aid in keeping track of the transistors inspected.
6. On completion of inspection, note the work performed, initial and date the process control card.
7. Return module to assembly to have the remaining components installed.

4.4.2 Other Components

1. Starting in the area where the component positioning numbers are the lowest, check only one type of component at a time checking this same type thru the entire module.
2. Inspect each component for possible physical damage of any kind.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT	PAGE 6	of 13

4.4.2(Cont'd)

3. Lift the component up high enough to read the Position number, Value and Tolerance.
4. In the case of diodes and tantalytic capacitor also check the polarity (+, A or M, -) of the installation.
5. Check off each component on the parts list as you inspect it, and do not push the component all the way down to the positioning film. This will aid in determining which components have yet to be inspected.
6. On completion of inspection note work performed, initial and date the Process Control card.
7. Return module to assembly to have top positioning and matrix film installed.

4.5 Component Leads to Matrix Welds

4.5.1 Visual and Clip, Inspection No. 1

1. Visually inspect each weld under a 12X to 15X microscope. Clip the excess component lead flush with the top of the interconnecting wire, as each weld is inspected. Do not clip the feed-thru or component lead that connects this level matrix with the next level matrix, as indicated with a triangle (Δ) on the film.
2. Return to fabrication for repair or replacement of any questionable welds or components.
3. Note the work performed, initial and date on the Process Control card. Give the assembly to the next inspector, para. 4.5.2.

4.5.2 Visual and Mark, Inspection No. 2

1. Using a 12X to 15X microscope, visually inspect and mark each weld with an ultraviolet dye.
2. Observe the module under an ultraviolet lamp. The welds that have been inspected and marked with an ultraviolet dye will fluoresce. Repeat Step 1 for any weld that does not fluoresce.
3. Return to fabrication for repair or replacement of any questionable welds or components.
4. All rework, modifications, repairs, or changing of components, etc. will require a complete inspection of that work incorporating all inspection steps.
5. The weld inspection steps will be repeated for each level of matrix.
6. Note the work performed, initial, and date Process Control cards.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.004	A
SCALE	DO NOT SCALE PRINT	PAGE	7 of 13

4.5.3

Components and Component Centering, Inspection No. 3

1. Inspect all components to see that they are centered between the top and the bottom matrix. If not centered, return to fabrication for corrective measures. All component leads and feed-thru wires must be straight. Bent leads and wires may be straightened by the inspector.
2. Transistors and all components must "stand off" from positioning film 1/32", when possible, to allow the potting compound to completely encapsulate the transistor. Check all transistor leads to see that they have not been crossed and that they are in proper holes in positioning film (see para. 4.4).
3. Inspect all diodes for cracks in the glass body of the diode, using a 15X microscope. Check all diodes to see that they are installed with the cathode connected to the proper matrix as indicated on the film by this symbol ().
4. Check all tantalytic capacitors to see that they are installed with proper polarity as indicated on the film. Positive to positive (+), negative to negative (-).
5. Check the assembly and/or layout drawings to verify that the variable capacitors, trimpots, heat sinks and thermistors are positioned as specified on the drawing.
6. Modules containing errors must be returned to fabrication for correction and the repairs must be re-inspected.
7. Note the work performed, initial and date on the Process Control card. After the last level of matrix has been installed and welded send module to assembly for header installation.

4.6

Header Flags to Matrix Wires

4.6.1

Visual and Circuit Inspection No. 1

1. Using a header and module assembly drawing, check that the header and module are properly connected.
2. Using a 12X to 15X microscope, inspect each weld. Clip the excess wire as each weld is inspected.
3. Return to fabrication for cutout and repair of questionable welds.
4. Note the work performed, initial and date the Process Control card. Send to next inspection, para. 4.6.2.

4.6.2

Visual and Mark Inspection No. 2

1. Using a 12X to 15X microscope, visually inspect and mark each weld with an ultraviolet dye.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.004	A
SCALE	DO NOT SCALE PRINT		PAGE 8 of 13

4.6.2(Cont'd)

2. Place the module under the ultraviolet lamp and check for missed welds. Repeat Step 1 for any weld that has not been previously inspected and marked.
3. Return to fabrication for cutout and repair of questionable welds.
4. Note the work performed, initial and date the Process Control card. Send to next inspection, para. 4.6.3.

4.6.3

Module Pre-Electrical Mechanical Inspection

1. After the header has been welded to the module, check the wiring of the header to the module leads against the assembly drawing for correct connections.
2. Check the leads for insulation where needed.
3. Put the label identifying the module with its assembly and serial number on the module header.
4. Note the work performed, initial and date the Process Control card.
5. Send module parts list, weld specimens and component envelopes to the Reliability Group for processing.
6. Send the module with its process control cards and RCN drawing to electrical test.

4.7

Pre-Encapsulation Component and Weld Inspection

4.7.1

Inspection No. 1

1. With a 12X to 15X microscope, inspect all components visible along the side of the package to verify that they have not been damaged in handling. Look for damage such as bent leads and cracked diodes.
2. Check header flags for bent wires and shorts.
3. Visually inspect with a 15X microscope and physically touch each weld on the package that can be seen or reached without physically deforming or applying pressure to the module matrix or its components.
4. Note the work performed, initial and date the Process Control card. Send to the next inspection, para. 4.7.2.

4.7.2

Inspection No. 2

1. With a 15X microscope, inspect all components visible along the side of the package to verify that they have not been damaged in handling. Look for damage such as bent leads and cracked diodes.

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT		PAGE 9 of 13

4.7.2(Cont'd)

2. With a 15X microscope, check header flags and the matrix wires that connect to the header flags. Look for bent wires and shorts.
3. Visually inspect with a 15X microscope and physically touch each weld of the package that can be seen or reached without physically deforming or applying pressure to the module or any of its components.
4. Note the work performed, initial and date the Process Control card. Send to the next inspection, para. 4.7.3.

4.7.3 Assembly for Encapsulation

1. Assemble the mold.
2. Fit the module into the mold.
3. Note the work performed, initial and date the process Control card.
4. Send the module in the mold to the Encapsulation Laboratory.

4.8 Book Base Mold with Matrix and Header Welded

(Note: Prior to Inspection No. 1 each level of the header should be welded and inspected per para. 4.3.)

4.8.1 Inspection No. 1, Mechanical

1. Verify that all book base wire wrap pins are pushed down into the rubber mold until they bottom. The nickel matrix wire that is welded to the pin should be at least .010" above the rubber mold at the pin, to allow for the flow of epoxy around the weld.
2. Verify that the header mold bottoms, and is centered in the holding plate. The header pin, wire wrap end, must extend beyond the mold $\frac{3}{8}$ of an inch.
3. Verify that the header flags and the matrix wire that is welded to the flags clear the edge of the rubber mold by at least .010". The first level of matrix wires are not insulated, all other levels must be insulated with teflon tubing from the last hole on the matrix to the header flag.
4. Visually check the header flags, and matrix wire that is welded to the flags, for shorts and potential shorts. Start the inspection at the No. 1 header pin and check every flag and its matrix wire one by one.

CODE IDENT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.004	A
SCALE	DO NOT SCALE PRINT	PAGE	10 of 13

4.8.1 (Cont'd)

5. Using an Xacto knife with a No. 11 blade, cut out the excess mylar film, being careful not to expose wires that could cause shorts. In particular, cut out all the excess mylar film around the spacers. The object is to allow free flow of epoxy during encapsulation.
6. Carefully inspect all accessible areas of the mold for scrap pieces of nickel cuttings. Every piece of nickel cut, should be accounted for. Be sure to check the header between the rubber and the linen board guides for loose pieces of nickel.
7. Note the work performed, initial and date the Process Control card. Send to the next inspection, para. 4.8.2.

4.8.2

Inspection No. 2, Visual

1. Using a 12X to 15X microscope, inspect each weld connecting the matrix to the header pin flags.
2. Using a 12X to 15X microscope, inspect each weld connecting the matrix to the book base wire wrap pins.
3. Return to fabrication for cut out and repair of questionable welds.
4. Note the work performed, initial and date the Process Control card. Send to the next inspection, para. 4.8.3.

4.8.3

Inspection No. 3, Visual and Mark

1. Using a 15X microscope, visually inspect and mark each weld with an ultraviolet dye as you inspect it.
2. Observe the book base under an ultraviolet lamp. The welds that have been inspected and marked will fluoresce. Repeat Step 1 for any weld that has not been inspected and marked.
3. Return to fabrication for cut out and repair of questionable welds.
4. Note the work performed, initial and date the Process Control card. Send to next inspection, para. 4.8.4.

4.8.4

Inspection No. 4, Circuit Short Check

1. Set an ohmmeter on the RX 100K scale and connect one lead of the meter to the number one pin on the header board. Connect the other lead of the meter in turn to each pin on the book base, then to each pin on the header. Make sure that the ohmmeter shows no reading except for those pins in the book base that the assembly drawing indicates should be connected to the header pin. Several book base pins may be connected to one flagged header pin; every flagged header pin will be connected to the book base mold. Circuits may be accidentally shorted together through the base of the mold. Lift book base pins .005" to assure that a short doesn't exist.

CODE IDENT NO.	SIZE		
88898	A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT		PAGE 11 of 13

4.8.4(Cont'd)

2. Remove the meter lead from the first pin on the header board, connect it to the second pin on the header board and repeat Step 1.
3. Continue this sequence until every pin in the header board has been checked. Check every pin for shorts to the book base mold. Shorts or errors are to be corrected as located.
4. Note the work performed, initial and date the process control card. Send the book base to the Encapsulation Laboratory.

4.9

Integrated Circuits - After Welding into a Support Structure

4.9.1

Inspection No. 1

1. Visually inspect every integrated circuit for damaged cases, poor seals, and cracked or damaged leads. The unit should be rejected for any of these reasons.
2. If an epoxy support structure is used as a permanent holding fixture visually inspect it for cracks and loose leads. Both of these can be repaired with epoxy cement. The leads should be repaired on the inside of the structure.
3. On a 14-lead support structure check leads 1-7-8-14 for shorts to the adjacent lead in the support structure, where the integrated circuits are mounted. If shorted, appropriate action can be taken to correct the short, or possible short, by cutting the long leads off or moving one of the leads.
4. Initial and write inspection number on the envelope under the serial number as work is performed. Send the integrated circuit to next inspection, para. 4.9.2.

4.9.2

Inspection No. 3

1. Visually inspect and clip or break off the end of the integrated circuit lead if it is long enough to pull on.
2. One questionable weld that cannot be cut out and redone automatically makes the unit unsatisfactory for use in flight modules.
3. Initial and write inspection number on the envelope under the serial number as work is performed. Send integrated circuit unit to next inspection, para. 4.9.3.

QCCT UNIT NO.	SIZE	ISSUE	
88898	A	RQAM - 8.004	A
SCALE	DO NOT SCALE PRINT		PAGE 12 of 13

4.9.3

Inspection No. 3

1. Visually inspect and mark each weld with ultraviolet dye.
2. Observe the unit under an ultraviolet lamp. Inspect and mark any weld not marked with the dye.
3. Initial and write inspection number on the envelope under the serial number as work is performed. Send integrated circuit to Electrical Test.

CODE IDENT NO. 88898	SIZE A	RQAM - 8.004	ISSUE A
SCALE	DO NOT SCALE PRINT	PAGE 13 of 13	