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Multiprogram/Project Common Use Document

Quality Program Provisions For MSFC Test Area Contractors

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DOCUMENT HISTORY LOG

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Baseline		11/10/2005	This document supercedes MSFC-HDBK-1630 Rev. A, and was changed to MSFC-STD-3459 to comply with current documentation rules.

FOREWORD

This publication establishes tailored general and specific requirements for quality assurance programs for the MSFC Test Area activities. Requirements of this publication should be invoked contractually to the extent needed, and consistent with program, project and contract requirements. This document supercedes MSFC-HDBK-1630 Rev. A, and was changed to MSFC-STD-3459 to comply with current documentation rules.

This publication meets the necessary requirements of SAE AS 9100, "Quality Systems-Aerospace-Model for Quality Assurance in Design, Development, Production, Installation and Servicing." It is designed to provide requirements which address quality assurance programs for MSFC Test Area modification, buildup, activation, and operations.

Questions concerning the application of this publication to specific contracts shall be referred to the MSFC Safety and Mission Assurance Directorate.

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1. SCOPE

This Handbook establishes basic and detailed requirements for Quality Assurance programs for MSFC Test Area activation and operation. This document applies to MSFC on-site activities, and those off-site procurements as specifically identified by the Safety and Mission Assurance Directorate and the Contracting Officer.

MSFC shall invoke the requirements of this publication contractually in full or in part, as appropriate, to various flight, flight-related, ground systems and equipment, and research and development (R&D) test projects and services for testing at MSFC. This publication may also be invoked on subcontracts to the extent necessary to ensure the required quality of test articles, materials, structures, components and services. The contract shall specify which portions of this document are applicable. On programs where a formal contract does not exist, such as Independent Research and Development (IRAD) programs, Cooperative Agreements, Space Act Agreements and Memos of Understanding (MOUs), this document can be tailored for the establishment of an acceptable quality system. This document can also be used in conjunction with National Consensus Code (e.g. ASME) requirements.

This publication is consistent with the requirements of ISO 9001 and SAE AS 9100 for Quality Assurance requirements, but provides quality assurance requirements with emphasis on test and test-related activities and operations which may or may not involve flight hardware. For contractors who provide flight hardware quality assurance programs as required by NASA contracts, and who are also required to provide test activity support, applicable portions of this document shall be invoked for purposes of establishing an on-site quality program.

2. APPLICABLE DOCUMENTS

ISO 9001 *Model for Quality Assurance in Design, Development, Production, Installation and Servicing*

SAE AS 9100 *Quality Systems-Aerospace-Model for Quality Assurance in Design, Development, Production, Installation and Servicing*

MPR 7120.2 *Multiprogram/Project Common Use Documentation*

MWI 7120.4 *Documentation Preparation, Programs/Projects*

3. DEFINITIONS

None

4. GENERAL REQUIREMENTS

The contractor shall maintain an effective quality assurance system which shall include provisions for defining and verifying article, material, and service quality throughout all operations including procurement; fabrication, processing, assembly inspection, test, checkout, packaging, shipping, storage, maintenance, field use and delivery. The system shall include procedures for the identification, collection, storage, maintenance and disposition of quality records. These records, including records of inspections and test results, shall be maintained to demonstrate achievement of the required quality and the effective operation of the quality system. The system shall also ensure that any unsatisfactory conditions are discovered and documented and that remedial and preventive actions are taken at the earliest possible time.

The contractor's management approach shall include quality management system principles and continuous improvement as part of the overall project or contract management. The approach shall ensure that all activities and operations are organized to provide the highest quality goods and services, through such methods as appropriate planning, training, process controls, process verifications, inspections, teaming and employee motivation and recognition. The quality plan shall detail this approach.

4.1. Actions and Prerogatives of the Government

The operation and work of contractors and suppliers is subject to evaluation, review, audit, survey, and inspection by the NASA S&MA Directorate or its designated Government quality representative. When deemed appropriate, The government shall assess supplier qualifications through surveys or audits before issuance of a contract. The contractor or supplier shall be notified of deficiencies and the contractor or supplier shall take appropriate corrective action.

5.0 DETAILED REQUIREMENTS

5.1. Quality Assurance Plan

A Quality Assurance Plan shall be prepared and submitted as required by contract. The Plan shall outline the quality assurance program, which will be established for the specific activities required by the contract. The Plan shall reference and be supplemented by detailed implementing procedures. The types of implementing procedures to be written are listed in appendix A, however, the numbers and types of procedures will be determined by the scope of the contract. Plans and procedures are subject to review and approval by the MSFC Safety and Mission Assurance Directorate per the contract requirements. As applicable, the Quality Assurance Plan shall reference other contractually required plans, such as a Personnel Certification Plan, or a Government Property Control plan.

The Plan shall address the requirements detailed in this document, and shall either follow the format of this document or provide a cross-reference chart keyed to this document. The plan is subject to the approval of the contracting officer.

5.1.2. Organization

The contractor shall have an independent quality assurance function with organizational freedom to assess problems and to recommend and effect solutions. The contractor shall establish sufficient, well-defined responsibilities for all personnel performing quality program functions and define functional assignments for the implementation of the quality system. The effectiveness of the quality program functions and the ability of assigned personnel to objectively assess, document, and report findings shall be maintained during all phases of work and shall not be reduced by other considerations, such as the influence of engineering changes, rework, or rescheduling. The contractor shall designate one on-site individual responsible for directing and managing the quality program. This person shall have unimpeded access to the management level having full responsibility for the contract work and shall report regularly to higher management on the status and adequacy of the program.

5.1.3. Procedures

The contractor shall have written, approved procedures for activities, including the control of articles and materials during processing, transportation, handling, packaging, packing, storage, assembly, disassembly, test, inspection, and refurbishment. Procedures shall be written with clear, concise technical direction with sufficient detail to assure acceptable completion of the instruction, and shall include quality and safety requirements. The extent of detail shall be based on education, training, and experience of the personnel performing the activities.

The contract may be written to require either the use of MSFC furnished procedures, procedures developed jointly by the contractor and MSFC, or procedures developed by

the contractor with MSFC approval. Procedures shall be in compliance with applicable government regulations or directives.

Specific procedures shall be provided for limited life articles, and materials, electrostatic sensitive items, program critical hardware, test articles, ground support equipment, foreign object damage and debris (FOD) controls, and the maintenance of cleanliness levels, as applicable. Specific procedures shall also be established for handling, packaging, packing, and storage of hazardous materials.

Storage procedures shall be established, which will ensure that traceability and inspection status of items is maintained and that procedures for issuing articles and components will ensure that the correct items are released for processing.

5.1.4. Quality Records

The contractor shall establish a quality records system and designate an individual who will be responsible for controlling these records; controlling and tracking open work and test constraints; maintaining procedures and work authorizing documents, including "as run" procedures; and implementing configuration and change control procedures for drawings, procedures and specifications.

5.1.5. Training And Certification

Quality Assurance personnel shall have training, qualifications, certifications, and experience, appropriate for activities as required by the contract. Or, such training as is required shall be provided before performing or witnessing the required inspections or tests. The contractor shall ensure that all personnel required to be certified for the performance of their duties, such as nondestructive testing, welding, soldering, and handling of program critical hardware and propellants have evidence of the appropriate certification. Records of employee certifications shall be retained, and updated as required. Certified personnel shall be given a card identifying the certification that has been issued, and the card shall be on that person while performing his or her duties.

5.1.6. Government Property Controls

a. Contractor Responsibility The contractor shall be responsible for all Government Furnished Property (GFP) supplied by the Government in accordance with the provisions of the contract. Contractor responsibilities toward Government property shall include, but not be limited to, the following:

(1) Inspection upon receipt to detect damage in transit.

(2) Inspection for quantity, completeness, proper type, size, and grade as specified in procurement and shipping documents.

(3) Provision for the protection, maintenance, calibration, periodic inspection, segregation and controls necessary to prevent unauthorized use, damage, or deterioration during handling, storage, installation, or shipment.

(4) Maintenance of records which include:

(a) Identification and location of the property.

(b) Dates, types, and results of contractor inspections, tests and other significant events.

(5) To the extent required, perform functional testing to determine satisfactory operation before processing or installation.

b. Unsuitable Government Property. Any Government property found damaged, malfunctioning, or otherwise unsuitable for use, shall be immediately identified, segregated, and reported in accordance with Government procedures. Government property shall not be dispositioned, repaired, reworked, scrapped, replaced, or in any way modified, unless authorized by the NASA Contracting Officer or his authorized representative.

c. Additional Requirements. The contract requirements may entail the procurement, modification, construction, operation and maintenance of government test facilities, systems, or equipment which support test facilities, special support equipment, vehicles, or special test equipment. The contract may also require the receipt, processing, and testing of various test article components and systems. Where such requirements exist, the contractor's procedures shall take into account the complexity and type of GFP to be operated and maintained. Appropriate controls shall be incorporated into all phases of contract activity.

5.1.7. Quality Program Audits

The contractor's Quality Assurance plan shall describe the system for conducting audits of personnel, procedures and operations to verify whether quality and operational activities comply with requirements, and to determine the effectiveness of the quality system. Audits may be scheduled or unscheduled and shall include examination of products, processes and documentation and evaluation of actual operations as compared with established requirements. The results of audits, including recommendations for remedial and preventive actions, and the follow-up actions required to correct deficiencies, shall be documented and brought to the attention of the personnel having responsibility in the area audited. The audits and follow-up actions shall be carried out in accordance with documented procedures. Audit records shall be made available for review by the Government.

5.1.8. Procurement Controls

a. The contractor shall be responsible for the adequacy and quality of all purchased articles, materials and services.

b. Articles and materials shall be inspected upon receipt. When it is not practical or feasible to determine quality conformance upon receipt, the contractor shall assign quality assurance personnel to perform inspections at supplier facilities. When so assigned, the contractor will provide a list of duties, responsibilities, and authorities of his assigned quality assurance personnel to the Government representative at the contractor's facility.

5.1.9. Government Source Inspection

The need for Government Source Inspection (GSI) will be determined by the MSFC Safety and Mission Assurance Directorate or its delegated Government representative subject to the provisions of the contract inspection clause. Source inspection, performed by the Government on procured services, articles, or materials, shall not replace contractor verification and/or inspection nor shall it relieve the contractor of his responsibility for ensuring the quality of procured services, articles, and materials.

5.1.10. Procurement Document Controls

a. Procurement documents shall be controlled to ensure incorporation of applicable quality and technical requirements in accordance with subparagraphs b. and c.

b. Technical Requirements. Procurement documents shall incorporate or reference the appropriate technical requirements or specifications for articles, materials, or services to be provided. Applicable revisions shall also be indicated and documents provided.

c. Quality Requirements The following detailed quality requirements, as necessary, shall be included, or technical documents containing these requirements shall be referenced in the subcontracts. Applicable revisions of referenced documents shall be indicated and documents provided as necessary.

(1) Changes Suppliers shall notify the contractor of any proposed changes in design, fabrication methods, or processes previously approved by the contractor and obtain written approval of the changes from the contractor. Changed articles shall be clearly identified in a different manner from previous articles. When a proprietary item is procured by the contractor, the supplier shall be required to notify the contractor of changes.

(2) Purchased Raw Materials Purchased raw materials shall be accompanied with actual chemical and/or physical test results.

(3) Raw Materials Used in Purchased Articles Results of tests performed on specimens, or detailed analyses of supplier's acceptance test results on all raw materials that are required to satisfy specification requirements and which are employed in the fabrication of articles purchased on a subcontract or purchase agreement, shall be made available to the contractor upon request.

(4) Preservation, Packaging, Packing, and Shipping, Requirements for preservation, packaging, packing, and shipping of articles and materials shall be specified or referenced.

(5) Age Control and Life Limited Products Records for articles and materials having definite characteristics of quality degradation, or drift with age/use, shall indicate the date and test time or cycle at which useful life was initiated, the life or cycles used, and the date and test time or cycle at which useful life will be expended. When appropriate, specify that the articles and materials exhibit similar information. Suppliers shall ensure removal or rework of such articles and materials as required.

(6) Identification and Data Retrieval. Identification and data retrieval requirements shall be specified.

(7) Inspection and Test Characteristics. Characteristics to be subject to inspections or tests by the supplier shall be specified.

(8) Inspection and Test Records. Inspections and test records to be maintained by the supplier shall be clearly specified. Records to be provided to the contractor or his quality assurance personnel shall be specified.

(9) Resubmission of Nonconforming Articles or Materials. Nonconforming articles and materials returned by the contractor and, subsequently, resubmitted by the supplier shall bear adequate identification of such nonconformance, either on the articles, materials, or applicable supplier records. Reference shall be made to the contractor's nonconformance documents and evidence provided by the supplier that causes for nonconformances have been corrected and actions taken to preclude recurrence.

(10) Contractor Quality Assurance Activity at Source. When contractor quality assurance activity is required at a supplier's facility, the procurement document shall so indicate.

(11) Government Source Inspection (GSI). When the Government elects to perform inspection at a supplier's plant, the following statement shall be included in the procurement document;

"All work on this order is subject to inspection and test by the Government at any time and place. The Government quality representative who has been delegated NASA quality assurance functions on this procurement shall be

notified immediately upon receipt of this order. The Government representative shall also be notified forty-eight (48) hours in advance of the time articles or materials are ready for inspection or test."

(12) Procurements Other Than Those Requiring GSI. Procurements, which do not require Government Source Inspection, shall include the following Statement;

"The Government has the right to inspect any or all of the work included in this order in accordance with the inspection clause of the contract."

(13) Records Retention. Detailed requirements for retention of records shall be specified by the contract.

5.1.11. Supplier Selection

For articles and materials requiring fabrication or special processes, the contractor Quality Assurance organization shall have disapproval authority over any supplier considered to be unsatisfactory. This may require the establishment of a qualified suppliers list or an award survey at the supplier's facility. Periodic audits or surveys may be required to update the suppliers list or to ensure continued compliance with contract requirements.

5.1.12. Commercial Off-the-Shelf “COTS” Procurements

For procurements of some "COTS" items, such as valves and components for liquid oxygen and liquid hydrogen systems, or test equipment, the procurement documents should also specify delivery of manufacturer drawings, parts lists, and operating and maintenance manuals, as applicable.

5.2. FABRICATION AND PROCESS CONTROL

5.2.1 Fabrication and Process Planning

The contractor shall identify and plan the fabrication, processing, and where applicable, installation processes which directly affect the quality of test articles, facilities, pressure vessels, and related equipment. The contractor shall ensure that these processes are carried out in accordance with the following criteria:

a. approved work authorizing documentation defining the manner of production and installation;

b. the use of procedures where their absence would adversely affect quality;

c. use of suitable production and installation equipment;

d. compliance with drawings, specifications, design codes, quality plans, process parameters and other applicable documents;

e. monitoring and control of suitable process and product characteristics during fabrication, processing and installation;

f. the approval of processes and equipment;

g. workmanship standards shall be stipulated to the greatest practicable extent, with written examples or by means of representative samples.

5.2.2. Configuration Control

Configuration shall be established and maintained as required by the contract, and "as run" or "as built" documentation shall be provided to the government upon request.

5.2.3. Special and/or Critical Processes

The contractor shall provide, as part of the Quality Assurance plan, requirements for a documented listing of all special and/or critical processes, and the steps to be taken to monitor and control the processes. Documented procedures are required to ensure compliance with the specified requirements. Records shall be maintained for all qualified processes, equipment, and personnel, as appropriate,

5.2.4. Process Reviews

A system shall be maintained to ensure processes are documented and updated as "lessons learned" dictate.

5.2.5. Process Controls

The contractor's quality system shall maintain appropriate procedures and controls for critical processes, and include a method for dispositioninq hardware which is subjected to a critical process, when that process is determined to have fallen outside the specified parameters. This method shall be tailored to the type of hardware being produced and the effect of the process on the test objectives, or contract specifications. Process problems affecting the contract or the test objectives shall be reported to the cognizant contracting officer's technical representative (COTR), and government quality personnel.

For special or critical processes, if the process is not performed as the qualified process procedure describes, the cause of the departure, and corrective actions to be taken shall be determined. This shall include considerations such as process improvements, documentation improvements, operator training, and adequacy of the equipment and materials.

5.3 RAW MATERIAL CONTROLS

For applications where material properties are specified by drawings, specifications, or other applicable documents, the contractor shall purchase, or obtain from MSFC if available, raw materials with appropriate certification of chemical and physical test results. These materials shall be segregated, issued, and controlled in a manner to ensure

that traceability is maintained, and that use of incorrect materials is precluded. Material Usage Agreements (MUAs) or approval of the Materials and Processes Laboratory shall be obtained for liquid oxygen and liquid hydrogen service and when otherwise required. Environmental controls and cleanliness levels shall be established and maintained when required.

5.4. INSPECTION

5.4.1. Planning

Inspection planning shall be performed by the contractor's quality assurance organization for all phases of contract activity. Input shall be obtained from MSFC Quality Assurance Personnel, MSFC engineering, contractor engineering, test plans, codes, standards, specifications, safety assessments, and other appropriate sources, to establish criteria for mandatory inspection, monitoring, surveillance, and testing. The contractor's surveillance or Mandatory Inspection Points (MIPs) shall be designated in appropriate work-authorizing documentation. In cases where MSFC Quality Assurance has notified the contractor when government MIPs are required, the contractor shall establish a system to ensure that those MIPs are included in the documentation and that MSFC Quality Assurance Representatives are notified in a timely manner when those points are reached. Government inspections will not be used to take the place of contractor inspections. Government MIPs may not be bypassed without prior authorization of appropriate MSFC Quality Assurance personnel.

5.4.2. Receiving Inspection

The contractor shall establish a receiving inspection activity and written procedures for receiving inspection. These procedures will ensure that quality assurance personnel verify that articles, materials, and data packages comply with purchase order requirements, that nonconformances are documented, and that all items are segregated until conformance to requirements is verified. Procedures shall also define acceptance criteria and the extent of receiving inspection operations, such as whether items were source inspected by the contractor, whether additional testing or inspection is required, or whether items are "COTS". Procedures shall also take into consideration special handling and storage requirements of the articles and materials, such as static sensitive components or assemblies, software or hazardous materials.

5.4.3. Nondestructive Examination (NDE)

Applicable NDE methods shall be utilized to maintain high quality hardware. The contractor shall establish and implement an NDE program as required to fulfill contractual requirements. Qualification of personnel, procedures and equipment shall comply with the requirements of applicable codes and standards. Documentation shall be maintained for currently qualified personnel, processes, and equipment in accordance with the requirements of pertinent codes and standards.

The program shall include, but not be limited to the following: Documented training and certification of all personnel performing or witnessing NDE, implementing procedures, traceability to standards, and appropriate facilities to perform tests. The contractor shall ensure such things as: Training and certification procedures are approved; personnel are adequately trained and certified; techniques and procedures have been approved; compliance with approved procedures; tests conducted by certified personnel; facilities, equipment, and materials are certified and controlled as required; tests are properly documented; documentation and records are controlled.

If NDE is performed by a subcontractor, the contractor shall ensure that the subcontractor complies with the above requirements.

5.4.4. Records

All inspection records, reports, and other documentation shall be maintained and controlled as required by the contract.

5.5 DOCUMENT REVIEW AND CONTROL

5.5.1. General

Articles and materials shall be received, stored, processed, fabricated, inspected, and tested to applicable documents, including authorized changes thereto.

5.5.2. Document Control

A document control system shall be maintained, which provides for document distribution to the proper points at the proper times and removal of obsolete documents from operating areas. The system shall ensure proper authorization for changes by requiring changes be reviewed and approved by the same functions/organizations that performed the original review and approval unless specifically designated otherwise. The control system shall provide for initiation of document change requests. Changes which involve interface relationships, or which affect articles and materials controlled by others, shall be coordinated with the affected parties. These requirements shall be effectively integrated with other document control requirements of the contract.

5.5.3. Document Review

The contractor shall review the documentation required for the performance of the contract to ensure compliance with applicable MSFC or contractor requirements and procedures, and that all appropriate signatures and "buy-offs" have been accomplished prior to closeout. Documents shall not be destroyed without prior approval of the government.

5.5.4. Document Retention

Documents shall be retained as required by the Contract.

5.6. NONCONFORMANCE CONTROL

5.6.1. Nonconforming Article or Material

When an article or material does not conform to applicable drawings, specifications, or other requirements, for any reason, it shall be identified as nonconforming, segregated to the extent practicable, and held for review action.

5.6.2. Nonconformance Documentation

The contractor shall:

a. Ensure documentation of nonconformances that are discovered by contractor, subcontractor, supplier personnel and/or the designated Government quality representative.

b. Prepare and issue documents for each nonconformance containing, as a minimum:

(1) A unique and traceable number.

(2) The nomenclature and identification of the nonconforming article or material.

(3) A description of the nonconformance and the required characteristics or design criteria.

(4) Cause or reason for the nonconformance, and when detected.

(5) Remedial actions taken or recommended.

(6) Disposition of the nonconforming article or material.

(7) Signature of the document initiator.

(8) Signatures of authorized personnel.

c. Nonconformance documentation shall not be "closed" until implementation of the disposition has been verified. Closure shall be indicated by inspection stamp or signature. Electronic documentation systems shall be password protected.

5.6.3. Remedial and Preventive Action

The contractor shall:

a. Conduct appropriate analysis and examination of nonconforming articles, materials, or conditions to determine the cause or reason for the nonconformance.

b. Conduct timely and effective remedial action to ensure the correction of the article or material.

c. Conduct timely and effective preventive action to prevent recurrence of the nonconformance, including correction of technical documents, correction of other identical articles or materials at all locations, and the prevention of detrimental side effects.

d. Assign responsibility for follow-up of remedial and preventive actions to ensure accomplishment.

e. Notify responsible contractor or supplier organizational elements of nonconformances and the need for remedial and preventive actions.

f. Classify nonconformances as to criticality and process on a priority basis.

g. Closeout nonconformance documentation after verifying that effective remedial and preventive actions have been taken.

h. Appropriately document analyses and remedial and preventive actions.

i. Notify the MSFC Quality Assurance Representative and the Design and/or Test Engineer of nonconformances and their related remedial and preventive actions, as established by contract.

5.6.4. Initial Review Dispositions

a. Nonconforming articles or materials shall be reviewed initially by contractor engineering and quality assurance personnel and shall be subjected to one of the following dispositions:

(1) Return for Rework or Completion of Operation. If the nonconformance is in the category of "return for completion of operations" or "return for rework to drawings, specifications or procedures," the article or material shall be returned for rework or completion using established technical documents and operations. During such rework, the article or material shall be resubmitted to normal inspection and/or test operations.

(2) Scrap. If the article or material is obviously unfit for use, it shall be dispositioned in accordance with Government-approved contractor procedures for identifying, controlling, and disposition of scrap. Government property shall not be scrapped without approval of the contracting officer or designated representative.

(3) Return to supplier. When an article or material is found to be nonconforming on receipt, it may be returned to the supplier. The contractor shall provide the supplier with nonconformance information and assistance, as necessary, to facilitate remedial and preventive action.

(4) Submit to Material Review Board or MSFC. When the dispositions, as described above, are not appropriate, the nonconformance report shall be submitted to the Material Review Board (MRB) for final disposition if authorized by contract, or submitted to appropriate MSFC personnel for disposition.

(5) Reuse and Refurbishment. Test articles which are to be re-used will undergo degradation due to test conditions. Re-use and refurbishment criteria shall be developed by engineering and incorporated into processing

procedures. Standard Repair Procedures shall be developed, where appropriate and approved by the MRB.

b. Articles and materials disposed of without referral to MRB may be subject to a review of each case by the designated Government quality and engineering representative to verify contractor decisions.

c. Initial review dispositions shall be recorded on nonconformance documentation. For Government property, disposition shall not be implemented until appropriate procedures are provided and approved by the Government.

5.6.5. Tracking and Trending

If required by contract, the contractor shall maintain a system for tracking and trending of nonconformances and anomalies. The system shall be tailored to fit the needs of the contract.

5.7 MATERTAL REVTEW BOARD (MRB)

5.7.1. Authority

The contract shall specify whether MRB authority will be granted. MRB procedures shall be submitted to the MSFC Safety and Mission Assurance Directorate for approval, or as required by the contract.

5.7.2. Membership

The Material Review Board shall be comprised of contractor representatives whose responsibility is engineering, one contractor representative whose responsibility is quality, and designated Government quality and engineering representatives. Contractor members for the Material Review Board shall be selected by the contractor on the basis of technical competence and shall have sufficient authority to make appropriate dispositions of the article or material involved. Contractor personnel designated for membership shall be approved by the Government representatives.

5.7.3. Responsibility

The Material Review Board shall:

a. Evaluate the proposed disposition of submitted articles or materials designated as nonconforming.

b. Ensure that effective remedial and preventive actions are documented on the nonconformance document,

c. Provide contractor recommendations to the Contracting Officer concerning nonconformance dispositions requiring government approval and verify implementation after approval is obtained.

d. Ensure that accurate records of MRB actions are maintained.

5.7.4. MRB Dispositions

The appropriate design engineer shall propose a repair, use-as-is, or deviation disposition. Complete rationale for the disposition shall be presented to the Material Review Board members for evaluation. Dispositions, other than scrap, require the unanimous agreement of the Board members. In determining dispositions, the Board shall: consider the effect of the nonconformance upon the intended use, review records of earlier review actions affecting the same article or material, and consider the recommendations of personnel acting in an advisory capacity. The board shall specify approval of the disposition, as defined below.

a. Repair When, in the opinion of the Board, an acceptable repair is possible, repair action may be authorized. Rationale shall include appropriate analysis information. Procedures shall be established to perform this repair and shall be approved by the MRB. Procedures shall include appropriate inspections, tests and retests to verify the acceptability of the repair.

b. Scrap If the article or material is unfit for use, it shall be dispositioned in accordance with Government approved contractor procedures for identifying, controlling, and disposing of scrap.

c. Use As Is Nonconformances, which do not adversely affect safety, reliability, durability, performance, interchangeability, weight, or the basic objectives of the contract, may be accepted for use as is. The rationale for making a “use as is” disposition shall be documented on or attached to the nonconformance report, along with appropriate analysis information.

d. Standard Repair Standard repair procedures shall be developed where appropriate and approved by the MRB. Work authorizing documentation which implements the repair shall be traceable to the standard repair procedure. These shall not be used in lieu of engineering changes, process changes or other remedial actions.

e. Conditional Use This is a repair or use-as-is disposition which places constraints on the use of an item. Examples are: downgrade for test, use on a limited number of cycles, or derated capacities. Exact conditions or constraints shall be specified and the item marked or tagged to identify the limits.

f. Request NASA Contracting Officer Approval Nonconformances which do adversely affect safety, reliability, durability, performance, interchangeability, weight, or the basic objectives of the contract shall be referred to the NASA Contracting Officer. MSFC Form 847, “Deviation Approval Request” shall be submitted.

5.8 STAMP CONTROL SYSTEM

5.8.1. Stamp Requirements

The contractor shall establish and maintain a documented stamp control system, including written procedures, which provide for the following:

a. Stamps shall identify that articles and materials have undergone source and receiving inspection, in-process fabrication and inspection, end-item fabrication and inspection, end-item testing, storage, and shipment as applicable.

b. Stamps shall be traceable to each individual responsible for their use and records shall be maintained to identify individuals with specific stamps. Technician and inspection stamps shall be of different design.

c. Stamps shall be applied to records to indicate the fabrication or inspection status of associated articles and materials.

d. Stamps shall be applied to tags, cards, or labels attached to individual articles and materials or their containers, as appropriate.

e. Stamps indicating that fabrication, inspection or test operations have been performed may be applied directly to articles and materials, except when this is impractical due to physical limitations of the article or such applications will compromise their quality.

f. Stamping methods and marking materials must be compatible with the articles and their use.

g. Stamps issued to personnel being transferred or terminated shall be returned and shall not be reissued for a period of six months; Worn or damaged stamps shall be destroyed at the time replacements are issued.

h. Electronic work authorizing document systems shall include password protection for electronic stamps of buy-offs.

5.8.2. Stamp Restriction

Contractor's stamps shall not contain the designation "NASA," nor resemble government stamps in any manner.

5.9. SAMPLING

Sampling plans shall be generated in compliance with the contract, if applicable. These plans will be designed to comply with appropriate codes and standards, and are subject to review and disapproval by the government.

5.10 METROLOGY CONTROLS

5.10.1 General

The contractor shall establish and utilize a documented metrology system to maintain calibration on all Inspection, Measurement, and Test Equipment (IM&TE) associated with the following:

a. Where test equipment accuracy and dependability is essential for the safety of personnel

b. Used to perform acceptance testing, inspections, maintenance, calibration, and/or qualification of flight hardware or ground support equipment that interfaces with flight hardware, telecommunication, transmission, and test equipment where exact signal interfaces and circuit confirmations that are essential to mission success, development testing, or special applications where the specification/end products and data are accuracy sensitive

IM&TE shall be selected and controlled to the degree necessary to meet the requirements of the contract.

5.10.2. Acceptance

Prior to acceptance, the contractor shall ensure that all IM&TE used for inspecting and/or testing conforms to the acceptance requirements. Documented results of the inspection and/or tests shall be maintained by the contractor.

5.10.3. Evaluation

All IM&TE shall be evaluated under intended operating conditions to verify that:

a. When used in the intended measurement process, the IM&TE measure the desired characteristics to the required accuracy and provide the desired indications or records.

b. The IM&TE is compatible with the configuration of related hardware and environmental conditions.

c. Operating instructions are correct and complete. Documented results of the evaluations shall be maintained by the contractor.

5.10.4. Article or Material Measurement Processes

Random and systematic errors in any article or material measurement process shall not exceed 10 percent of the tolerance of the article or material characteristic being measured, Authorization for exception shall be requested from MSFC.

5.10.5 Calibration Controls

a. Calibration Services The contractor will determine if Government-owned IM&TE shall be calibrated to meet the requirements of the contract by the MSFC Calibration Facility, Outside Calibration Vendor (OCV), or by an approved company process. Non-Government-owned test equipment shall have a proof of calibration certificate and traceability to a nationally or internationally recognized standards organization, such as the National Institute of Standards and Technology. Contractors that use non-Government-owned test equipment shall, at a minimum, meet ISO9001 or SAE 9100 requirements. The MSFC Safety and Mission Assurance Representative shall approve the use of this equipment by verifying the calibration certification and traceability.

b. Traceability All calibrated IM&TE shall be traceable to international or national standards [I.E. National Institute of Standards and Technology (NIST)] or their values shall be derived from a controlled measurement process utilizing fundamental or natural physical constants with values assigned by NIST.

c. Handling Storage, and Transportation All measurement standards and equipment shall be handled, stored and transported in a manner which shall not adversely affect quality nor result in hazardous conditions

d. Identification and Labeling All measurement standards and equipment shall be uniquely identified and labeled, tagged or coded to indicate calibration status and due date of next calibration.

e. Calibration Intervals The period for a given piece of IM&TE shall be as recommended by the manufacturer. In the absence of a recommendation from the manufacturer, the interval shall not exceed 1 year. Changes to the Calibration Interval shall have justified rationale. This information will be documented and maintained for the life of the IM&TE by the contractor.

f. IM&TE Calibration Categories. All Government-owned and Non-Government-owned IM&TE used in measurement processes shall be calibrated and entered into the Marshall Calibration Management System (MCMS). IM&TE not recalibrated by the recall due date shall be removed from service or otherwise restricted from use. Authorization for exception shall be obtained from the MSFC Safety and Mission Assurance Directorate, and cognizant engineering and customer personnel. The contractor shall identify, maintain, and label all IM&TE according to the following categories:

1. Category I. Recalled IM&TE calibrated on an established interval.
2. Category II. IM&TE calibrated upon request. Infrequently used IM&TE should be included in this category
3. Category III IM&TE that is not calibrated

4. Category IV IM&TE that is calibrated prior to use or on a periodic interval by the using organization.
5. Category V IM&TE that is calibrated initially as part of the manufacturing process and requires no periodic calibration because the item is a physical object whose properties are intrinsic and remain stable with respect to time and use

g. Calibration Records The contractor shall maintain individual records of IM&TE to the extent required by the contract. These records shall include but not be limited to the following:

1. Identification of IM&TE to be calibrated.
2. Identification of IM&TE and calibration procedure utilized in the calibration process.
3. Calibration intervals.
4. Dates and results of each calibration.
5. Due date of next calibration.
6. Individuals performing calibration.
7. Calibration facility.
8. Degree of nonconformance of IM&TE received for calibration.
9. Location of equipment.

5.10.6. Environmental Requirements

Environmental characteristics (e.q. temperature, humidity, vibration, cleanliness) shall be compatible with the accuracy requirements of the article and material and calibration measurement processes.

5.10.7. Remedial and Preventive Action

The contractor shall establish a tracking record for IM&TE utilized in paragraph 1 above in the event a piece of IM&TE is found to be out of calibration or found to be suspect during or after use. This tracking record shall identify the serial number or NASA Calibration Control Number and calibration due date of the Category I, Category II, and Category IV IM&TE used. Calibration of Category IV equipment prior to use or on a periodic interval shall be noted in the tracking record. The contractor shall identify when the IM&TE was used and perform any required re-inspection or re-tests.

5.11 TEST ARTICLE REQUIREMENTS

5.11.1. General

For contracts involving test article requirements, the contractor's procedures shall provide adequate controls and documentation for the intended purpose of the test.

5.11.2. Test Article Controls

For qualification, for acceptance testing, for flight or program critical hardware, for hardware which could be used as flight hardware at a later date, or for development test articles as required by contract, procedures should reflect the level of detail required to document configuration, time/cycle, nonconformance dispositions, and all appropriate inspections, tests, retests, and software controls. Hazardous items such as solid propellant rocket motors shall be processed in accordance with all contractual safety requirements, with sufficient inspection points to ensure safe operations with trained or certified personnel.

Appropriate pre-test and post-test inspections shall be determined and incorporated into the work authorizing documentation, including photographs, measurements, and other data as appropriate.

5.11.3. Procedures

Procedures shall include appropriate instructions for maintenance of required cleanliness levels. Transportation and handling procedures shall be tailored to the expense and criticality of the test article and the hazard involved in the operation.

5.11.4. Hardware Handling Requirements

The contractor shall support handling reviews, comply with MSFC safety and program critical hardware requirements, establish interfaces with other cognizant contractor personnel, and conduct all inspections, tests and operations with the controls appropriate to ensure successful completion of required tasks. The contractor shall supply information and documentation as required for Operational Readiness and Test Readiness reviews.

5.11.5. Ground Support Equipment and Special Test Equipment

Ground Support Equipment and Special Test Equipment which is specially designed and fabricated for interface with the test article shall be operated and maintained in a manner to ensure that it is kept operational, or that any nonconformances are documented, dispositions implemented, and that the item is segregated or tagged in such a manner to preclude use pending implementation and verification of the disposition, and that configuration is controlled.

5.12 FACILITIES, GROUND SUPPORT SYSTEMS AND SERVICES

5.12.1. Procedures

For contracts requiring facility or ground systems construction, fabrication, modification, buildup, activation, operation and maintenance, the contractor shall establish the

appropriate procedures, or verify compliance with government furnished procedures, which will ensure that all contractual requirements are satisfied.

5.12.2. Configuration Control

The contractor quality activity shall support fabrication operations to ensure that work authorizing documents contain all required information and that work is performed in accordance with drawings, specifications, standards, codes or other applicable instructions. Configuration shall be verified during system baselining and maintained after the system has been activated. Drawings, schematics, component data and other pertinent configuration information will be traceable to approved work authorizing documentation and maintained per contract requirements.

5.12.3. Work Authorizing Documents

All work shall be accomplished using approved and released work authorizing documents. Changes and deviations shall be documented and approved per MSFC directives, as specified by contract. Work authorizing documents shall include, but not be limited to, instructions or procedures for:

a. Precision cleaning or verification to ensure that cleanliness levels meet the required specification.

b. Maintaining required cleanliness.

c. Verification that welding is in accordance with applicable codes and standards, and that welders are appropriately certified.

d. Verification that non-destructive testing is performed by certified personnel in accordance with applicable codes and standards.

e. Inspection of materials to ensure compliance with drawing or specification requirements and material usage agreements.

f. Use of special equipment and verification of proof test, and calibration.

g. Handling of solid and liquid propellants, pressurants, and pressurized systems as required by regulations and Safety directives.

h. Tests or retests.

i. Construction, installation, operation and maintenance.

5.12.4. Nonconformances

Nonconformances shall be documented and dispositioned using the contractor's procedures and forms or MSFC forms as directed by the contract.

5.12.5. Documentation

The contractor, as required by the contract, shall supply information and documentation, and will support Operational Readiness Inspection (ORI) activities, and Test Readiness Reviews. The contractor shall track open work and maintain (or provide information to the appropriate contractor) an open items list to support test activities.

5.13 TEST OPERATIONS

5.13.1. Surveillance

Test surveillance or monitoring shall be provided for during the performance of Facility Activation Procedures (FAPs) Facility Operation Procedures (FOPS), Test and Checkout Procedures (TCPs), and other testing as defined by contract requirements and work authorizing documents. The contractor shall ensure such things as: procedures are approved; compliance with approved procedures; documentation of test anomalies; current calibration or proof loading of equipment; compliance with precautions; identification and closeout of constraints; that the crew is properly trained, briefed and certified when required; that configuration is properly established; that open work is identified, and that changes to baselined systems are properly documented. These requirements shall also be complied with for installation, removal, assembly, disassembly and refurbishment procedures.

5.13.2. Test Records

All records pertaining to the test such as, "as run" FAPs, FOPS, TCPs, plots and graphs, and electronic media, shall be collected, indexed, filed; stored and maintained as appropriate. All records shall be legible and identifiable to the test involved. Records shall be stored and maintained in such a way, that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and to prevent loss. With electronic media, special care shall be taken to prevent storage in the proximity of electromagnetic generators.

5.13.3. Nonconformances or Test Anomalies

Nonconformances or test anomalies shall be documented and dispositioned using the contractor's procedures and forms or MSFC procedures and forms as directed by the contract.

5.14 POST-TEST AND REFURBISHMENT OPERATIONS

The contractor shall maintain post test inspection, disassembly, refurbishment, and maintenance procedures for test article, GSE, STE, and facilities. All post-test work shall

be conducted using approved work authorizing documents. Configuration shall be maintained. All nonconformances and/or test anomalies shall be closed as soon as possible.

5.15 CUSTOMER SATISFACTION AND CONTINUAL IMPROVEMENT

5.15.1 Customer Satisfaction.

The contractor shall establish and maintain a system for obtaining and assessing customer satisfaction data. This data shall be used to assess the need for process changes where needed.

5.15.2 Continual Improvement

The contractor shall continually improve the effectiveness of the quality management system. Methods for obtaining data for areas needing improvement shall include but not be limited to: audits, customer satisfaction, lessons learned, employee suggestions, nonconformance and mishap trends, root cause analysis, assessment of new technology, and other methods as appropriate for the contract.

6.0 NOTES

MSFC–STD-3459 replaces MSFC-HDBK-1630A. This change was made due to NASA rules review requirements.

APPENDIX A

Implementing Procedure Examples:

a. Configuration Control
b. Control of Government Property
c. Design Control Program
d. Fabrication Controls
e. Facility Activation Procedure Quality Assurance
f. Facility Operation Procedure Quality Assurance
g. Government Source Inspection
h. Identification and Tagging
i. Material Control
j. Material Review Board
k. Materials and Services Control
l. Nonconforming Articles and Materials
m. Personnel Certification Program
n. Processing of Work Authorizing Documents
o. Procurement of Articles
p. Qualification and Use of Special Processes
q. Receiving Inspection
r. Scheduling, Conducting, and Reporting Quality Audits
s. Stamp Identification Use and Control
t. System Baselining
u. Test Anomaly Reporting
v. Test, Inspection, and Evaluation

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