ATTACHMENT B

PRODUCT ASSURANCE REQUIREMENTS

A. GENERAL

1. Applicability

The Contractor shall plan, maintain, and implement a product assurance program for this contract in accordance with the requirements shown herein. These Product Assurance Requirements shall apply to all System articles (including instrumentation) designed, used, tested, and/or delivered, and meet the intent of corresponding requirements described in NASA Glenn Research Center's GLM-QE-8700.2 SPACE ASSURANCE REQUIREMENTS AND GUIDELINES (SARG) Revision C2, April 18, 2007.

2. Product Assurance Program Plan:

The Contractor shall prepare, maintain, and implement a Product Assurance Program Plan, which describes how the Contractor will assure compliance with the product assurance requirements shown herein. The Product Assurance Program Plan shall be submitted to NASA GRC for approval. The plan shall cover all product assurance program activities for the program and serve as the master planning and control document. The order of the plan shall be the same as the order in which the requirements are given in this Exhibit.

3. Management

The Contractor shall designate one individual to be responsible for directing and managing the Product Assurance Program. This individual shall have direct, unimpeded access to higher management and shall report regularly to the Contractor Program Manager on the status and adequacy of the program.

4. Government Product Assurance

The product assurance system of the Contractor is subject to continuous evaluation, review, and verification by NASA GRC or its designated Government representatives. Actions by or on behalf of the Government will determine not only whether the requirements of this Exhibit have been met, but also that the contract articles are of satisfactory quality and meet the intended design. Surveys of the Contractor's Product Assurance Program may be made by NASA GRC or its designated Government representative. The Contractor will be notified in advance of these visitations and written notice will be given of any unacceptable areas noted. An appropriate period of time within contracting limits will be given to correct these deficiencies. The Contractor's existing product assurance system will be considered adequate upon satisfactory demonstration to NASA GRC that it continuously provides a product assurance system that meets the requirements herein.

B. SYSTEM SAFETY

The Contractor shall perform a Preliminary Hazards Analysis (PHA) and an Operating and Support Hazard Analysis (O&SHA) of the System. The PHA and O&SHA shall be in accordance with MIL-STD 882D. Action shall be taken by the Contractor to preclude or minimize the effects of potential hazards found. The results of the PHA and O&SHA shall be documented and presented as a part of the PDR and CDR Design Reviews. Five copies of the PHA and O&SHA shall also be furnished to NASA as a part of the above mentioned Design Reviews.

C. RELIABILITY

1. Design Reviews

The Contractor shall establish and conduct a program of planned, scheduled and documented internal design reviews. They shall be conducted as appropriate to support the reviews specified in Exhibit A. Participation shall be inter-organizational, including personnel from design, fabrication, test, reliability, quality, parts application, safety and other areas of the Contractor's organization, as well as NASA representatives (at the discretion of NASA). All participating elements of the Contractor's organization, shall sign all design review reports to indicate concurrence with their completeness and accuracy. Follow up on action items shall be performed to assure or verify their satisfactory completion.

2. FMECA

The Contractor shall develop a Failure Mode, Effect, and Criticality Analysis (FMECA) of the System. The primary objective of these analyses shall be to identify critical failure areas, to enable removal of susceptibility to such failures or their effects from the System, and to minimize risk. A significant category is that of single point failures; these should be given particular attention throughout subsequent design, test, and project decision activities. The results of the FMECA shall be documented and presented as a part of an appropriate design review. Five copies of the FMECA shall also be furnished to NASA as a part of the above mentioned design review.

D. QUALITY ASSURANCE

1. Quality System

The Contractor shall maintain an effective and timely quality system to provide that non-conformances or other unsatisfactory conditions are discovered and corrected at the earliest practical point. The system shall provide for determining material and product quality from the time materials are procured until completion of the use of the articles in this program. The system shall provide recorded evidence of quality in the form of inspection and test results. The Contractor shall make this recorded evidence of quality readily available for on-site review by NASA GRC and/or its designated Government representative upon request.

2. Contractor's Obligation

The Contractor shall perform all inspections and tests, and provide all documentation, facilities, equipment, samples, materials, and assistance to NASA GRC or its designated Government representative to act on behalf of NASA, as required by the contract and this Exhibit.

3. Configuration and Change Control

The Contractor shall utilize a configuration control system to assure that articles are fabricated, inspected, and tested to the applicable drawing or specification, and that necessary changes are accomplished and so documented on the inspection records for the part, component, or assembly.

4. Procurement Source Control

The Contractor shall be responsible for adequate and effective control over his procurement sources to assure that materials, supplies, components, and services purchased for use on this contract meet all quality requirements. Adequate records of inspections and test performed at source shall be maintained. When it is neither practicable nor feasible to determine quality conformance at the Contractor's plant, the Contractor shall provide for non-Government source inspection and/or control. Purchase Orders shall be controlled to assure incorporation of all pertinent technical and quality requirements, including authorized changes.

5. Government Source Inspection Requirements

All orders shall include a statement that assures the following right: The Government reserves the right to inspect any or all of the materials included in this order at the supplier's plant.

6. Material Identification, Handling, and Storage

Adequate methods and facilities shall be established for controlling the identification, handling, and storage of raw and fabricated materials. These controls shall be maintained from the time of receipt of the material until completion of the use of the material in this program, and shall prevent damage, deterioration, loss or substitution.

7. Materials Control

Materials shall be inspected and tested (e.g., chemical and physical tests) to determine conformance to applicable specifications and drawings. Reports of actual test results shall be identified with the particular materials. The Contractor shall separate, and prevent the use of, raw materials which do not conform to requirements or which are awaiting completion and receipt of test results.

8. Process Control

The Contractor shall establish those inspections and controls over processes as necessary to assure compliance with quality requirements that are not readily detectable or measurable by inspection and test of finished articles. When approval or certification of special processes, operating personnel, special equipment, or procedures, is required by the drawing or specification, the Contractor shall obtain the necessary approvals or certification prior to processing the articles. These special processes include plating, anodizing, radiography, magnetic particle and liquid penetrant inspection, heat treating, welding, soldering, etc. Records of in-process inspections and control may be used as evidence of quality of end items, and may reduce but not eliminate further in-process fabrication, or end item inspection.

9. Inspection and Tests

The Contractor shall perform sufficient inspections and tests of all parts, components, and assemblies to assure, prior to test or delivery, that all articles conform to applicable drawings and specifications with respect to all details, such as workmanship, finish, construction, functional performance, weight, interchangeability, identification and marking. These inspections and tests shall include receiving, processing, fabrication, assembly, end item, and shipping phases. Written inspection and test procedures shall be prepared to make clear the details of the inspection and measuring equipment required, and detailed operations to be performed, and the criteria for determining quality conformance or rejection of articles. These procedures shall be made available for on-site review by NASA GRC or its designated Government representative on request.

10. Nonconforming Articles

Non-conforming articles are articles (or materials) that do not conform to applicable drawings, specifications, or other requirements. The Contractor shall provide for the review of nonconforming articles to control their use as articles offered for test and/or delivery. Nonconforming articles shall be identified and separated from normal work operations. When the Contractor wishes to offer the nonconforming articles for test, the following procedures shall be followed:

a. The Contractor shall establish a Review Board (RB), which will review all nonconforming articles. The RB shall consist of a cognizant engineer and a cognizant quality assurance representative. Decisions to accept nonconforming articles by the RB shall be by mutual agreement of the two members. RB decisions shall be documented and the documentation shall show the details of the nonconformity and the appropriate disposition such as repair, use as is, or reject.

b. Non-conformances which do not adversely affect safety, reliability, durability, performance, interchangeability, weight or basic objectives of the contract may be accepted. After RB decisions to accept this type of nonconformance, the Contractor shall submit three (3) copies of the inspection and RB decision documentation to NASA and shall maintain one (l) copy of the same documentation for inclusion in the Equipment Log. The documentation submittals shall be made monthly to NASA GRC.

c. Non-conformances which do adversely affect safety, reliability, durability, performance, interchangeability, weight, or the basic objectives of the contract may be accepted. Within ten (10) working days after a RB decision to accept this type of nonconformance, the Contractor shall submit three (3) copies of the inspection and RB decision documentation to NASA and shall maintain one (l) copy of the same documentation for inclusion in the Equipment Log. However, in these cases, NASA GRC may disapprove the Contractor's decision and RB decision documentation. The Contractor will be notified in writing of any NASA GRC disapprovals.

11. Inspection, Measuring, and Test Equipment Control

The Contractor shall provide and maintain suitable inspection, measuring, and test equipment of range, accuracy, and type necessary to assure conformance of articles to contract requirements. At intervals established to assure continued accuracy, each unit of inspection, measuring, and test equipment shall be calibrated against certified standards which have known, valid relationships to National Bureau of Standards. Records of calibrations performed shall be maintained. The due date, or other identification attesting to the due date, of the next calibration shall be displayed on each unit of inspection, measuring, and test equipment.

12. Inspection Status Indication

The Contractor shall maintain a system for indicating the inspection status of articles in a manner distinctly different from Government Inspection identification. This shall be accomplished by means of stamps, seals, decals or other methods of their application on individual articles, tags, routing cards, move tickets or other normal control devices associated With to the articles or their containers. Indications shall not be applied in any way which damages the articles or compromises their quality.

13. Inspection and Test Records

The Contractor shall maintain adequate records of all inspections and tests performed. The records shall provide evidence that the required inspections and tests have been performed, including part or component identification, inspection or test involved nature of non-conformances, and basic causes for rejection. These data shall cover both conforming and nonconforming items. When tests and inspections so require, the actual measurements and observations obtained shall be indicated, including any instrument multiplier factors. Where data or information is required to be recorded, the film, tape, or other media shall be identified with the characteristics being measured and any necessary instrument multiplier factors. Records of all inspections and tests shall be made available for on-site review by NASA GRC or its designated Government representative on request.

14. System Equipment Log

Throughout the inspection, assembly, and test of the System, the Contractor shall maintain a log as a means of documenting the continuous history of the item. The log shall be maintained in chronological order and account for all periods of time including

idle periods and any movements of the item. Entries shall be complete, self-explanatory and include, but not be limited to the following:

a. Date and time of entry (assembly and disassembly by date only).
b. Identity of test or inspection.
c. Environmental conditions.
d. Characteristics being investigated.
e. Performance parameter measurements including checkout tests.
f. Complete identification of instrumentation used.
g. Failure observations and failure report reference, when applicable.
h. Accumulated operating time on all items.
i. Complete configuration identification.
j. Serial number identification of all major components and parts.
k. Non-conforming article documentation.
l. Repair and maintenance records.
m. Record of pertinent, unusual or questionable occurrences involving the equipment.
n. Identity of individual making entry.

15. Government Furnished Equipment

Inspection - When property is furnished by the Government, the Contractor shall:

a. Upon receipt, inspect to detect damage in transit.
b. Inspect for completeness and proper type, size, or grade.
c. Provide for the protection, periodic inspections, and controls necessary to preclude damage or deterioration during handling or storage.
d. When contractually required, perform functional testing prior to further processing or installation to determine satisfactory operation.

16. Failure Reporting

For each functional failure occurring in the test program, the Contractor shall prepare an individual failure report. This report shall contain a complete description of the circumstances of the failure, analysis of causes, recommendations for corrective action, and corrective action taken. An interim issue of the reports issued each month shall be summarized in the Monthly Technical Progress Report. The status of failure reports still open (no final issue) from previous monthly reports shall be stated.

The failure report format shall be included in the Product Assurance Program Plan.

E. PRODUCT ASSURANCE REPORTING

Monthly reporting of significant Product Assurance accomplishments, activities, problems, and corrective action shall be included as a separate section of the Monthly Technical Progress Report. System Safety, Reliability, and Quality Assurance shall be covered.