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PRODUCT ASSURANCE PROGRAM PLAN

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PRODUCT ASSURANCE PROGRAM PLAN

Data Item Identification Number

P017-SS090205-F1

NUCLEAR ROCKET OPERATIONS

September 1968

CLASSIFICATION CATEGORY

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J. Golden
CLASSIFYING OFFICER

9-26-68
DATE

AEROJET-GENERAL CORPORATION
A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

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PRODUCT ASSURANCE PROGRAM PLAN

Data Item Identification Number

P017-SS090205-F1

September 1968

CONTENTS

	<u>PAGE</u>
<u>SECTION I - INTRODUCTION</u>	
1.0 GENERAL	I-1
2.0 ORGANIZATION	I-2
2.1 General	I-2
2.2 NTO Product Assurance	I-2
2.3 AGC Propulsion Division (Sacramento Plant)	I-3
3.0 PROGRAM DOCUMENTATION	I-4
3.1 General	I-4
3.2 Product Assurance Procedures	I-4
3.3 Program Plan Changes	I-4
3.4 Product Assurance Reporting	I-5
3.5 NTO Product Assurance Program Plan	I-5
3.6 Product Assurance Documentation	I-5
<u>SECTION II - QUALITY PROGRAM PLAN</u>	
1.0 GENERAL	II-1
2.0 BASIC REQUIREMENTS	II-2
2.1 Quality Program Documentation	II-2
2.2 Change Control	II-3
3.0 MANAGEMENT	II-3
4.0 DESIGN AND DEVELOPMENT CONTROL	II-4
4.1 Design Drawing Levels	II-4
4.2 Drawing and Specification Review	II-4
4.3 Qualification Tests	II-5
4.4 Identification	II-5
5.0 CONTROL OF CONTRACTOR PROCURED MATERIAL	II-6
5.1 General	II-6
5.2 Selection of Procurement Sources	II-6
5.3 Procurement Documents	II-7
5.4 Government Source Inspection	II-7
5.5 Contractor Source Verification and Acceptance	II-7
5.6 Receiving Inspection	II-8
5.7 Identification	II-9
5.8 Failure and Deficiency Feedback	II-10
5.9 Supplier Rating and Preferred Source List	II-10
5.10 Coordination of Contractor-Supplier Measuring and Test Equipment Standards	II-10

CONTENTS

	<u>PAGE</u>
<u>SECTION II - QUALITY PROGRAM PLAN</u> (Continued)	
6.0 CONTROL OF GOVERNMENT FURNISHED PROPERTY (GFP)	II-11
6.1 Inspection of Government Furnished Property	II-11
6.2 Defective Government-Furnished Property	II-11
7.0 CONTROL OF CONTRACTOR-FABRICATED ARTICLES	II-12
7.1 General	II-12
7.2 Conformance Criteria	II-12
7.3 Inspection and Test Planning	II-13
7.4 Inspection and Test Performance	II-14
7.5 Fabrication Controls	II-15
8.0 NONCONFORMING MATERIAL	II-19
8.1 Material Review	II-19
8.2 Approval of Contracting Officer (Waiver/Deviation)	II-19
8.3 Control of Nonconforming Material	II-19
8.4 Rework Without MRB	II-21
9.0 INSPECTION, MEASURING, AND TEST EQUIPMENT	II-22
9.1 General	II-22
9.2 Periodic Calibration	II-22
9.3 Calibration Facilities and Standards	II-22
9.4 Evaluation	II-23
9.5 Maintenance and Control	II-23
9.6 Written Procedures	II-23
9.7 Records	II-23
10.0 INSPECTION STAMPS	II-24
11.0 PRESERVATION, PACKAGING, HANDLING, STORAGE, AND SHIPPING	II-25
12.0 STATISTICAL PLANNING, ANALYSIS, AND QUALITY CONTROL	II-26
13.0 TRAINING AND CERTIFICATION OF PERSONNEL	II-27
13.1 Training	II-27
13.2 Certification of Fabrication and Inspection Personnel	II-27
14.0 DATA REPORTING AND CORRECTIVE ACTION	II-28
14.1 General	II-28
14.2 Data Reporting	II-28
14.3 Corrective Action	II-30
15.0 AUDIT OF QUALITY PROGRAM PERFORMANCE	II-31
15.1 Performance of Audits	II-31
15.2 Audit Reports and Corrective Actions	II-31
APPENDIX A GLOSSARY OF TERMS	
APPENDIX B REFERENCE DOCUMENTS	

SECTION I

INTRODUCTION

CY 1969 - 1975

CONTENTS

SECTION I - INTRODUCTION

	<u>PAGE</u>
1.0 GENERAL	I-1
2.0 ORGANIZATION	I-2
2.1 General	I-2
2.2 NTO Product Assurance	I-2
2.3 AGC Propulsion Division (Sacramento Plant)	I-3
3.0 PROGRAM DOCUMENTATION	I-4
3.1 General	I-4
3.2 Product Assurance Procedures	I-4
3.3 Program Plan Changes	I-4
3.4 Product Assurance Reporting	I-5
3.5 NTO Product Assurance Program Plan	I-5
3.6 Product Assurance Documentation	I-5

SECTION I - INTRODUCTION

1.0 GENERAL

The NERVA Product Assurance Program Plan, NRO Report 2469E CY 1969 - 1975, summarizes the basic policy of Nuclear Rocket Operations, (NRO), Aerojet-General Corporation for the implementation of an effective quality program for hardware and documentation generated on the non-nuclear portion of the NERVA Program.

The applicability of specific portions of this Program Plan to a particular contract year will be as delineated in the Contract Work Statements for that year.

The program plan presented herein represents Aerojet Nuclear Rocket Operations' interpretation of NASA Quality Publications NPC 200-2, 200-3 as applicable to the NERVA Program. This program-plan approach is used to assure a complete definition and consistent coverage, without duplication, of all applicable activities from initial design to delivery of Contract End Items. The plan describes the policy and general procedures for meeting the applicable requirements of NPC 200-2 and 200-3. Implementation of this Program Plan is detailed in the referenced Quality Control Instructions and Procedures.

The NERVA Engine System, as defined in the Contract End Item Specification, is the propulsion system to be used in NERVA manned space flight and must meet high standards of quality and safety. All phases of the NERVA Development program will be conducted with quality, reliability and safety as the prime considerations and will not be compromised by other factors.

The successful achievement of the reliability and quality objectives of the NERVA Program depends upon many operations, from design through procurement, fabrication, shipment, installation, and checkout of the engine system as well as the instrumentation, ground support equipment, test facilities and equipment. In view of the many detailed steps which must be performed, this Product Assurance Program Plan emphasizes the concept of the NRO team approach to be the most effective method for actually realizing a high quality in a given end product. It indicates that the NRO Task Manager responsible for the design and development of a specific component or a particular subsystem, or who has the responsibility for a particular system of the NERVA engine is also the captain of a team

that includes personnel representing the various disciplines required to ensure that the end product meets all its objectives. The team captain is responsible for coordinating the activities of his team members.

The basic responsibility for maintaining quality, or minimizing any degradation from the maximum possible quality rests with the fabricators, assemblers, and testers. The Product Assurance Program provides a planned, systematic effort in all program phases to assure that acceptable quality is planned for and achieved, and that objective evidence of quality conformance is maintained.

2.0 ORGANIZATION

2.1 GENERAL

The Product Assurance Manager has direct, unimpeded access to NERVA top management in that he reports to the Manager, Nuclear Rocket Operations. The Product Assurance Manager is responsible for assuring that all quality requirements of the NRO NERVA Program are being met. He is responsible for reporting the status of the Quality Program to the NRO NERVA Program Manager. This includes prompt and accurate reporting of interdepartmental problems or delinquent decisions that may impact adversely upon the programmatic commitments by NRO to SNPO-C.

2.2 NTO PRODUCT ASSURANCE

The Product Assurance operations at NRDS will report to the NTO Management. The Product Assurance tasks to be accomplished by NTO will be described in Report NTO-A-0013, Product Assurance Program Plan as referenced in Section I, Paragraph 3.5, of this plan.

2.3 AGC PROPULSION DIVISION (SACRAMENTO PLANT)

Specific quality tasks relative to the procurement, fabrication, inspection, and test effort needed to support NRO Quality Activities will be provided by the Manufacturing Operations Quality Control (MOQC) Department, an organizational unit within Manufacturing Operations, Propulsion Division, AGC Sacramento. Support by MOQC includes: (1) Sharing of data input to the Coordinated Aerospace Suppliers Evaluation (CASE) Register; (2) Performing inspection, acceptance, and documentation functions in the receiving complex, in the fabrication/assembly shops and laboratories, and in the test area complex; (3) Inspecting and controlling government furnished property; (4) Controlling nonconforming materials; (5) Calibrating and controlling inspection, measurement and test equipment; (6) Issuing and controlling inspection stamps; (7) Providing inspection coverage of preservation, packaging, handling, storage, and shipping of NERVA material; (8) Applying statistical sampling techniques as deemed economical and appropriate by NRO Quality Engineering; (9) Controlling special processes and training and certifying special process inspectors and operators; (10) Verifying (for accuracy and completeness), storing, retrieving, and collating documentation as specifically identified and deemed appropriate by NRO Quality Engineering for use in demonstrations of objective evidence of AGC conformance to NRO quality requirements; (11) Auditing the activities of Manufacturing Operations as appropriate to assure that the Quality Control System as defined in the Quality Control Instructions (QCIs) and Quality Procedures (QPs) is implemented in a manner that assures achievement of quality of products processed by Manufacturing Operations (including NERVA hardware and associated equipment). All quality control actions, decisions, and events that affect NERVA hardware and the associated documentation will be subject to the direction (or redirection) by the NRO Product Assurance Manager.

3.0 PROGRAM DOCUMENTATION

3.1 GENERAL

The quality control activities of the Product Assurance Program Plan outlined herein are documented in detail in subsidiary operating procedures including, but not limited to, those referenced in the applicable sections of this document. They provide detailed instructions relative to implementation of this program plan and are submitted to SNPO-C for information.

Certain documentation identified in this plan may fall within the scope and intent of quality data items prescribed by the NERVA Program Requirements Document SNPO-NPRD-1, NERVA Specification Tree SNPO-C ST-1A, Contractor Data Management AFSCM/AFLCM 310-1 or Configuration Management AFSCM 375-1. The content and format of these quality data items will be governed by the plans and directives issued by the NERVA Program Manager. Included in these plans are the NERVA Program Management Plan RN-S-0465, the NERVA Program Configuration Management Plan C018-SS090205-F1, and the NERVA Program Data and Documentation Management Plan (identification number to be assigned).

3.2 PRODUCT ASSURANCE PROCEDURES

The detailed procedural instructions for implementing the policy reflected in the NERVA Product Assurance Program Plan are contained in the NERVA Quality Procedures (NQPs). The NQP is an instruction by NRO Management to all persons responsible for implementation of a specific portion of the NERVA Product Assurance Program. The NRO Product Assurance Manager is responsible for preparation and issuance of NQP's.

Quality Control Instructions (QCI's) and the subsidiary Quality Procedures (QPs), are prepared and issued by Manufacturing Operations Quality Control Department and provide definition of the operational quality control system that supports all activities (including the NERVA quality program) conducted in-plant at the AGC Propulsion Division, Sacramento. The NRO Product Assurance Manager utilizes these QCI and QP system documents as he deems them to be appropriate to Contract SNP-1. Through the issuance of NERVA Quality Procedures (NQPs), the system documents are modified as necessary to reflect the specific procedural baseline of the NERVA Quality Program.

3.3 PROGRAM PLAN CHANGES

Changes to the Program Plan, NRO Report 2469, will be submitted to SNPO-C for approval, except that contemplated changes to Section I - 2.0, "Organization," will be submitted prior to implementation of such changes.

3.4 PRODUCT ASSURANCE REPORTING

Quality Assurance events will be summarized and transmitted to the NERVA Program Manager for inclusion in the NERVA Weekly Highlight Report, RN-HR-6813.

Quality Assurance progress will be reported quarterly in the Quality Assurance Informal Progress Letter as required by Contract SNP-1. The report includes the following, as appropriate:

- a. Narrative discussions of Product Assurance activities and problems occurring during the period.
- b. Corrective action taken or planned for the problems reported, and follow-up of previously reported problems.
- c. Discussions of significant events programmed for the next report period.
- d. Summaries of design reviews, test plan reviews, failure reports, corrective action, audits, supplier surveillance, inspection activities, special test equipment evaluations, and new procedures issued.
- e. Status of tasks scheduled during the period and identification of tasks scheduled for the next quarter.

3.5 NTO PRODUCT ASSURANCE PROGRAM PLAN

The Quality Control activities affecting the testing operations at NRDS will be described in the NTO Product Assurance Program Plan, NTO-A-0013. This plan will be an extension of, and consistent with, NRO Report 2469. It will be written by NTO and will require the approval of WANL, NRO, and SNPO-C. NRO Management has the primary responsibility to ensure that the NTO Plan and the implementation of the plan by NTO are adequate to meet the NERVA program objectives.

3.6 PRODUCT ASSURANCE DOCUMENTATION

Product Assurance documents for submittal to SNPO-C are detailed in Section II, "Quality Program Plan." Those documents falling within the

definition of Data Management Items are identified as such in Section II. Product Assurance documents submitted to SNPO-C will also be submitted to SNPO.

3.6.1 Documents Submitted for Approval

SNPO-C approval or disapproval will be submitted in writing within 30 days from transmittal date. NRO shall not implement documents in this category until SNPO-C approval is granted, except in emergency, in which case, the SNPO-C Resident Representatives shall be notified. Neither approval, nor waiver of such approval, shall relieve NRO of the obligation to meet requirements of the contract.

Changes to the Product Assurance Program Plan, NRO Report 2469, are subject to SNPO-C approval in accordance with Section I, Paragraph 3.3.

3.6.2 Documents Submitted for Review

Documents in this category will be submitted to SNPO-C a minimum of two weeks prior to their use by NRO. If NRO has not been notified of disapproval within this period, implementation may proceed.

Should an emergency require it, NRO may - based on its own best judgment - take action within the two-week review period; but with the knowledge of the SNPO-C Resident Representative. In this case, advance copies of the pertinent document will be provided to the Resident Representative.

3.6.3 Documents Submitted for Information

Documents in this category shall be transmitted for the purpose of communicating current Product Assurance Program status, progress, and future planning. These documents are transmitted in accordance with programmatic instructions from the NRO NERVA Program Manager.

SECTION II

NERVA QUALITY PROGRAM PLAN

CY 1969 - 1975

CONTENTS

SECTION II - QUALITY PROGRAM PLAN

	<u>PAGE</u>
1.0 GENERAL	II-1
2.0 BASIC REQUIREMENTS	II-2
2.1 Quality Program Documentation	II-2
2.2 Change Control	II-3
3.0 MANAGEMENT	II-3
4.0 DESIGN AND DEVELOPMENT CONTROL	II-4
4.1 Design Drawing Levels	II-4
4.2 Drawing and Specification Review	II-4
4.3 Qualification Tests	II-5
4.4 Identification	II-5
5.0 CONTROL OF CONTRACTOR PROCURED MATERIAL	II-6
5.1 General	II-6
5.2 Selection of Procurement Sources	II-6
5.3 Procurement Documents	II-7
5.4 Government Source Inspection	II-7
5.5 Contractor Source Verification and Acceptance	II-7
5.6 Receiving Inspection	II-8
5.7 Identification	II-9
5.8 Failure and Deficiency Feedback	II-10
5.9 Supplier Rating and Preferred Source List	II-10
5.10 Coordination of Contractor-Supplier Measuring and Test Equipment Standards	II-10
6.0 CONTROL OF GOVERNMENT FURNISHED PROPERTY (GFP)	II-11
6.1 Inspection of Government Furnished Property	II-11
6.2 Defective Government-Furnished Property	II-11
7.0 CONTROL OF CONTRACTOR-FABRICATED ARTICLES	II-12
7.1 General	II-12
7.2 Conformance Criteria	II-12
7.3 Inspection and Test Planning	II-13
7.4 Inspection and Test Performance	II-14
7.5 Fabrication Controls	II-15
8.0 NONCONFORMING MATERIAL	II-19
8.1 Material Review	II-19
8.2 Approval of Contracting Officer (Waiver/Deviation)	II-19
8.3 Control of Nonconforming Material	II-19
8.4 Rework Without MRB	II-21

CONTENTS

SECTION II - QUALITY PROGRAM PLAN (Continued)

	<u>PAGE</u>
9.0 INSPECTION, MEASURING, AND TEST EQUIPMENT	II-22
9.1 General	II-22
9.2 Periodic Calibration	II-22
9.3 Calibration Facilities and Standards	II-22
9.4 Evaluation	II-23
9.5 Maintenance and Control	II-23
9.6 Written Procedures	II-23
9.7 Records	II-23
10.0 INSPECTION STAMPS	II-24
11.0 PRESERVATION, PACKAGING, HANDLING, STORAGE, AND SHIPPING	II-25
12.0 STATISTICAL PLANNING, ANALYSIS, AND QUALITY CONTROL	II-26
13.0 TRAINING AND CERTIFICATION OF PERSONNEL	II-27
13.1 Training	II-27
13.2 Certification of Fabrication and Inspection Personnel	II-27
14.0 DATA REPORTING AND CORRECTIVE ACTION	II-28
14.1 General	II-28
14.2 Data Reporting	II-28
14.3 Corrective Action	II-30
15.0 AUDIT OF QUALITY PROGRAM PERFORMANCE	II-31
15.1 Performance of Audits	II-31
15.2 Audit Reports and Corrective Actions	II-31

SECTION II - QUALITY PROGRAM PLAN

1.0 GENERAL

The Quality Control portion of the Product Assurance Program Plan described in this section constitutes the basic policy for providing complete quality control coverage from design development through manufacture, assembly, testing, and shipping of finished parts.

The Product Assurance Program Plan is based on NASA Quality Publications NPC 200-2 and 200-3, as interpreted by NRO to be applicable to the NERVA Development Program. The headings of this plan generally follow the section headings of NPC 200-2.

2.0 BASIC REQUIREMENTS

2.1 QUALITY PROGRAM DOCUMENTATION

The following list summarizes the Quality documentation and the actions required for these items.

<u>Item</u>	<u>NPC 200-2 Reference Paragraph</u>	<u>Data Item Number</u>	<u>NRO Action</u>
NERVA Product Assurance Program Plan, CY 1969 - 1975 NRO Report 2469 Revision E	3.1	P017- SS090205-F1	Submit for Approval
WANL Product Assurance Program Plan (WANL-TNR-088)	3.1		Submit for Approval
NTO Product Assurance Program Plan (NTO-A-0013)	3.1		Submit for Approval
NRO Reports for End Item	14.2.4		Submit for Approval
Test Plans for Contract End Item	7.4.2		Submit for Approval
Qualification Status List	4.3.5		Submit for Review
NRO Data Books	7.4.2.3		Submit for Review
Test Inspection Procedures	7.3.1		Submit for Review
NRO Quality Assurance Progress Letter (Submitted Quarterly)	2.2		Submit for Information
Quarterly Listing and Copies of Quality Procedures and Related Documents - Revisions, Supplements, and New Issue	2.2		Submit for Information
Evaluated Suppliers List	5.9		Available at NRO for Information
Coordinated Aerospace Suppliers Evaluation Register	5.9		Available at NRO for Information

2.2 CHANGE CONTROL

Drawing and specification change control will be conducted in accordance with the procedural baselines of the AFSCM 375 series and AFSCM 310-1/AFLCM 310-1 as interpreted by the NERVA Program Configuration Management Plan. As a standard practice, Product Assurance reviews changes to design and process documents to assure appropriate quality provisions, configuration control, appropriate effectivity, and prompt removal of obsolete documents. Procurement documents and Interplant Work Authorizations (IWA) that implement changes are reviewed by Product Assurance and appropriate planning is prepared as necessary.

3.0 MANAGEMENT

The NRO Product Assurance Manager has overall responsibility for control of product quality for the NERVA Program and for achievement of specific quality objectives of the SNP-1 Contract.

4.0 DESIGN AND DEVELOPMENT CONTROL

4.1 DESIGN DRAWING LEVELS

The AGC policy with supporting instructions and procedures for translating design concepts into engineering drawings and specifications that conform to government agency requirements are contained in the AGC Engineering Manual Volume I through VI.

Level 1 design drawings are used for engine component hardware, support equipment, facilities, instrumentation and control, and special test equipment that is used directly in functional testing of end items. For other special test equipment or facilities, individual plant drawing practice level may be used.

Level 2 design drawings are used for deliverable and prototype production hardware: i.e., hardware that is delivered to and accepted by the government. The shipment of hardware to test sites for testing and evaluation does not constitute delivery.

Design drawings other than Levels 1 and 2 may be used to define hardware during the design, research and evaluation phase of Contract SNP-1.

4.2 DRAWING AND SPECIFICATION REVIEW

All drawings and specifications, including interface control documents, are subjected to review by quality engineering to assure that characteristics which regulate quality are adequately defined. The review also assures that the design meets contractual requirements relative to quality and that hardware evolving from the design can be inspected or tested effectively.

The NRO policy and guidelines for the effective application and integration of all disciplines involved in the preparation, review, release, change and accounting for NRO specifications and drawings will be reflected in the NERVA Program Configuration Management Plan (NPCMP). NQP 12-1-24 entitled Quality Design Review - NRO (currently in preparation) will be responsive to NPCMP and will reflect the procedural details for accomplishing the quality review of specifications and drawings generated under Contract SNP-1.

4.3 QUALIFICATION TESTS

All test plans throughout the evolution of the design-development-delivery-logistic support cycle (including qualification and re-qualification tests) are prepared and implemented under the direction of the NRO Task Manager responsible for the design and development of components or subsystems of the NERVA Program as specifically assigned by NRO Management. Inspection coverage, documentation and evaluation of test results is accomplished in accordance with instructions of the quality engineer designated to provide Product Assurance support to the cognizant NRO Task Manager. In accordance with established practice, the responsibility for preparation and submittal of technical progress reports showing planned and completed qualification status of each part, component, subassembly, and major subsystem (i.e., Qualification Status List per NPC 200-2, paragraph 4.3.5) rests with the cognizant NRO Task Manager.

4.4 IDENTIFICATION

The basic serialization identification system for component parts, subassemblies, and assemblies is defined by a Propulsion Division Standard Practice Instruction. This procedure requires that each part, subassembly, and assembly shall be assigned a unique part number. In addition, on a selective basis, unique serial and lot numbers are assigned independent of the part number for the purpose of distinguishing between parts or groups of parts of the same part number. It is required that the drawing (Level 1 and Level 2) specify that serial or lot numbers shall be assigned to the parts when manufactured. Manufacturing Operations is responsible for incorporating the serial or lot numbers into the ordering documents and implementing the marking requirements. The part number and serial or lot number identification is utilized on all record documents relating to the part and forms the basis for complete traceability of any serialized part.

5.0 CONTROL OF CONTRACTOR PROCURED MATERIAL

5.1 GENERAL

Product Assurance is assigned the responsibility for evaluating procured material to determine the extent to which it meets specified requirements. This responsibility includes the detection and elimination of conditions which might result in discrepant products or inadequate documentation. Product Assurance emphasizes the detection of material discrepancies and system deficiencies and the successful completion of planned corrective action at the earliest practicable point in time.

5.2 SELECTION OF PROCUREMENT SOURCES

Product Assurance will evaluate and approve or disapprove procurement sources primarily on the basis of NRO survey results and NRO quality history records. Surveys are performed in accordance with procedural disciplines established by AGC in coordination with government agencies. The survey includes (1) Analysis of quality requirements imposed by the particular government agency having contract cognizance; (2) Preparation of comprehensive check lists in order to detail the system or process controls unique to each facet of the quality requirements; (3) Evaluation of the physical facilities of the candidate supplier; (4) Examination of quality records that are maintained and actively used by the candidate supplier; (5) Assessment of the technical competency and intent of the supplier's management to satisfy the quality requirements of the Prime contract; (6) Issuance of statement of approval or disapproval of the candidate supplier. (See Paragraph 5.9)

At the discretion of the Product Assurance Manager, the need for a survey may be waived in those cases where the lack of complexity of the item permits effective and economical assessment of the quality status of the item upon arrival at its scheduled destination. This includes suppliers of commercial and "off-the-shelf" items where the supplier's capability and quality performance has been repeatedly demonstrated in the aerospace environment. Pending completion of NRO evaluation surveys, conditional approval for a limited period may be granted, based upon verification of the suppliers quality performance on other NASA prime contracts.

5.3 PROCUREMENT DOCUMENTS

NRO Quality Engineering reviews all NRO procurement documents to ensure that quality and documentation requirements are delineated explicitly prior to release or award of the purchase order contract. The Propulsion Division procedural policy for review of procurement documents by Quality Control has been documented and is implemented accordingly by NRO. Standard quality control clauses have been formulated and are designated by the cognizant quality engineer as appropriate to satisfy the specific quality requirements of Contract SNP-1. The quality review of procurement documents includes (1) Designation of the inspection/quality control system requirements associated with the fabrication, assembly, test and supplier acceptance of the procured article; (2) Delineation of technical requirements defined by specifications and drawings, e.g., factory inspection and test plans, submittal of test specimens and test reports, identification of items that are sensitive to age or environment; (3) Enumeration of specific product and process verification requirements, e.g., government source inspection, NRO source verification, special process approvals and certifications, lot control and traceability; (4) Initiation of quality planning to be used to document inspection results upon NRO receipt of the procured article.

5.4 GOVERNMENT SOURCE INSPECTION

If government source inspection (GSI) becomes a requirement, the cognizant quality engineer will assure that appropriate instructions for same are incorporated into the procurement documents prior to release by NRO procurement.

5.5 CONTRACTOR SOURCE VERIFICATION AND ACCEPTANCE

Source verification and acceptance is accomplished as deemed appropriate by NRO. Normally it is performed by NRO quality engineering but it may be delegated by the Product Assurance Manager to other AGC quality control organizations. Source verification and acceptance is utilized when:

- a. The determination of conformance of the supplies and services with contract requirements at any other point would require uneconomical disassembly or destructive testing.

- b. Considerable loss could result from the manufacture and shipment of unacceptable supplies, or from delays in making necessary corrections.
- c. Special instruments, gages, or facilities required for inspection are available only at source.
- d. Inspection at any other point would destroy or require the replacement of costly packing and packaging.
- e. Quality Control and inspection are closely related to production methods.
- f. Inspection at the procurement source is necessary to verify test reports, inspection records, certificates, or other evidence of quality.
- g. The shipment is to be sent directly from the supplier to a destination other than NRO.
- h. It is determined to be in the best interests of NRO and SNPO-C.

5.6 RECEIVING INSPECTION

For NRO procured articles, Manufacturing Operations Quality Control is responsible for apprising NRO Quality Engineering of the need for inspection planning, performing receiving inspection, documenting inspection results and for accepting, collating and storing the source inspection data and supplier furnished documentation prescribed by NRO purchase order contracts. NRO Quality Engineering monitors receiving inspection operations to ensure that:

- a. Receiving inspection planning reflects accurately and completely the significant quality characteristics and related acceptance criteria for each NRO procured article.

- b. Receiving inspection verifies the capability of the procured article to meet the acceptance criteria stipulated in the planning and applicable specifications, drawings, and purchase order instructions as prescribed by latest issues of the Manufacturing Operations Quality Control Instructions and Procedures identified as follows:

QCI 4-1	Receiving Inspection of Materials
QP 4-1-1a	Receiving Inspection of Inert Metal Parts

- c. Quantity and degree of inspection performed is consistent with the critical nature of the article, the results of previous inspections and tests, and specific instructions of the NRO Product Assurance Manager.

d. Hardware discrepancies are documented on Inspection Report in accordance with QP 15-1-9b entitled Preparation of the Inspection Report (IR) AGC 2-784/AGCS 0721-3 and NQP 15-1-22a entitled Preparation of the Inspection Report (IR) - NRO. Discrepancies are dispositioned by NRO Quality Engineering in accordance with QCI 15-1-0 entitled Sacramento Plant Nonconforming Material Control Manual as modified by the NERVA Quality Procedure 15-1-21a entitled Nonconforming Material Control - NRO.

e. Documentation is generated, collated, and presented to NRO Quality Engineering for incorporation into Data Books and End Item Reports as required by Contract SNP-1 and as prescribed by NERVA Quality Procedures identified as follows:

NQP 12-1-21	Documentation Control - NRO PAD
NQP 12-2-21a	End Item Reports - NRO
NQP 12-2-22a	Quality Assurance Data Books - NRO

f. Segregation of nonconforming materials from accepted articles is maintained and all procured articles are identified adequately with the inspection/test status throughout the inspection cycle as prescribed by current issues of Manufacturing Operations Quality Control Instructions and Procedures identified as follows:

QCI 16-1a	Indication of Inspection Status
QP 16-1-1b	Issuance, Control and Application of Quality Control Stamps
QP 16-1-2b	Quality Control Tags, Labels or Forms used to Identify Quality/Inspection Status

5.7 IDENTIFICATION

Manufacturing Operations Quality Control is responsible for assuring that the identification as NERVA hardware and the quality status of NRO procured articles is affixed to the articles or to records traceable to the article prior to their release from receiving inspection. Manufacturing Operations is responsible for maintaining this identity in store rooms and during processing operations through the use of records and shop planning generated during the fabrication and test cycle. NRO Quality Engineering monitors the entire sequence of operations to assure that traceability is maintained as required by Contract SNP-1.

5.8 FAILURE AND DEFICIENCY FEEDBACK

NRO Product Assurance has an established system that provides feedback of information regarding nonconforming subcontractor-furnished material and products detected during receiving inspection, fabrication, assembly, testing or end use. Such information is provided to the subcontractor through the Procurement and Materiel Organization. NRO Quality Engineering representatives are provided for on-site resolution of critical problem areas.

The execution by the supplier of the AGC "Supplier Information Request," (as described in NQP 3-4-21 entitled Suppliers Information Request - REON) assures accurate feedback and clarification of engineering intent of drawings and specifications. The execution of the AGC "Supplier Discrepancy Action Request" (as described in NQP 3-4-22 entitled SDAR Control - REON) assures accurate declaration by the supplier of nonconforming product and focuses the attention of the cognizant design engineer and the quality engineer upon the disposition decision. Significant factors that affect the decision to accept are the Failure/Discrepancy Records for the particular part and adequacy of supplier's corrective action. The system meets the corrective action requirements of NASA NPC 200-2 Paragraph 14.3. The NERVA Program Manager is apprised in a timely manner of interdepartmental problems or delinquent decisions affecting NRO work in progress in suppliers' plants.

5.9 SUPPLIER RATING AND PREFERRED SOURCE LIST

The results of objective evaluations of suppliers' quality control and special process capabilities are systematically categorized in two guideline documents that are updated quarterly; namely, Evaluated Suppliers List and Coordinated Aerospace Supplier Evaluation Register. These documents are used by the Procurement and Materiel Department in the procurement of NERVA hardware and associated equipment.

5.10 COORDINATION OF CONTRACTOR-SUPPLIER MEASURING AND TEST EQUIPMENT STANDARDS

Quality Engineering will assess continuously the effectiveness of the inspection measuring and test equipment used by suppliers and will coordinate with in-plant personnel as necessary to assure compatibility of equipment and technique used to determine acceptability of procured articles.

6.0 CONTROL OF GOVERNMENT FURNISHED PROPERTY (GFP)

6.1 INSPECTION OF GOVERNMENT FURNISHED PROPERTY

Manufacturing Operations Quality Control will inspect Government-furnished property to detect damage in transit and completeness for its intended use. Control of Government-furnished property will be maintained to ensure that damage or deterioration does not occur. The action of Manufacturing Operations Quality Control is detailed in QCI 19-2, Control of Government-Furnished Property. The SNPO-C Resident Representative will be notified upon receipt of Government-furnished property.

6.2 DEFECTIVE GOVERNMENT-FURNISHED PROPERTY

Product Assurance will advise and request disposition instructions from the SNPO-C Resident or any Government-designated representative as identified in the GFP agreement of such property found damaged, malfunctioning, or unsuitable for its intended use.

7.0 CONTROL OF CONTRACTOR-FABRICATED ARTICLES

7.1 GENERAL

The NRO Quality program will ensure that contractual quality requirements are satisfied throughout the fabrication, assembly, inspection, test, checkout, packaging, storage, maintenance, and shipment activities. The program provides for the early and prompt detection of actual or potential system deficiencies, marginal quality trends or, conditions that could result in degradation of the quality of the product. It utilizes the system defined by the NERVA Program Management Plan for prompt isolation, identification, and resolution of significant problems and for override by the NERVA Program Manager of inadequate or delinquent decisions at the interdepartmental level.

Fabrication of NERVA hardware and associated equipment by the Propulsion Division is accomplished in accordance with integrated fabrication and inspection planning prepared and contained in a single, sequentially organized document prepared in accordance with Division Procedures. Integrated planning is provided by the responsible manufacturing control organization. Planning for inspection, test, and shipment of NERVA articles is prepared and/or approved by NRO Quality Engineering prior to use in the particular area. Manufacturing Operations Quality Control inspects and controls the quality of process fabrication, assembly, and test operations from inception of manufacturing through functional testing, and shipment from the Sacramento Facility. NRO Quality Engineering monitors the effectiveness of the quality control operations in the fabrication, assembly, test and shipment of NERVA hardware and associated equipment. This is accomplished to the same depth of detail as outlined for receiving inspection operations -- See 5.6 paragraph (a) through (f).

7.2 CONFORMANCE CRITERIA

Applicable design drawings, specification, fabrication and inspection planning, in-process inspection standards and test documents accompany NERVA hardware and related equipment through the phases of fabrication, assembly, inspection, test, storage, packaging and shipment. These documents are made available at the time and place of inspection and testing and provide conformance criteria for NERVA hardware, including end item report requirements as applicable.

7.3 INSPECTION AND TEST PLANNING

The measurement and assessment of quality of NERVA hardware and associated equipment is accomplished in accordance with preplanned instructions that either have been prepared by or approved by NRO quality engineering prior to release for use.

Inspection operations are incorporated into the NERVA shop orders. This integrated fabrication and inspection planning document is a detailed sequential array of operations and inspections to be performed and documented. NERVA Quality Procedure 11-1-21 entitled Inspection Planning: Fabrication and Assembly Operation - REON defines the preparation and use of this planning. As a minimum, the planning includes the following:

- a. Identification of the article to be inspected or tested (e.g., part number, applicable specification, system involved, and nomenclature).
- b. Objectives of the inspection or test.
- c. Identification of specialized test equipment or measurement devices to be used.
- d. Detailed operations to be performed and characteristics to be measured or tested - including operational checks or calibrations of the test equipment.
- e. Conditions that must be maintained during inspection and test, including ambient or environmental, and precautions to be observed to prevent damage to personnel, test items, instruments involved. Safety precautions are required if applicable.
- f. Criteria for passing or failing the test or for determining conformance or rejection of the article including reference to inspection standards.
- g. Sampling plans to be used if applicable.
- h. The recording forms required and instructions for filling out the form.

7.4 INSPECTION AND TEST PERFORMANCE

7.4.1 In-Process Inspection

In-process and end item inspections and tests are performed and results documented in accordance with the integrated shop order planning as described in the previous paragraph 7.3. NRO Quality Engineering maintains surveillance of the fabrication areas and provides verbal instruction and guidance as necessary to assure that quality requirements for NRO hardware and associated equipment are understood and achieved by the factory. As the inspection and testing operations are completed, the planning is stamped and processed in accordance with the requirements of the NERVA Quality Procedure 12-1-21 entitled Documentation Control - NRO PAD. This procedure defines the functional responsibilities and the process flow chart for acquiring and collating the records that constitute objective evidence of the quality status of NERVA hardware and associated equipment.

7.4.2 End Item Test Plans

The preparation of End Item Test Plans is the responsibility of the NRO Task Manager who has technical cognizance and responsibility for design and development of hardware designated as end items.

7.4.3 Test Area Control

Test procedures are prepared and used in accordance with NERVA Quality Procedure 6-1-21 entitled REON Product Assurance Test Area Control Plan. It delineates the quality control operations related to the receipt, test, post-test analysis, and return of NERVA hardware to the fabrication and assembly area.

7.4.4 Control Points

Through NRO/SNPO-C coordination specific control points or verification stations may be imposed by the government. If controls of this nature become a requirement, Quality Engineering will incorporate these control points into the fabrication, assembly, and test planning and coordinate the implementation of same.

7.4.5 Documents and Records

Data books containing pertinent inspection documentation accumulated in the shop traveler-packets are prepared for the major component, sub-assemblies and assemblies in accordance with the current revision of NQP 12-2-22a entitled Quality Assurance Data Books - NRO and NQP 12-2-24a entitled Buildup and Travel Log Books - NRO. Upon completion of the final acceptance test or final acceptance inspection of a contract end item, Manufacturing Operations Quality Control determines that quality documentation is in order and that applicable inspection stamps or tags are affixed. NRO Quality Engineering and the designated representative of the cognizant NRO Task Manager review and approve the completed data books prior to their submittal to the resident SNPO-C representative.

A report for each contract end item is prepared as discussed in paragraph 14.2.4, and is reviewed and approved by NRO Engineering, NRO Quality Engineering, and SNPO-C Resident Representative in a meeting of End Item Review Board. Subsequent to approval, the master copy of the report is microfilmed and filed for maintenance, permanent storage, and ready retrieval.

7.4.6 Modifications after Final Test and Inspection

After completion of final acceptance tests and final inspection of contract end items, there will be no modifications, repairs, or replacements prior to shipment without MRB action and concurrence by SNPO-C. Product Assurance ensures compliance with all documents and record requirements prior to release of the contract end item for shipment from the Sacramento Facility.

7.5 FABRICATION CONTROLS

7.5.1 Production Tooling and Equipment Control

Identification, maintenance, and calibration control of tooling and fabrication equipment that in turn, controls dimensions and contours are accomplished by the cognizant activities within the Propulsion Division. QCI 2-2a entitled Receipt, Inspection and Control of Production Tooling and specific instructions from NRO Quality Engineering constitute the controls that are in existence.

7.5.2 Material Control

NERVA material (including those items with limited shelf or use life) is procured, processed, and stored in accordance with the specific controls defined by the applicable drawings and specifications (e.g., identification by part number, change letter, lot control, age control, number and frequency of test cycles). Fabrication and test planning documents provide identification of those articles that require special handling and recording of specific life, time, or cycle data.

7.5.3 Control of Cleanliness of Fabrication and Test Areas

Cleanliness of NRO fabrication and test areas is maintained in accordance with the requirements specified in Aerojet Standard AGC-STD-9007C entitled Cleanliness Levels, Components and Assemblies. Subsequent to release, the "cleanliness" paragraph of the contract end-item specification for the NERVA engine will apply. A NERVA Quality Procedure 5-1-20 entitled Control of Cleanliness of Fabrication Assembly, and In-Process Test Areas - NRO, will be prepared which incorporates the NERVA Program requirements for cleanliness into a single procedure that will be implemented in the fabrication and assembly areas as appropriate for NERVA hardware and associated equipment.

7.5.4 Process Control

Special processes are approved or certified for compliance to applicable specifications which describe each process. Personnel responsible for performing and inspecting special processes operations (e.g., radiography, welding, soldering, ultrasonic inspection and penetrant inspection) are specially trained and certified by qualified examiners. Records of such certification are maintained by Manufacturing Operations Quality Control. Nondestructive testing is performed in accordance with drawing requirements and applicable specifications, quality control standards, and inspection planning.

7.5.5 Assembly and Disassembly - Control of

Components that have been readied for assembly are identified with acceptance tags that either: (1) provide traceability to procurement or fabrication; or (2) indicate evidence of conformance to applicable

design drawings or specifications after test or rework. Procedures for assembly are provided by the cognizant Task Manager. Assembly procedures are identified to an approved test plan for contract end items. Inspection planning and test requirements, as determined by NRO Quality Engineering, may be included in the procedures or provided as a separate document. Assembly procedures may include provisions for inspection stamps that may be used as evidence of acceptability of the assembly for incorporation into a contract end item. NRO Quality Engineering provides surveillance of assembly operations. Signature or inspection stamp approval of in-process and completed assembly operations is provided by organizations designated in the assembly procedure.

Disassembly operations are accomplished in accordance with procedures provided by the cognizant Task Manager and approved by cognizant quality engineer. Inspection planning and test requirements, as determined by the cognizant quality engineer, may be included in the procedures or provided as a separate document. Product Assurance provides surveillance of disassembly operations. Signature or inspection-stamp approval of these operations is provided by organizations designated in the disassembly procedure.

Complex hardware may be assembled or disassembled under controlled conditions in laboratories approved by the NRO Task Manager and the NRO Product Assurance Manager. Controls are imposed as necessary to ensure that quality objectives are not jeopardized due to lack of approved procedures or records of decisions or actions pertinent to each component or subassembly. Laboratories used include the Controls Laboratory, Cryogenic Laboratory, Component and Structures Laboratory, Measurement Standards Laboratory, Aerophysics Laboratory, and Transducer Laboratory. For end-item hardware, applicable documents are maintained.

Data books are maintained in accordance with the current revision of NQP 12-2-22a and contain documentation related to each occurrence of complete or partial assembly and disassembly. Control of the data books is the responsibility of NRO Quality Engineering. Assembly travel log books, prepared in accordance with NQP 12-2-24 accompany the item when transferred to Test Operations for testing. The log book is maintained by Manufacturing Operations Quality Control and is returned with the unit for insertion into the applicable assembly data book.

7.5.6 Interfacility Work Authorizations

Quality requirements for work at Aerojet facilities, other than the Propulsion Division (Sacramento) are designated on an inter-facility Work Authorization (IWA). Requirements for quality are specified on each IWA by NRO Quality Engineering.

8.0 NONCONFORMING MATERIAL

8.1 MATERIAL REVIEW

The Quality Program Plan provides for the review, control, and disposition of nonconforming material in a standard formalized manner by application of the instructions contained in QCI 15-1-0 entitled Sacramento Plant Nonconforming Material Control Manual and interpreted by NERVA Quality Procedure 15-1-21a entitled Nonconforming Material Control - NRO. The system provides for accurate identification and segregation of nonconforming material and for disposition action only by authorized and technically competent persons.

8.2 APPROVAL OF CONTRACTING OFFICER (WAIVER/DEVIATION)

Nonconformances that may affect adversely safety, reliability, durability, performance, interchangeability, weight, or basic objectives of the contract will be identified and directed to SNPO-C for decision on suitability of the nonconforming article for continued contractual use. A waiver constitutes granted use or acceptance by NRO and SNPO-C of an article that does not meet specified requirements. A deviation constitutes a specific authorization granted before the fact by NRO and SNPO-C to depart from a particular requirement of specifications or related document.

8.3 CONTROL OF NONCONFORMING MATERIAL

8.3.1 Material Review Board (MRB)

Board membership and its policies and procedures for achieving the desired control are defined in the quality system documents enumerated in paragraph 8.1 above. A representative of SNPO-C is a participating member of the MRB while the NRO quality engineering representative serves as chairman and ensures that decisions, actions, and events relative to the implementation of the MRB dispositions are documented and retained for future use as objective quality evidence. The quality engineering representative also ensures that the SNPO-C representative receives copies of documents reflecting board decisions. The board makes final acceptance

decisions for the nonconforming characteristics that do not affect adversely safety, reliability, durability, performance, interchangeability, weight, or basic objectives of Contract SNP-1. The board also evaluates the previous disposition actions of the Engineering Review Board to "accept as is" and/or to "repair" and may effect reinspection of the questionable hardware and reversal of decisions if appropriate.

8.3.2 Engineering Review Board (ERB)

While formal membership of the board is limited to representatives of NRO engineering and NRO product assurance, it has access to the entire spectrum of talent and disciplines within NRO or the Sacramento Facility. The NRO quality engineering representative serves as chairman of the board and ensures that decisions, actions, and events relative to the implementation of board disposition are documented and retained for future use as objective quality evidence.

8.3.3 Preliminary Disposition Authority

Processing of nonconforming material (for which an inspection report has been prepared and disposition made by the appropriate Engineering Review Board) may, in emergency conditions, be allowed to continue, while the cause and corrective action are being established. Such emergency conditions are defined on the Inspection Report (IR) as part of the disposition action which includes designation of the date, time, and the identification of the organization that will provide the cause and corrective action statement. Such emergency conditions may provide for minimizing test and fabrication "down-time" or the processing delay that might be caused by removal of the nonconforming material from fabrication, assembly, test or tooling setups. Such nonconforming material, and shop traveler-packet documentation, will be identified by a "Notice of Discrepancy" tag until the IR is cleared.

8.3.4 Standard Repair Authority

Standard repair procedures approved by NRO and SNPO-C describing methods of repair for specific nonconformances will be used without Material Review Board action. The repairs will be properly inspected and

documented and become a part of the quality documentation. The decision to "repair" in accordance with standard repair procedures may be made by quality control with the concurrence of the cognizant design engineering representative when a standard repair procedure exists for the nonconformity.

8.4 REWORK WITHOUT MRB

Disposition of nonconforming material in the category of "rework to print (drawing)" is accomplished by Engineering Review Board in accordance with written procedures previously identified in paragraph 8.1.

9.0 INSPECTION, MEASURING, AND TEST EQUIPMENT

9.1 GENERAL

The Measurement Standards Laboratory assists in the selection and evaluation of measuring equipment. It controls the calibration of all inspection standards, gages, measuring and test equipment necessary to determine conformance with specification, drawing, and contract requirements.

9.2 PERIODIC CALIBRATION

All inspection, measuring, and test equipment used in product control or in critical engineering tests is periodically calibrated at established intervals to assure that the original accuracy is maintained within prescribed limits. Each piece of equipment is identified by an identification number applied to the piece of equipment or the case. Each piece of equipment or its case is also tagged with a sticker showing the last date of calibration and the date of the next required calibration. A record system provides for the following, as a minimum.

- a. Identification of the piece of equipment.
- b. Results of initial calibration and periodic re-calibration, including applicable dates and the name of the individual performing the evaluation and calibration.
- c. A system for positive recall for calibration.
- d. A record of all repairs performed.

9.3 CALIBRATION FACILITIES AND STANDARDS

Calibration facilities in the Measurement Standards Laboratory provide an environment that is sufficiently controlled to allow each piece of inspection, measuring, and test equipment to be evaluated and calibrated to its design accuracy. The dimensional gage laboratory is essentially dust-free and the temperature and humidity are maintained at 68 degrees ± 2 degrees F and maximum 50 percent relative humidity, respectively. Within state-of-the-art limitations, the standards used for calibration of inspection, measuring, and test equipment will have a tolerance no greater than 10 percent of the allowable tolerance for the equipment being calibrated and will be traceable to the National Bureau of Standards. Approved commercial laboratories are utilized for calibrations when necessary.

9.4 EVALUATION

Commercial inspection, measuring, and test equipment is initially evaluated as necessary to determine its accuracy and its suitability for performing the desired inspection or test. New special test equipment will be subjected to tests and analytical evaluations, as appropriate, to verify its capability of dependably performing the intended operations. The results of new special test equipment evaluation are documented.

9.5 MAINTENANCE AND CONTROL

All inspection, measuring, and test equipment is maintained in a manner that will provide assurance that the original calibration accuracy and capability of the equipment is retained. Any defective inspection, measuring, and test equipment is removed from service and not made available for reuse until adequate repairs and re-evaluation assure that the equipment is again accurate and capable.

9.6 WRITTEN PROCEDURES

The policies, responsibilities, and procedural instructions for maintaining calibration of inspection measuring and test equipment are documented and maintained in the Measurement Standards Instruction Manual. The Measurement Standards Laboratory is an organizational unit within the Manufacturing Operations Quality Control (MOQC) organization and operates within the policy defined in the QCIs and QPs.

9.7 RECORDS

Through the use of an IBM system, records are maintained on the recalibration status, condition, and corrections or repairs for each inspection, measuring, and test equipment and provide the basis for recall instructions and procedures.

10. INSPECTION STAMPS

The acceptability status of products is indicated on the product or through the use of tags, stickers, and copies of inspection documents attached to the product or the product container. Stamps (rubber and steel) are provided to each inspector for use on the tags, stickers, and inspection documents for identification purposes. The stamps are provided in several designs to indicate clearly inspection status, and each stamp is numbered and traceable to an individual inspector. The design of the stamps is intended to be such that they cannot be confused with Government inspection stamps.

The system to control design, procurement, issuance, accountability, maintenance, and use of stamps for indication of inspection status of manufactured articles (including NERVA hardware and associated equipment) and the related documentation is defined in the Manufacturing Operations Quality Control Instruction and Procedures enumerated previously in Paragraph 5.6.f of this Quality Plan.

11.0 PRESERVATION, PACKAGING, HANDLING, STORAGE, AND SHIPPING

Design and manufacturing engineers are responsible for specifying preservation, packaging, handling, storage, and shipping designs and procedures. NRO Quality Engineering reviews and approves such designs and procedures for adequacy and provides surveillance to verify compliance with the requirements.

Quality system requirements are defined in Manufacturing Operations Quality Control Instruction 18-1 entitled Shipping, Quality Control of. Specific program requirements are defined in NERVA Quality Procedure 18-1-21 entitled Shipping Material for Government Contracts - REON and NQP 18-1-22 entitled Supplier Direct (Drop) Shipments - REON.

12.0 STATISTICAL PLANNING, ANALYSIS, AND QUALITY CONTROL

NRO Quality Engineering will formulate inspection plans for NERVA hardware and raw material items which lend themselves to sample inspection. Where practicable, these plans will be as defined in MIL-STD-105, MIL-STD-414, or Handbooks H 106, H 107, H 108. Authorization of supplier's sampling plans requires prior approval from NRO Quality Engineering.

13.0 TRAINING AND CERTIFICATION OF PERSONNEL

13.1 TRAINING

Manufacturing Operations Quality Control maintains a continuous training program to ensure personnel proficiency in inspection operations. Performance of Inspection personnel is reviewed on a continuing basis to assess the need for additional training. In addition, Product Assurance monitors and reports on the need for training in areas which have an effect on NERVA product quality.

13.2 CERTIFICATION OF FABRICATION AND INSPECTION PERSONNEL

Certification is required for personnel performing specialized operations such as welding, soldering, radiography, and dye penetrant. Certification procedures include oral, written, and proficiency testing. Periodic evaluation of inspections, tests, and quality audits establish the need for additional training and recertification. Records are maintained of all individuals certified with the dates of effectivity of the certification. A card is issued for evidence of certification and is to be carried by the individual performing tests.

Manufacturing Operations Quality Control is responsible for the design, administration, and control of the personnel and process certification system employed in AGC Propulsion Division Plant (Sacramento Facility).

14.0 DATA REPORTING AND CORRECTIVE ACTION

14.1 GENERAL

The documentation system for closed-loop data management control described in NERVA Quality Procedure 12-1-21 entitled Documentation Control - NRO PAD will be continued. The system is responsive to the reliability and quality engineering requirements for collection, evaluation, storage, and retrieval of records of inspections and decisions made concerning procured or fabricated NERVA hardware and associated equipment. Also, the system is responsive to data inputs and retrieval requests of NRO reliability and design engineers in their performance of failure analyses and implementation of corrective actions related to the evaluation of reliability or product design and for maintenance of quality of articles produced.

14.2 DATA REPORTING

NRO Product Assurance and Manufacturing Operations Quality Control (with support by other NRO and Sacramento Facility organizations) provide the documentation required by this product assurance program plan. Such documentation is available for SNPO-C approval, review, or information.

14.2.1 Documentation Submitted for SNPO-C Approval

a. Annual revisions of the Product Assurance Program Plan, submitted as indicated in Section I of this document.

b. Test plans for contract end items. The SNPO-C letter of approval will indicate modifications and will be forwarded to NRO within two weeks of documentation receipt.

c. End item reports prepared and presented by NRO quality engineering for evaluation and approval by the membership of the End Item Review Board (EIRB). The resident SNPO-C representative is a participating member of the EIRB.

14.2.2 Documentation Submitted for SNPO-C Review

- a. The qualification status of NERVA engine components is included in the technical progress reports and is issued by the NRO engineering activity.
- b. NRO quality program documentation, including test inspection procedures and data books.

NRO Test Inspection Procedures submitted to SNPO-C for review will include existing and new Aerojet documents that reflect control by Product Assurance of functional and acceptance tests conducted in-plant and at suppliers plants for NERVA hardware and associated equipment. These documents will be submitted to the SNPO-C resident representative. Documents thus submitted will be implemented unless written notification of disapproval is received within two weeks after submittal.

14.2.3 Documentation Submitted for SNPO-C Information

- a. A quarterly quality assurance informal progress letter, including a discussion of significant accomplishments and quality problems.
- b. Periodic summary reports of discrepancy data from inspection reports (IRs), supplier information requests (SIRs), and supplier discrepancy action requests (SDARs) and quality reliability disposition reports (QRDRs originated at NTO) are prepared and published by an electronic data processing system. Copies will be furnished to the SNPO-C resident representative upon request.
- c. Additional NRO quality program documentation, including a quarterly listing and copies of quality procedures and related documents (e.g., revisions, supplements and new issues).

14.2.4 End Item Reports

End item reports are prepared in accordance with the current revision of NERVA Quality Procedure 12-2-21a, entitled End Item Reports - NRO for all contract end items. Prior to release of these items for shipment, the End Item Report (EIR) is submitted to, and approved by, an End Item Review Board (which includes resident SNPO-C representatives). A copy of the approved EIR is included with the shipping documents and two copies provided

the resident SNPO-C representative. The EIR defines: (1) the contract end item and engineering critical components; (2) related configuration; (3) nondestructive testing; and (4) pressure, functional and acceptance tests performed. It also includes a summary of significant problems encountered, material review actions, corrective actions accomplished or pending, interface control dimension records, and shipping and operating instructions.

14.3 CORRECTIVE ACTION

Discrepancies found during receiving inspection, fabrication, assembly, or testing at the AGC Propulsion Division Plant (Sacramento Facility) are reported on an inspection report. Discrepancies found at subcontractors' facilities are reported on the supplier's discrepancy action request and other equivalent reports. Discrepancies found at NTO are reported on quality reliability disposition reports to NRO, Westinghouse, and SNPO-C. Procedures for documenting the cause (and corrective actions taken as a result of reported discrepancies) are those defined in the applicable quality procedures.

NRO Product Assurance is responsible for monitoring and ensuring that corrective action is accomplished in a timely and effective manner by NRO, NTO, and WANL. Management action is secured when necessary through the use of a corrective action meeting called either by NRO quality engineering, or by the Product Assurance Manager as prescribed by NERVA Quality Procedure 15-1-23 entitled Corrective Action System - NRO.

15.0 AUDIT OF QUALITY PROGRAM PERFORMANCE

15.1 PERFORMANCE OF AUDITS

The NRO Product Assurance effort includes an informal but continuous audit of all facets of the NERVA Quality Program as implemented at WANL, NTO, NRO, and suppliers' plants. The audit results and corrective actions are discussed regularly with the Product Assurance Manager and are concerned with the elements enumerated as follows:

- a. Effectiveness of feedback and corrective action.
- b. Existence and adequacy of quality control procedures and instructions, inspections and tests.
- c. Existence of, and adequacy of, process instructions and process controls.
- d. Certification of personnel.
- e. Effectiveness of failure and trouble-reporting system.
- f. Availability of required documentation for any operation.
- g. Familiarity of personnel with required documents.
- h. Effectiveness of the Engineering Review Board (ERB) and Material Review Board (MRB) actions.
- i. Effectiveness of configuration control system.
- j. Effectiveness of the data-reporting system.
- k. Effectiveness of training programs.

15.2 AUDIT REPORTS AND CORRECTIVE ACTIONS

Corrective action plans and commitments are monitored by the Product Assurance Manager. This is continued until satisfactory results have been demonstrated and objective evidence of completed action is presented to the Product Assurance Manager.

Quality control deficiencies evolving from inadequate or delinquent decisions at the interdepartmental level are isolated and identified for the attention of the NERVA Program Manager. With inputs from the Product Assurance Manager and all other affected organizational units, the NERVA Program Manager will assess the total impact of the problem and direct final action to remove the deficiency and to implement corrective action.

APPENDIX A

GLOSSARY OF TERMS
NERVA PRODUCT ASSURANCE PROGRAM PLAN
NRO REPORT 2469 REVISION E

APPENDIX A GLOSSARY OF TERMS

These definitions apply to terms used in NRO Report 2469E.

ACCEPTANCE TEST - Any test or inspection which is used to determine the acceptability of a fabricated part or system. Acceptance relates to hardware as opposed to design. Acceptance is determined by comparing acceptance test or inspection data to the acceptance criteria defined by drawing or specification.

ARTICLE - A unit of hardware or any portion thereof required by the contract.

CHARACTERISTIC - Any dimensional, visual, functional, mechanical, electrical, chemical, physical, or material feature or property; and any process-control element which describes and establishes the design, fabrication, and operating requirements of an article.

COMPONENT - A part, assembly, or combination of parts, subassemblies, or assemblies mounted together to perform a design function.

CONTRACT - The contractual agreement formally executed by the Government and the prime contractor which requires performance of services and/or delivery of a product at a cost to the Government, in accordance with terms and conditions set forth therein.

CONTRACT END ITEM (CEI) - The definition of CEI as applicable to Contract SNP-1 will be disclosed in the NERVA Configuration Management Plan - (presently in preparation).

DESIGN SPECIFICATION - A document prescribing criteria to be satisfied in designing a particular component, subsystem, or system (or part). Typical criteria include performance requirements under specified environments, interface requirements, size, weight, ruggedness, safety margins, derating factors, and apportioned reliability goal (with definition of failure).

DEVELOPMENT TESTS - Any engineering test conducted as a source of engineering information to assist in making design decisions so that selections can be made of conceptual designs, component configurations, and materials prior to the design layout stage.

DEVIATION - A specific authorization, granted before the fact, to depart from a particular requirement of specifications or related documents.

DIAGNOSTIC OR EVALUATION TEST - Special test conducted to evaluate, interpret, or diagnose a condition after the part or component, subsystem or system has formally passed the proof test.

DISCREPANT MATERIAL - Raw material, parts, subassemblies, and assemblies which do not conform to the drawing or specification to which they were procured or manufactured.

APPENDIX A

END ITEM - Any contractually required item supplied by NRO for delivery to NRDS or other SNPO-C designated destination for testing, or in support of testing.

END ITEM REPORT (EIR) - A product assurance report per the requirements of NPC 200-2, covering an end item.

ENGINEERING CRITICAL COMPONENT - The designation given to certain selected components or component equivalent items because of their importance to engineering management, complexity, performance, or critical nature with regard to engineering aspects of system/equipment development and production.

ENGINEERING REVIEW BOARD (ERB) - A review board composed of the cognizant Design and Quality Engineers who review the history and determine the disposition of discrepant or nonconforming materials.

FAILURE - The lack of ability to perform within the limits of its intended use. A malfunction of an article, subassembly, or assembly as determined by failure to comply with specification requirements, in any way, without regard to whether due to defective articles or assemblies, or an act or omission of an individual.

FAILURE ANALYSIS - The study of a specific failure which has occurred to determine the circumstances which caused the failure and to arrive at a course of corrective action which will prevent its recurrence.

FAILURE EFFECT ANALYSIS - Study of the potential failures which might occur in any part of a space system to determine the probable effect of each on all other parts of the system and on probable mission success.

GOVERNMENT FURNISHED PROPERTY (GFP) - Any government-owned material supplied to AGC.

INSPECTION - The examination, including testing, of contract work, articles, and services to determine conformance to contract requirements.

INSPECTION INSTRUCTIONS - Instructions which define the required inspection, equipment to be used, method of inspection, measurements and data to be obtained, persons to be contacted as certain control points are reached, documentation to be prepared, processed, disseminated and maintained.

INSPECTION REPORT (IR) - The form for reporting a known (or believed) discrepant characteristic.

INTERFACE - The junction points, or the points within or between systems or subsystems where matching or accommodation must be properly achieved in order to make their operation compatible with the successful operation of all other functional entities in the test article, test equipment, test facility, space vehicle and ground equipment.

APPENDIX A

MAJOR COMPONENT - A component whose reliability is considered particularly critical to the reliability of the subsystem or system in which it is used and which is designated as a major component in the approved Reliability Program Plan for the contract.

MATERIAL REVIEW BOARD (MRB) - A review board composed of cognizant Design and Quality Engineers, and a representative from SNPO-C.

This board reviews nonconformances in components, subassemblies and assemblies which in the judgment of Product Assurance do not affect safety, reliability, performance, or interchangeability of the articles or the basic objectives of Contract SNP-1.

NONCONFORMANCE - A material, part, subassembly or assembly which does not meet the requirements of the drawing or specification.

NQP - NERVA Quality Procedure is a controlled document that disseminates quality requirements that are unique to the NERVA Program. (See Quality Procedures.)

NRDS - Nuclear Rocket Development Station (in Nevada).

NTO - NERVA Test Operations (located at NRDS).

PRELIMINARY FLIGHT RATING TEST (PFRT)- A formal series of engine tests, including acceptance, checkout, cold flow, startup, transient endurance, shutdown, and cooldown, which demonstrate adequacy of the as-built design to meet, to the maximum extent possible, the Contract End Item Specification requirements.

PROCESS APPROVAL - The AGC decision to authorize (prior to its use by a supplier) the application and use of a qualified process or procedure in the fabrication or preparation of NERVA hardware and associated equipment.

PROCUREMENT QUALITY REQUIREMENTS - A document prepared and applied by QE which establishes the quality requirements that will apply to all purchasing documents, in-plant work orders, or IWA's that are related to materials, components, and services that are required in the fabrication and testing of end items.

PROOF TEST - A component test that is required for demonstration of achievement of design criteria of a designed part or component.

QUALIFICATION - Determination by a series of tests and examination of documents and processes that a part, component, subsystem, or system is capable of meeting performance requirements prescribed in the purchase specification or other documents specifying what constitutes adequate performance capability for the item in question.

APPENDIX A

QUALIFICATION TEST - The determination by a formal series of tests and examinations of documents and processes that a part, component, subsystem, or system is capable of meeting the performance requirements prescribed in the Contract End Item Specification and considered as part of PFRT.

QUALIFIED PROCESS OR PROCEDURE - A process or procedure that has demonstrated by a series of tests and examinations of resultant information that the prescribed process or procedure will produce within the performance requirements established by approved drawings, specifications and standards.

QUALITY CONTROL (QC) - A management function to control the quality of articles to conform to quality standards. This management function is defined and performed by NRO Product Assurance as explained under Quality Assurance. The specific tasks of controlling the quality is primarily within the assigned responsibility of NRO Quality Engineering, WANL Quality Engineering at Westinghouse, and NTO Quality Engineering at NRDS.

QUALITY CONTROL INSTRUCTION (QCI) - A procedural system maintained by Manufacturing Operations Quality Control (MOQC) Department for distribution and control of formal statements of quality control policy applicable to Manufacturing Operations, AGC Propulsion Division. When referenced in the NRO Report 2469E, these documents have been identified as QCIs. (e.g., QCI 15-1-0)

QUALITY CONTROL STANDARD (QCS) - A corporate quality control standard.

QUALITY-RELIABILITY DISPOSITION REPORT (QRDR) - A document initiated by NTO Product Assurance for the purpose of documenting formally the discrepancy and failure data and corresponding corrective action for NERVA hardware and associated equipment that is tested or utilized at NRDS.

QUALITY PROCEDURES (QP) - A procedural system maintained by the Manufacturing Operations Quality Control (MOQC) Department for distribution and control of detailed procedures necessary for the satisfactory implementation of quality control policy established for Manufacturing Operations, AGC Propulsion Division. When referenced in NRO Report 2469E, these documents have been identified as QPs. (e.g. QP 15-1-9b)

Detailed procedures that are unique to the requirements of the NERVA Program are prepared by the NRO Product Assurance Manager, assigned a unique control number (-20 series) and issued through the MOQC procedural system. When referenced in NRO Report 2469E, the NERVA Quality Procedures have been identified as NQPs (e.g. NQP 15-1-21a)

REPAIR - An action whereby an item is made functionally acceptable for its intended use while remaining nonconforming in a nonfunctional manner.

REWORK - An action whereby an item is made to meet drawing or specification requirements by further processing.

APPENDIX A

STANDARD PRACTICE INSTRUCTION (SPI) - Interdepartmental and interdivisional policies and procedures covering activities which concern a plurality of activities within the AGC Propulsion Division.

STANDARD REPAIR - A repair action, based on an MRB-approved procedure which describes a method of repairing a specific nonconformance and is authorized for use for a specified period of time or on a specified quantity of pieces.

SUBCONTRACTOR - The individual(s) or concern(s) who enter into a contract or purchase order under a Government prime contract.

SUPPLIER - A contractor or subcontractor actually performing the services or producing the contract articles under a Government Prime Contract.

SUPPLIER DISCREPANCY ACTION REQUEST (SDAR) - An AGC form used by a supplier to report any nonconformance or discrepancies he knows exist on an item which he plans to deliver to AGC.

SUPPLIER INFORMATION REQUEST (SIR) - An AGC form used by a supplier to request information on, or modifications to, a drawing or specification prior to fabrication of the item.

SYSTEM - One of the principal functioning entities comprising the project hardware and related operational services within a project of flight mission. Ordinarily, a system is the first major subdivision of project work. Similarly, a subsystem is a functioning entity within a system. A system also may be a procedural entity which accomplishes a specific task, e.g., a quality system.

WAIVER - Granted use or acceptance of an article which does not meet specified requirements.

APPENDIX B

REFERENCE DOCUMENTS
NERVA PRODUCT ASSURANCE PROGRAM PLAN
NRO REPORT 2469 REVISION E

APPENDIX B

REFERENCE DOCUMENTS NERVA PRODUCT ASSURANCE PROGRAM PLAN NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	Document DATE OF ISSUE	Reference Page No. SECTION I INTRODUCTION	in Text SECTION II QUALITY
NASA/SNPO Documents	NPC 200-2	Quality Program Provisions for Space Contractors	4-62	1	1, 5, 10
	NPC 200-3	Inspection System Provisions for Suppliers of Space Materials, Parts, Components and Services	4-62	1	1
	SNPO-C ST-1A	NERVA Specification Tree	6-5-68	4	-
	SNPO-NPRD-1	NERVA Program Requirements Document	6-5-68	4	-
Other Govern-ment Documents	AFSCM 375-1,	Configuration Management	6-1-64	4	3
	AFSCM/AFLCM 310-1	Contractor Data Management	3-15-64	4	3
	MIL-STD-105D Change 2	Sampling Procedures and Tables for Inspection by Attributes	4-29-63 3-20-64	-	26
	MIL-STD-414	Sampling Procedures and Tables for Inspection by Variables for Percent Defective	6-11-57	-	26

APPENDIX B

REFERENCE DOCUMENTS NERVA PRODUCT ASSURANCE PROGRAM PLAN NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	Document	Reference Page No.	in Text
			DATE OF ISSUE	SECTION I INTRODUCTION	SECTION II QUALITY
Other Government Documents (Continued)					
	Handbook H 106	Multi-Level Continuous Sampling Procedures and Tables for Inspection by Attributes	10-31-58	-	26
	Handbook H 107	Inspection and Quality Control - Single Level Continuous Sampling Procedures and Tables for Inspection by Attributes	4-30-59	-	26
	Handbook H 108	Quality Control and Reliability - Sampling Procedures and Tables for Life and Reliability Testing (Based on Exponential Distribution)	4-29-64	-	26
AGC Propulsion Division Standard Practice Instructions and Manuals	-	Coordinated Aerospace Suppliers Evaluation Register	Revised Quarterly	2	2, 10
		Evaluated Suppliers List	Revised Quarterly	-	2, 10
	AGC-STD-9007C	Cleanliness Levels Components and Assemblies	1-15-68	-	16
	Volume I thru Volume VI	AGC Engineering Manual	Current	-	4

APPENDIX B
REFERENCE DOCUMENTS
NERVA PRODUCT ASSURANCE PROGRAM PLAN
NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	Document Reference DATE OF ISSUE	Page No. in Text SECTION I INTRODUCTION	SECTION II QUALITY
AGC Manufacturing Operations Quality Control Instructions and Procedures	QCI-2-2a	Receipt, Inspection and Control of Production Tooling	1-24-57	-	15
	QCI-4-1	Receiving Inspection of Materials	3-21-67	-	8
	QP-4-1-1a	Receiving Inspection of Inert Metal Parts	8-15-68	-	8
	QCI-15-1-0 Amendment I Amendment II	Sacramento Plant Noncon- forming Material Control Manual	4-1-66 5-18-66 5-19-68	-	9, 19
	QP-15-1-9b Amendment I	Preparation of the In- spection Report (IR) AGC 2-784/AGCS 0721-3	6-2-67 1-1-67	-	9
	QCI-16-1a	Indication of Inspection Status	5-6-66	-	9
	QP-16-1-1b Amendment I	Issuance, Control and Application of Quality Control Stamps	6-16-67 6-3-68	-	9
	QP-16-1-2b	Quality Control Tags, Labels or Forms used to Identify Quality/Inspection Status	8-19-68	-	9
	QCI-18-1	Shipping, Quality Control of	2-19-65	-	25
	QCI-19-2	Control of Government- Furnished Property	5-7-65	-	11
		AGC Measurement Standards Instruction Manual	Current	-	23

APPENDIX B

REFERENCE DOCUMENTS NERVA PRODUCT ASSURANCE PROGRAM PLAN NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	Document Reference DATE OF ISSUE	Page No. in Text SECTION I INTRODUCTION	SECTION II QUALITY
AGC NERVA Quality Procedures	NQP-3-4-21	Supplier Information Request REON	6-27-66	-	10
	NQP-3-4-22 Amendment I	SDAR Control - REON	6-27-66 8-16-67	-	10
	NQP-5-1-20	Control of Cleanliness of Fabrication, Assembly and In-Process Test Areas - NRO	Pending	-	16
	NQP-6-1-21	REON Product Assurance Test Control Plan	3-14-66	-	14
	NQP-11-1-21	Inspection Planning: Fabrication and Assembly Operation - REON	7-30-65	-	13
	NQP-12-1-21	Documentation Control - NRO PAD	3-10-67	-	9, 14, 18
	NQP-12-2-21a	End Item Reports - NRO	3-10-67	-	9, 29
	NQP-12-2-22a	Quality Assurance Data Books - NRO	3-10-67	-	9, 15, 17
	NQP-12-1-24	Quality Design Review - NRO	Pending	-	4
	NQP-12-2-24a	Buildup and Travel Log Books - NRO	6-30-67	-	15, 17

APPENDIX B

REFERENCE DOCUMENTS NERVA PRODUCT ASSURANCE PROGRAM PLAN NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	Document Reference DATE OF ISSUE	Page No. in Text SECTION I INTRODUCTION	SECTION II QUALITY
AGC Nerva Quality Procedures (Continued)					
B-5 AGC NRO Plans and Reports	NQP-15-1-21a Amendment I	Nonconforming Material Control - NRO	6-30-67 10-12-67	-	9, 19
	NQP-15-1-22a	Preparation of the Inspection Report (IR) - NRO	10-31-67	-	9
	NQP-15-1-23 Amendment I	Corrective Action System - NRO	2-28-67 8-16-67	-	30
	NQP-18-1-22	Supplier Director (DROP) Shipments - REON	6-29-66	-	25
	NQP-18-1-21	Shipping Material for Government Contracts - REON	5-15-65	-	25
	Pending	NERVA Program Data and Documentation Management Plan	Pending	5	-
	Pending	NERVA Program Configuration Management Plan	Pending	5	3, 4

APPENDIX B

REFERENCE DOCUMENTS NERVA PRODUCT ASSURANCE PROGRAM PLAN NRO REPORT 2469 REVISION E

DOCUMENT TYPE	DOCUMENT NUMBER	DOCUMENT TITLE	DATE OF ISSUE	Document Reference Page No. in Text	
				SECTION I INTRODUCTION	SECTION II QUALITY
AGC NRO Plans and Reports	RN-S-0465	NERVA Program Management Plan	4-68	-	12
	RN-HR-6813	NERVA Weekly Highlights Report		5	-
	-	Reliability and Quality Assurance Informal Progress Letter	Quarterly CY 1969	5	2
Major Participants Plans	NT0-A-0013	NT0 Product Assurance Program	CY 1969	2, 5	2
	WANL-TNR-088	WANL Product Assurance Program Plan	CY 1969	-	2

B-6