SSP 41173
Revision C

Space Station Quality Assurance Requirements

International Space Station Program

Revision C

September 30, 2003

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas

REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
-	SRR Baseline issue (Reference SSCD: 000002)	02-11-94
A	Revision A reflecting NASA/Prime technical convergence agreements – Ref. 8-31-94 MOU (Reference SSCD 000082 Eff. 11-04-94)	11-07-94
B	General Update, including post-production and on-orbit support per SSCN 6508	11-26-02
C	Revision C incorporates a complete update to Section 3.7 NONCONFORMING ARTICLES AND MATERIALS, changes to the glossary definitions, and minor changes to the wording in Sections 3.1.6 and 3.6.1 (Reference SSCN 007718)	09-30-03

ERU: /s/ Mary C. Nooney 11-26-02

PREFACE

SPACE STATION QUALITY ASSURANCE REQUIREMENTS

International Space Station (ISS) Quality Assurance (QA) and Software Quality Assurance (SQA) requirements are defined and controlled in this document. In the implementation of QA and SQA requirements, consideration shall be given to criticality, complexity, state of hardware or software development and unit and life cycle costs. The methods for implementing these requirements shall be described in the QA and SQA plans. This document is under the control of the Space Station Control Board (SSCB) and any changes or revisions to this document shall be approved by the Program Manager.

Program Manager,
International Space Station

Date

INTERNATIONAL SPACE STATION ALPHA PROGRAM

SPACE STAION QUALITY ASSURANCE

SEPTEMBER 30, 2003

CONCURRENCE

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INTERNATIONAL SPACE STATION PROGRAM

SPACE STATION QUALITY ASSURANCE REQUIREMENTS

LIST OF CHANGES

SEPTEMBER 30, 2003

All changes to paragraphs, tables, and figures in this document are shown below:

BOARD	ENTRY DATE	CHANGE	PARAGRAPH(S)
SSCB 000002	02/07/94	Baseline	All
SSCD 000082	11/07/94	Revision A	3.0, 3.4.2.3, 3.4.3.3.3, 3.5.2.3
	09/30/02	Revision B	All
SSCN 007718		Revision C	1.2, 3.1.6, 3.4.2.2, 3.6.1, 3.7, Appendix A, Appendix B

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1.0 INTRODUCTION

1.1 PURPOSE

This document establishes programmatic Quality Assurance (Section 3.0) and Software Quality Assurance (Section 4.0) requirements for the design, development, production, assembly, integration, test, and operation of the International Space Station and includes post-delivery and on-orbit QA requirements.

Quality Assurance encompasses quality management, quality planning, quality improvement, quality control, and quality engineering functions performed by QA representatives comprised of Quality Management, Quality Assurance, Quality Improvement, Quality Control and Quality Engineering personnel and their designated representatives.

For the purpose of this document, the term Customer shall be interpreted to mean the procuring or receiving organization (i.e., Buyer) and includes the ultimate receiving organization (i.e., National Aeronautics and Space Administration (NASA) or International Partner/Participant). The term Provider shall be interpreted to mean the organization providing product for the ISS (includes IP/P, contractor, subcontractor, supplier). These terms are used interchangeably within this document.

1.2 SCOPE

These QA and SQA requirements are applicable to the NASA, prime contractors, Tier 1 subcontractors, suppliers, and any organization that provides, processes, or has custody of hardware and/or software for use on the International Space Station.

These quality requirements are applicable to all International Space Station (ISS) hardware and software designated as flight components, subsystems, systems, and/or equipment including Flight Support Equipment (FSE) and Orbital Support Equipment (OSE). These quality requirements are also applicable to Ground Support Equipment (GSE) that: 1) either physically or functionally interfaces with flight hardware/software; 2) could by its malfunction cause loss of life or loss/damage to flight, GSE, or facilities hardware/software; and/or 3) generated data used in determining flight worthiness/certification and acceptance of deliverable items. These quality requirements may be tailored for other GSE as appropriate to the mission and intended useful life. Non-deliverable Test Support Equipment (TSE) and Factory Equipment (FE) may be tailored to the appropriate company. TSE and FE that are determined to be deliverable must meet the requirements applied to GSE, as identified above.

1.3 MANAGEMENT APPROACH

Management of QA and SQA shall include the following:

1.3.1 Defining the major QA and SQA tasks. Assuring that these tasks are integrated into and performed during the applicable program phases(s).

1.3.2 Evaluating the quality of the hardware, software, and operations through analysis, tests, reviews, and assessments.

1.3.3 Providing status through program reviews and as a part of program status reports.

1.3.4 Ensuring compatible QA and SQA requirements among manufacturing, assembly, integration, test, launch, return, ground operations, on orbit operations, repair, maintenance, and refurbishment.

1.3.5 QA and SQA plans shall be prepared. These plans shall define the tasks and products of the QA and SQA activities and the organizational responsibilities for implementing these tasks. The plans will provide visibility of QA and SQA activities to be accomplished during the life of the ISS program.

1.4 PRECEDENCE

In the event of a conflict between the QA and SQA requirements set forth in this document and other Space Station Program (SSP) requirements documents, handbooks, or other sub-tier procedural documents, the requirements defined in this document shall take precedence. In the event of a conflict between this document and an International Partner/Participant bilateral agreement document, those agreed to documents shall take precedence.

1.5 INDEPENDENT EVALUATIONS

The Customer reserves the right to appoint independent representatives to assist in QA and SQA evaluation activities. These representatives will provide technical support to the Customer and determine the effectiveness of and recommend improvements for the QA and SQA activities.

1.6 DATA REQUIREMENT DESCRIPTIONS

Deliverable Data Requirements (DRs) which define the applicable QA and SQA documentation requirements for the Customer are contained in the applicable Contract, Statement of Work, bilateral agreement, or other binding document between the customer and the provider. This represents the basic set of DRs for use in all NASA ISS procurements. Prime contractors and their major subcontractors have the flexibility to add, combine, separate, expand, or tailor the NASA DRs as appropriate in their QA/SQA requirement flow-downs, but the basic DR obligations are mandatory at the prime contractor and major subcontractor levels. However, prime contractors cannot delete QA/SQA DRs in their flow-downs to their major subcontractors.

1.7 MILESTONE REVIEWS

QA and SQA activities shall include supporting internal and supplier design reviews, Customer, NASA and International Partner/Participant (as applicable) design and

readiness reviews. Participation in milestone reviews shall assure that QA and SQA requirements are adequately considered and satisfied.

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The documents in this paragraph are applicable to the extent specified herein. Inclusion of applicable documents herein does not in any way supersede the order of precedence as identified in the contract or bilateral agreement. The references show where each applicable document is cited in this document. "Current Issue" is shown in parentheses in place of the specific date and issue when the document is under an ISS Control Board control. The status of the documents identified by "Current Issue" may be determined from the ISS Program Automated Library System (PALS).

DOD-STD-2168 Rev. Base Date: April 29, 1988	Defense System Software Quality Program (Ref. 4.0)
MIL-STD-105 Rev. D Date: April 29, 1963	Sampling Procedures and Tables for Inspection by Attributes (Ref. 3.11.1)
MIL-STD-414 Rev. Base Date: June 11, 1957	Sampling Procedures and Tables for Inspection by Variable for Percent Defective (Ref. 3.11.1)
MIL-STD-45662 Rev. A Date: August 1, 1988	Calibration System Requirements (Ref. 3.8)
NPD 2810.1 Date: October 1, 1998	Security of Information Technology (Ref. 4.4)
NPG 2810.1 Date: August 26, 1999	Security of Information Technology (Ref. 4.4)
SSP 30223 (Current Issue)	Problem Reporting and Corrective Action System Requirements for the Space Station Program (Ref. 3.7.6, 4.3)
SSP 30312 (Current Issue)	Electrical, Electronic and Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program (Ref. 3.3.1.5)
SSP 30695 (Current Issue)	Acceptance Data Package Requirements Specification (Ref. 3.6.4.2)
SSP 41170 (Current Issue)	Configuration Management Requirements (Ref. 3.3.1, 3.3.1.1, 3.3.1.1.2, 3.3.1.1.3, 3.3.1.1.3.1, 3.6.3, 3.7.5.1.3, 3.7.5.1.4.4, 3.7.5.2.2.2, 3.7.5.2.3)
SSP 50276 (Current Issue)	Depot/Manufacturing Facility Certification Plan (Ref 3.7.5.2.1.2)

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the User in the application of this document. These documents may or may not be specifically cited within the text of this document.

D684-10020-01	Program Master Integration and Verification Plan
ISSP-JPD-327 (Current Issue)	Maintenance Action Request – Ground Based Maintenance
MIL-STD-1520C Date: 27 June 1986	Corrective Action and Disposition System for Non-conforming Material
NPG 6000.1D	Requirements for Packaging, Handling, and Transportation ...Equipment and Associated Components
NPG 8735.2 Date: August 15, 2000	Management of Government Safety and Mission Assurance Surveillance Functions for NASA Contracts
SSP 30233 (Current Issue)	Space Station Requirements for Materials and Processes
SSP 30524 (Current Issue)	Problem Reporting and Corrective Action (PRACA) Data System (PDS) Requirements Definition Document (RDD)
SSP 50231 (Current Issue)	Safety & Mission Assurance Certificate of Flight Readiness Implementation Plan
SSP 50123 (Current Issue)	Configuration Management Handbook
SSP 50287 (Current Issue)	Hardware/Software Acceptance Process

3.0 QUALITY ASSURANCE REQUIREMENTS

The requirements in the following paragraphs are the basic quality assurance requirements for ISS Program hardware and software.

3.1 MANAGEMENT AND PLANNING

3.1.1 PLANNING

Quality Assurance (QA) activities shall be planned and developed to be an integral part of Space Station design, development, test and evaluation, production, operational activities and refurbishment/overhaul. Scheduled status reporting will be used to provide visibility and assist in controlling the QA effort. Objectives will be to plan and establish the QA effort to define the major QA tasks and their place as an integral part of the design, development, and operations process and to assure the effective implementation of QA requirements. QA program planning shall address all program phases and shall provide a comprehensive management approach to preventing, detecting, documenting, and resolving actual or potential nonconformances.

3.1.2 ORGANIZATION

Organizations and personnel responsible for implementing and performing QA functions shall have well defined responsibilities, authority, and organizational freedom to develop and implement QA disciplines and controls. One designated person shall have the responsibility and authority for directing and managing the QA activity. That person shall have unimpeded access to the management level having full responsibility for the program/project work and shall report regularly on the status and effectiveness of quality activities.

3.1.3 QUALITY PROGRAM PLAN

QA shall prepare, implement, and maintain a QA program plan which describes the compliance with requirements set forth herein. The QA program plan content shall be readily identifiable with each cited requirement and shall cover all quality activities. The Provider's quality procedures which define involvement by the Customer shall be reviewed and approved by the Customer. New or existing policies and procedures with no Customer involvement shall be available for review. The QA program plan shall serve as the master planning and control document and shall be submitted in accordance with contract or bilateral agreement data requirements.

3.1.4 MANAGEMENT ASSESSMENT DATA

QA shall provide periodic quality progress and status reports/metrics to their respective program management office and the Customer.

3.1.5 TRAINING

3.1.5.1 QA shall provide input into training courses used in the various QA disciplines for submittal to NASA for inclusion in the flight crew training program. Included shall be courses for on-orbit verification methods, techniques, and equipment unique to the hardware being developed.

3.1.5.2 QA shall assure development, implementation, and maintenance of a documented training program for special processes. Personnel performing or inspecting special processes shall be trained and certified. Evidence of personnel certification shall be available in the area where duties are being performed. Personnel re-certification shall be required as a result of unsatisfactory performance, changes in techniques or required skills, and/or extensive interruption of work performance. Records of training, testing, and certification status of personnel shall be maintained and shall be available for review by the Customer or its delegated representative.

3.1.6 INTERNAL QUALITY PROGRAM AUDITS

3.1.6.1 QA shall conduct audits of task performance, procedures, and operations which implement the quality program. Assessments shall be conducted periodically as appropriate with program maturity and shall be performed by personnel not having specific line responsibilities in those areas. Each audit shall include an examination of operations and documentation, evaluation of actual operations as compared with each established requirement, documentation of discrepancies and deficiencies, and recommendations for corrective action, as appropriate. A corrective action plan which addresses measures to be taken to correct the discrepancies/deficiencies noted during the audit shall be prepared and approved. Follow-up activities shall include reviews to ensure that measures required by the corrective action plan are being implemented properly.

3.1.6.2 The results of audits shall be documented in a report to management. Management action shall be taken to ensure correction of the reported deficiencies. Follow-up reviews shall be made to ensure that required corrections have been implemented.

3.1.6.3 Records of the provider’s internal audits shall be available for review by NASA, the Customer or its delegated representative.

3.1.7 MILESTONE REVIEWS

QA activities shall include supporting project milestones such as design, acceptance, and readiness reviews. Participation in reviews shall assure that quality requirements are considered in decisions which affect hardware design, configuration controls, initiation of subsystem and integrated testing, delivery, shipment, and certification of readiness for flight. QA data presented will contain sufficient detail to allow management to assess the acceptability to proceed with the next program phase activity.

3.1.8 ON-ORBIT OPERATIONS PLANNING

QA shall develop a plan for evaluating and verifying on-orbit activities including assembly, planned and unplanned maintenance and hardware upgrades. Planning shall identify required verifications, tools (when required), frequency of verifications, calibrations (when required), and associated training. Results of on-orbit planning shall be provided as inputs to the on-orbit operations and logistics plans and crew procedures.

3.2 DESIGN AND DEVELOPMENT CONTROLS

3.2.1 TECHNICAL DOCUMENTS

QA shall conduct timely reviews of technical documents and changes thereto prior to document release. Technical documents include, but are not limited to, specifications, engineering drawings, engineering change orders, program plans, implementing procedures, work instructions, deviations/waivers, and documentation and DRs. Designs produced by automated systems shall have an equivalent level of control.

3.2.1.1 QA shall verify that a documentation system that assures the inclusion of quality characteristics and design criteria in specifications, procedures, drawings, fabrication and inspection planning, and test documents is established and implemented.

3.2.1.2 QA shall assure that the drawing system and other specifications identify hardware characteristics requiring verification with particular emphasis on critical characteristics. This identification shall be used in developing quality inspection and test verification planning and procedures.

3.2.2 CHANGE CONTROL VERIFICATION

3.2.2.1 Engineering changes shall be reviewed by QA to determine the quality impact, such as modified inspection/test requirements, identification of new or modified tooling, gaging, or test equipment needs, and identification of changes to critical inspection/test procedures. Change incorporation shall be verified by QA in accordance with specified effectivity with special attention to changes involving interface relationships.

3.2.2.2 QA shall ensure revisions to engineering documentation under NASA control are processed through the appropriate baseline control change process.

3.2.3 PRODUCT/PROCESS DEVELOPMENT

QA shall participate in product and process development activities to ensure that fabrication quality requirements are defined in concert with product requirements. QA shall assure criteria for material, and process controls are developed consistent with these requirements. Product and process activities include, but are not limited to development of mockups, engineering models, qualification/protoflight units, development test units, and development of processes and fabrication methods.

Commensurate with these activities, QA shall develop methods and plans for verification of these requirements with particular emphasis on early identification of critical characteristics.

3.3 IDENTIFICATION AND DATA RETRIEVAL

3.3.1 GENERAL

A documented identification and data retrieval system shall be developed, implemented, and maintained for: rapid retrieval of information to facilitate ground and on-orbit anomaly resolution, useful life, preventive maintenance and logistical planning. The provider shall use identification numbers (e.g., Configuration Item (CI), Contract End Item (CEI), part numbers, lot numbers, serial numbers, CAGE codes, etc.), related to the engineering design, as required by engineering documentation and SSP 41170. Criticality, design complexity, application, performance characteristics, manufacturing, processing or environmental conditions, and limited-life sensitivity shall be used to determine the level of control applied through identification and data retrieval requirements. An identification and data retrieval system shall be provided for parts and materials installed or consumed in the Space Station. This system shall provide traceability to the related manufacturer's lot or batch number and/or date code for parts and materials. An identification and data retrieval system shall be provided for part and material traceability as follows:

3.3.1.1 Each article and material shall be identified by a unique part or type number, and as applicable, one or more of the following detailed identification methods:

3.3.1.1.1 Manufacturer's Contractor and Government Entity (CAGE) code and date codes indicating date of manufacture to identify articles or materials made by a continuous and controlled process and those which are subject to variation or degradation with age.

3.3.1.1.2 Manufacturer's CAGE code and lot numbers to identify individual materials or articles produced in homogeneous groups.

3.3.1.1.2.1 When a CAGE code is not available, manufacturer's name/identity and address, if required to identify specific manufacturer, shall be used to ensure traceability to the true manufacturer.

3.3.1.1.3 Serial numbers to identify materials or articles for which unique data are to be maintained.

3.3.1.1.3.1 Controls shall be included to assure serial numbers are assigned in a consecutive manner, gaps in serial numbers not permitted.

3.3.1.1.4 Standard usage hardware (e.g., non-high strength fasteners, shims, pins) which are not safety or functionally critical and fall outside the date code, lot number, and serial number screens shall require part or type number traceability only.

3.3.1.2 Other identification methods, such as paint dots, etc., shall be approved in writing by the Customer or a designated representative prior to their use.

3.3.1.3 Methods of application and location (including on-orbit installed or stowed locations) of part or type numbers and detailed identification on articles shall be indicated in engineering drawings and/or specifications.

3.3.1.4 Records shall indicate detailed identification and be organized so that records and the related article or material may be located and retrieved as necessary.

3.3.1.5 Requirements shall be established for mechanical, electrical, electronic, and electromechanical (EEE) parts in accordance with this document and with SSP 30312, Electrical, Electronic, Electromechanical (EEE) and Mechanical Parts Management and Implementation Plan for Space Station Program, which will provide the capability of tracing backwards from fabricated hardware to the lot from which the part originated.

3.3.2 RETENTION OF RECORDS

Records shall be retained in a safe, accessible location for the period specified in the contract or bilateral agreement. Records shall not be destroyed unless authorized by the Customer's contracting officer.

3.3.3 RECORD RETRIEVAL

Record systems shall ensure that records are identified and related to the applicable articles and materials. The record retrieval system shall be organized so that these records and the related articles and materials may be rapidly located and retrieved for Program use and to support ground and on-orbit assembly and operations.

3.4 PROCUREMENT

3.4.1 PROCUREMENT CONTROLS

The Customer is responsible for assuring that purchased articles, materials, and services conform to the requirements specified in this document and other program requirements. Control of procurements shall include identification of contract or bilateral agreement quality requirements, selection of qualified suppliers, verification of product quality and compliance with contract or bilateral agreement requirements, and provisions for reporting and correcting nonconformances.

3.4.2 SELECTION OF SUPPLIERS

QA personnel shall participate in the selection of suppliers based on one of the following:

3.4.2.1 The supplier shall have a previous and continuing record of supplying quality articles, materials, or services of the type being procured.

3.4.2.2 A pre-award survey of the supplier's facility and quality system shall be conducted in accordance with documented procedures, developed by the Buyer, to determine if the supplier is capable of satisfying procurement quality requirements. The results of pre-award surveys shall be documented and maintained by the Buyer.

3.4.2.3 When articles or materials are/were fabricated by suppliers for NASA (or associated International Partners'/Participants' Government), or applicable Department of Defense (DOD) contracts that have current acceptable surveys, a pre-award survey is not required. Applicable DOD contracts are those requiring implementation of MIL-Q-9858 or MIL-I-45208, as appropriate.

3.4.2.4 Suppliers of off-the-shelf and industry standard products or services which are non-critical/non-complex and for which compliance with purchase order requirements can adequately be determined upon receipt, shall not require quality pre-award review, survey or evaluation. Verification of compliance to purchase order requirements shall be accomplished during Customer's receiving inspection/test.

3.4.3 PROCUREMENT DOCUMENTS

Procurement documents shall be written and processed in accordance with the following:

3.4.3.1 Prior to release, applicable procurement documents shall be approved by QA personnel to ensure inclusion of appropriate quality requirements and associated documentation.

3.4.3.2 Procurement documents shall require each supplier and its sub-tier sources to comply with the applicable requirements of this document. The supplier, in complying with these requirements, may use its existing procurement requirements documents subject to approval by the Customer prior to implementation.

3.4.3.3 Procurement documents shall contain the following specific requirements:

3.4.3.3.1 Changes. The supplier including proprietary sources under source drawing control shall be required to notify the Customer of any proposed changes in fabrication, materials, methods, product operating characteristics, or processes previously approved and shall obtain written approval from the procuring authority before making the change. Proprietary sources not under source drawing control shall notify the Customer of any changes in fabrication materials, methods, product operating characteristics, or process prior to delivery.

3.4.3.3.2 Test Results. Records of test results shall be maintained and must be traceable to the procured articles. Purchased raw materials shall be accompanied with chemical and/or physical test results.

3.4.3.3.3 Government Source Inspection (GSI). When a NASA representative elects to perform inspection at a procurement source, the following statement shall be included in the procurement document: "Work on this order is subject to inspection and test by NASA or its designated representatives at any time or place. The NASA QA representative who has been delegated the QA functions on this procurement shall be notified immediately upon receipt of this order. NASA or its designated representatives shall also be notified 48 hours in advance of the time articles or materials are ready for inspection or test." Imposition of GSI by the NASA representative does not direct the Customer to perform source inspection at the supplier. Non-performance of source inspection at the supplier does not relieve the supplier of responsibility to meet all contract or bilateral agreement requirements.

3.4.3.3.4 Procurements Other Than Those Requiring GSI. Procurements which do not require GSI shall include the following statement: "The Government reserves the right to inspect the work included in this order at the supplier's plant."

3.4.4 PROCUREMENT DOCUMENTS REVIEW

The Customer shall submit procurement documents to the designated NASA QA representative for GSI determination prior to procurement release for the following purchase types: 1) purchases for products or services that are either complex or have critical application and which conformance to requirements cannot or should not, for economical reasons, be fully determined on receipt, or 2) purchases requiring direct shipment from the supplier to NASA. However, procurement documentation for products or services for which conformance to requirements may be adequately determined by the Customer upon receipt do not require submittal to the NASA QA representative prior to release, but shall be available for review. Source inspection performed by and for the convenience of NASA shall not replace supplier source inspection or relieve the supplier of the responsibility for ensuring product quality.

3.4.5 QUALITY ASSURANCE PERSONNEL AT SOURCE

The procuring organization shall assign a resident or itinerant QA personnel at contractor, subcontractor, or supplier facilities based on the criticality and complexity of the equipment, experience with the source, when testing or critical inspections cannot be accomplished by the procuring organization, or when articles or materials are designated for direct shipment from the supplier to a NASA Center, or the using site. The procuring organization shall provide written instructions for its source personnel which will include a requirement to record the history and results of source activities in the following areas: general information, system control, product control, and process control.

3.4.6 RECEIVING INSPECTION

QA shall develop, implement, and maintain a documented receiving inspection activity to ensure that procured articles comply with procurement document requirements, inspection and test data are accurate and acceptable, evidence of supplier and/or government source inspection has been provided as required, specified identification

and data retrieval requirements have been met, time/cycle sensitive articles are identified, expended and remaining time/cycle information is complete, chemical analysis and physical tests are performed, and receiving inspection results and status of articles are maintained. Procedures shall provide for laboratory analysis and testing on a sampling basis to verify the validity of test reports received from suppliers.

3.4.7 SUPPLIER DATA

Inspection and test results commencing with receiving inspection shall be recorded to reflect, on a continuous basis, the qualitative and quantitative performance of individual suppliers and the quality histories of the supplied articles and materials. QA shall maintain data to aid in the selection of suppliers, establish trends of potential problems, and initiate action to resolve any negative trends.

3.4.8 AUDITS AND SURVEYS OF SUPPLIER OPERATIONS

3.4.8.1 The Customer shall schedule and conduct audits and surveys of suppliers to ensure compliance to QA requirements included herein and in the applicable contract or bilateral agreement. The frequency, depth and type of these audits and surveys shall be based upon the following:

3.4.8.1.1 Type of items being procured: e.g., criticality or complexity of article, material, or special processes involved.

3.4.8.1.2 Supplier quality history including known problems or difficulties.

3.4.8.1.3 Remaining period of supplier performance.

3.4.8.1.4 Major changes occurring in the suppliers organization, equipment, location, or activities which could impact capabilities.

3.4.8.2 For planning purposes, a schedule shall be prepared and shall include all planned audits and surveys and shall be amended to accommodate unanticipated problem areas. The schedule shall be maintained throughout the duration of the procurement and shall be available for review.

3.4.8.3 The audits and surveys shall be conducted to evaluate the quality program, including implementing policies and procedures, and shall be performed in accordance with documented procedures and checklists which are based on program requirements. Audit and survey results shall be documented and follow-up action shall be taken to ensure deficiencies have been corrected within the specified period of time.

3.4.8.4 To the maximum extent possible, audits and surveys shall be conducted concurrently with other functions (e.g., Configuration Management, Engineering, Manufacturing, Procurement) to minimize the number of audits and surveys performed at the supplier. Additionally, ISS procuring agencies shall participate in the planning and/or conduct of joint audits or surveys with the shuttle program to minimize the number of audits and surveys performed at common suppliers.

3.5 FABRICATION CONTROLS

3.5.1 FABRICATION OPERATIONS

QA shall support fabrication operations, including assembly and test, to verify that critical characteristics of the design are identified and their conformance to engineering specifications are maintained in all articles produced. Critical characteristics shall be selected by quality, manufacturing, and engineering personnel and shall be derived from drawings, specifications, Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL), Hazard Analysis, etc. Critical characteristics shall be designated as inspection points that must be verified by QA personnel. Identification of these characteristics, definition of methods, and sequence of operation shall be consistent with the criteria, methods, and plans developed during product development and reviewed at design reviews. Detailed fabrication and inspection planning shall contain the following as a minimum:

3.5.1.1 Nomenclature and identification of the article to be fabricated.

3.5.1.2 Drawings and specifications required.

3.5.1.3 Tooling, jigs, fixtures, and other fabrication equipment to be utilized.

3.5.1.4 Detailed instructions for fabrication and assembly of articles.

3.5.1.5 Critical characteristics and tolerances required.

3.5.1.6 Detailed procedures for controlling processes and cleaning, preservation, and packaging operations.

3.5.1.7 Special conditions to be maintained such as environmental controls, specific cleanliness levels, and precautions to be observed.

3.5.1.8 Workmanship standards if applicable.

3.5.1.9 Specific inspections and/or test operations to be performed during fabrication to provide verification of design characteristics.

3.5.1.10 Special handling equipment and protective devices [e.g., Electrostatic Discharge (ESD) control].

3.5.1.11 Traceability to the individual performing the operation and to the inspection personnel verifying compliance.

3.5.1.12 Traceability to the FMEA/CIL where applicable.

3.5.1.13 Traceability to the applicable configuration data, including parts lists, drawings, changes, specifications, and identification data, to ensure fabrication to the proper design requirements.

3.5.1.14 If QA designees (reference paragraph 3.5.8) are used, the operations to be performed by such personnel shall be strictly identified.

3.5.1.15 When the NASA representative has specified source control inspections for sub-tier purchases (as identified in paragraph 3.4.4) the provider's QA organization shall ensure government Mandatory Inspection Points (MIPs) (in accordance with criteria provided to the provider from the NASA or designated NASA QA representative) are incorporated into the detailed planning. The supplier's QA organization shall then coordinate with the NASA QAR for MIP coverage.

3.5.1.16 For in-house fabrication, assembly and test the provider's QA organization shall ensure government MIPs (in accordance with criteria supplied to the provider from the designated NASA QA representative) are incorporated in the detailed planning. QA shall then coordinate with the NASA QAR for MIP coverage.

3.5.1.17 For post-production maintenance, repair, modifications and test, QA personnel shall ensure government MIPs are incorporated in the detailed planning as authorized by a Maintenance Action Request (MAR). Post-production support (PPS) hardware (NASA-owned) shall be identified and controlled in accordance with Section 3.12.

3.5.1.18 For on-orbit maintenance, modifications and installation verification QA shall provide real-time operations support. QA shall verify modifications and installations for planned and unplanned on-orbit configuration changes for on-orbit configuration status accounting.

3.5.2 ARTICLE AND MATERIAL CONTROLS

The following controls shall ensure that only conforming articles and materials are accepted and used:

3.5.2.1 Data shall be maintained for articles identified as having characteristics of quality degradation or drift with age and/or use. The date, time, or cycle from which useful life is calculated; the date, time, or cycle at which the useful life will be expended; and the incurred operating time or cycles shall be recorded.

3.5.2.2 QA shall verify that requirements for articles and materials to be fabricated, processed, inspected, or tested in a temperature, humidity, ESD, or contamination controlled environment are properly implemented.

3.5.2.3 QA shall verify, prior to initial use and if analysis requires at established intervals thereafter, the accuracy of production jigs, fixtures, tooling masters, templates, patterns, and other devices used for inspection.

3.5.3 CLEANLINESS/CONTAMINATION CONTROL

QA shall assure that contaminant-sensitive items are cleaned and controlled in accordance with documented procedures to the levels specified in the applicable

technical documents and are maintained to these cleanliness levels. These procedures shall cover hardware, equipment, personnel, and control of such areas as fabrications, assembly, inspection, test, and storage. Specific cleanliness levels to be maintained for systems, subsystems, and major components shall be indicated on drawings, specifications, or other documents controlling the manufacture and test of those items. QA shall assure that clean-room disciplines and procedures are properly implemented and monitored to assure continuing compliance with requirements.

3.5.4 PROCESS CONTROLS

3.5.4.1 QA shall implement controls for those processes where uniform, high quality cannot be assured by inspection of articles alone. These processes include, but are not limited to, metallurgical and chemical processes, soldering, welding, potting, bonding processes, plating and coating processes, and surface treating processes. These controls shall assure that special processes are performed by certified personnel; that facilities, equipment, materials, and procedures are adequate, maintained, and properly used; and that records are controlled.

3.5.4.2 An up-to-date listing shall be maintained of all process control procedures and process specifications used in the fabrication, control, and inspection of the materials and articles. Supplier process specifications shall be available for review by the Customer or its delegated representative. The supplier shall also furnish similar information from the subcontractors upon request. Requirements for disclosure of contractor and subcontractor proprietary process specifications shall be established with NASA on an individual basis.

3.5.5 NONDESTRUCTIVE EVALUATION

Nondestructive Evaluation (NDE) methods shall be used, as required by engineering specifications, and controlled to ensure quality hardware. NDE standards shall be used or prepared based on hardware configurations and geometry. Quantitative acceptance or rejection criteria shall be established for each NDE application. Personnel performing NDE processes shall be trained and certified.

3.5.6 WORKMANSHIP

Where samples or visual aids showing acceptable workmanship are necessary, they shall be selected by the supplier subject to review by the Customer or its designated QA representative. Standards shall be reviewed and revised or replaced, as necessary, to satisfy current requirements. Standards shall contain appropriate product acceptance/rejection criteria.

3.5.7 CONTROL OF TEMPORARY INSTALLATIONS AND REMOVALS

QA shall maintain a log or otherwise ensure the management and control of articles or components that are temporarily installed or removed to facilitate manufacturing, assembly, testing, shipping, or handling of the End Item. The control shall be initiated upon installation or removal of the first temporarily installed or removed item and shall

be maintained through assembly complete to prevent them from becoming a part of the final flight configuration.

3.5.8 QUALITY ASSURANCE DESIGNEES

A systematic approach may be developed to designate certain trained and qualified engineers, manufacturing and test personnel to represent QA in performing selected inspection and test functions. The approach for QA designees shall be described in the Quality Program Plan. The selected inspection and test functions that are delegated to QA designees shall exclude those processes, inspections, and tests that are required to verify critical characteristics or where re-inspection cannot be readily accomplished due to further assembly or installation of hardware.

3.5.9 INSPECTION PROCEDURES

Where inspection operations are complex and difficult to perform, QA shall assure the preparation of specifically planned procedures to assure accuracy and validity of data and supplement the normal fabrication and inspection planning. These procedures shall be controlled and shall be based on current design information.

3.6 TEST CONTROLS

3.6.1 VERIFICATION

QA shall verify tests that demonstrate program, contract or bilateral agreement, drawing, and specification requirements have been met on all articles and materials procured and produced. QA shall provide approval of test results to ensure that the quality inherent in the design is maintained in the articles produced. QA shall review the test or verification plan to ensure inclusion of pertinent quality requirements.

3.6.2 TEST PROCEDURES

Approved test procedures shall be readily available to inspection and test personnel at the applicable location at the time of inspection or test. QA shall assure that test procedures include the following information:

3.6.2.1 Nomenclature and identification of the test article or material.

3.6.2.2 Characteristics and design criteria including values and tolerances for acceptance and rejection.

3.6.2.3 Identification of characteristics and design criteria specified for verification.

3.6.2.4 Detailed steps and operations to be taken in sequence including verifications to be made before proceeding.

3.6.2.5 Identification of measuring or NDE equipment to be used specifying range and type.

3.6.2.6 Details or instructions for operation of special data recording equipment.

3.6.2.7 Layout of interconnection of test equipment and articles.

3.6.2.8 Identification of hazardous situations or operations.

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

3.6.2.10 Environments and other conditions to be maintained.

3.6.2.11 Identification of any reference drawings, specifications, workmanship standards, and/or reference documents required to enable full comprehension of test requirements.

3.6.2.12 Constraints on inspection or testing.

3.6.2.13 Special instructions for nonconformances, anomalous occurrences, or results.

3.6.2.14 Details of sampling plans used.

3.6.2.15 Details of NDEs.

3.6.2.16 Identification of steps that involve critical items or requirements.

3.6.2.17 Configuration/revision level of hardware/software used during test.

3.6.3 TEST PERFORMANCE

QA shall assure that tests are performed in accordance with approved procedures and that any departures to the test procedures are properly documented, recorded, submitted to the applicable approving authority, and approved. Each test operation shall be traceable to the individual responsible for its accomplishment. Articles undergoing test shall not be adjusted, modified, repaired, reworked, or replaced except as authorized by properly approved documents. QA test verification shall include the following:

3.6.3.1 Prior to testing, QA shall verify that approved test procedures are available, that test equipment is calibrated and properly configured, that the facility is properly configured, that all manufacturing and lower level test operations are complete, and that the configuration of the article is correct and ready for test. If the necessity to depart from the approved test procedure is identified, QA shall verify that the departure to the test procedure is properly documented, recorded, submitted to the applicable approving authority, and approved prior to the start of the test.

3.6.3.2 During testing, QA shall verify that testing is performed in accordance with approved test procedures or that procedure departures are recorded and approved by appropriate level of authority, that test data are accurately recorded and that all nonconformances are properly documented.

3.6.3.3 Subsequent to testing, QA shall verify that test results and data are complete and traceable to the test articles, that proper dispositions of articles have been made and approved by appropriate level of authority, that nonconformances are documented, dispositioned, and approved, that remedial action and recurrence control requirements are initiated and that integrity control of test articles is properly established and implemented.

3.6.3.4 Documentation shall include procedures for the development, verification and control of computer software/firmware used in conjunction with measurement and test equipment for acceptance of articles.

3.6.4 INSPECTION AND TEST RECORDS AND DATA

3.6.4.1 Records. Records and data of all inspections and tests performed shall be prepared and maintained in sufficient detail to verify and evaluate the status of articles and materials.

3.6.4.2 Acceptance Data Package (ADP). ADPs shall be prepared and maintained in accordance with SSP 30695, Acceptance Data Package Requirements Specification, contract or bilateral agreement data requirements. QA shall ensure the organization responsible for accountability of the hardware or software prepares and maintains ADPs to reflect current status of the product throughout the life of the hardware/software.

3.6.5 ACCEPTANCE REVIEW (AR)

3.6.5.1 QA shall conduct and participate in ARs to assure compliance with documentation requirements. Provider shall ensure that the following information, items 3.6.5.1.1 through 3.6.5.1.10, shall be provided for review at the AR, additionally item 3.6.5.1.11 shall be readily retrievable at the AR.

3.6.5.1.1 A summary of test and checkout operations and results with anomalies encountered, failure history, remedial actions, and recurrence control.

3.6.5.1.2 The status of any open work, including open items from previous reviews, shortages, nonconformances, unincorporated engineering changes, etc., and constraints on further activities.

3.6.5.1.3 Identification of waivers/deviations and objective evidence of appropriate approvals.

3.6.5.1.4 Identification of limited life components and their remaining life.

3.6.5.1.5 A comparison of as-designed versus as-built configuration listings and rationale for any differences from approved baseline designs.

3.6.5.1.6 The test procedure and test data for all end item acceptance tests including strip charts, deviations, and other data applicable to evaluate test records.

3.6.5.1.7 Completed deliverable Acceptance Data Package (ADPs).

3.6.5.1.8 A form DD250 or other contractually authorized document(s) prepared for signature.

3.6.5.1.9 Records of all open nonconformances occurring during manufacturing and test of the end-item.

3.6.5.1.10 Handling, shipping, storage, preservation, packing, and packaging instructions, including environmental constraints, identification of hazards, and maintenance requirements and user manuals.

3.6.5.1.11 In addition, all supporting documentation, which may be required to establish equipment acceptability, should be readily retrievable. This includes, but is not limited to, engineering drawings, schematics, supplier ADPs, test specifications, closed nonconformances, fabrication and inspection test records, etc.

3.7 NONCONFORMING ARTICLES AND MATERIALS

3.7.1 NONCONFORMANCE GENERAL REQUIREMENTS

3.7.1.1 QA organizations shall establish, implement, and maintain documented closed-loop systems for reporting, investigating, and resolving nonconformances and for controlling nonconforming articles and materials.

3.7.1.2 QA organizations shall establish and implement written procedures to ensure compliance with the requirements defined within this Section.

3.7.1.3 Nonconformance recording shall commence with initial receipt of articles or materials for Government procurement and shall continue through all subsequent phases of the program including on-orbit operations, post-production repair, and maintenance. Contract or bilateral agreement data requirements shall take precedence with respect to documentation of nonconformances.

3.7.1.4 When articles or materials are found to be nonconforming, the nonconforming articles or materials shall be conspicuously marked or tagged (or otherwise identified if marking or tagging is not practical) and positively controlled to preclude their unauthorized use.

3.7.1.5 Nonconforming articles or materials submitted to a contractor Material Review Board (MRB) or Government for disposition shall be moved to a controlled area designated for storage of nonconforming articles or materials unless not practical due to

size, configuration, environmental requirements or other conditions authorized by the Contractor MRB or the Government. The designated area shall be protected to prevent the unauthorized removal of the nonconforming article or material. While on-orbit, articles or materials identified as nonconforming or noncompliant shall be appropriately identified and segregated by the on-orbit Crew to prevent unsafe or unauthorized use of such articles or materials.

3.7.1.6 The Government may delegate MRB authority to non-Government ISS hardware providers.

3.7.1.7 All on-orbit anomalies shall be initially documented and evaluated through the ISS Mission Evaluation Room (MER) to determine whether the anomaly is a nonconformance. After the ISS MER has identified an on-orbit nonconformance, the on-orbit nonconformance shall be documented and resolved per the requirements of SSP 30223.

3.7.1.8 QA organizations shall periodically audit, or have audited, the corrective action and disposition system for nonconforming articles or materials (both in-house and at suppliers where appropriate) for compliance with requirements of this document and to ensure effectiveness.

3.7.1.9 Acceptance or rejection of nonconforming articles or materials shall be the sole prerogative of the Government. The act of offering nonconforming articles or materials to the Government should be an exception and the consistent offering of nonconformances is indicative of degradation in the Contractor's control over quality. The right of Government disapproval, as related to nonconformances, specifically applies but is not limited to the following:

- Procedures, activities, and reports of Preliminary Reviews (PRs), MRB, and corrective action functions.
- Contractor-proposed Standard Repair Procedure (SRP) including expiration dates, limits, and extensions.
- Records and analyses of nonconformances and corrective actions related to those nonconformances.
- The right to withdraw approval of previously approved SRPs and MRB authority.

3.7.2 NONCONFORMANCE DOCUMENTATION REQUIREMENTS

3.7.2.1 Government and Contractor nonconformance reporting systems shall maintain records of all nonconforming articles and materials, dispositions, assignable causes, corrective actions, and effectiveness of corrective actions, as a minimum. These records shall be organized to permit efficient retrieval for data summation, knowledge of previous dispositions, and corrective action monitoring.

3.7.2.2 Documentation of nonconformances shall include the following:

- Initiator of the document.
- Date of initiation.
- Identification of the documents for traceability purposes.
- Specific identification (e.g., part number, name, serial/lot number) of the nonconforming material.
- Quantity of materials involved.
- Where the nonconformance was detected (site location).
- A detailed description of the nonconformance.
- Identification of the affected specification, drawing, or other requirements document.
- An analysis of the cause(s) of the nonconformance and identification of the root cause(s), where possible.
- Disposition of the nonconforming material.
- Identification of personnel responsible for making the disposition.

3.7.2.3 For dispositions other than return-to-supplier, rework, completion of operations, repair by SRP, or scrap, nonconformance documentation shall include additional information as follows:

- Inclusion of, reference to, or attachment of a written engineering analysis, when performed.
- Final disposition of the nonconforming article or material.
- Signature (or personal identification stamp) of disposition authorities.
- Contract and/or Program identification when feasible for use-as-is and repair dispositions.

3.7.2.4 If corrective action is required on an individual nonconformance, the following information shall be recorded:

- The action(s) taken to correct the cause(s) of the nonconformance and thereby preclude recurrence.

- Identification of the individual(s) and functional area(s) responsible for taking the corrective action.

- Date, serial number, or lot number when corrective action will be completed or is estimated to be completed.

3.7.3 PRE-DELIVERY CONTRACTOR NONCONFORMANCE DISPOSITIONS

3.7.3.1 Whenever Contractor hardware prior to delivery to and acceptance by the Government (i.e., pre-DD250) fails to conform to requirements or is overstressed, a nonconformance report shall be generated and processed in accordance with the appropriate contractor nonconformance system.

3.7.3.2 When articles or materials are initially found to be nonconforming, a Preliminary Review (PR) shall be performed by contractor-appointed QA personnel to determine if the nonconformance may be dispositioned without the participation of the Government or their designated representatives. PR dispositions shall be subject to review by the Government. PR dispositions are as follows:

3.7.3.2.1 Return to Supplier. Upon receipt of nonconforming articles or material, the nonconforming article or material should be returned to the supplier. The receiving organization shall provide the supplier with sufficient nonconformance information to allow correction of the defect and development of corrective action to preclude recurrence.

3.7.3.2.2 Rework or Completion of Operations. Rework or completion of operations shall be performed using established fabrication, inspection, and test documents.

3.7.3.2.3 Scrap. If the article or material is unfit for use and is below the approved cost threshold per the Contractor's approved procedure, its disposition shall be in accordance with the Contractor's approved procedures for identifying, controlling, and disposing of scrap.

3.7.3.2.4 Standard Repair Procedure. Repair per SRP shall be allowed only if an authorized MRB has previously approved the SRP. Limitations for use shall be specified on each SRP. The existence of standard repair procedures shall not relieve the provider of the responsibility for initiating preventive action to the fullest extent.

3.7.3.2.5 Material Review Board. All other nonconformances shall be submitted to an authorized MRB for review and disposition.

3.7.3.3 MRB is a Contractor responsibility and shall be comprised of at least one representative whose primary responsibility is engineering, one representative from the Contractor's QA organization, and a designated Government QA representative. MRB members shall be selected on the basis of their technical competence. MRB members may consult with other organizations and personnel, as required, to arrive at optimum decisions.

3.7.3.4 The MRB shall not approve the disposition of major nonconformances. The MRB shall review and recommend disposition of major nonconformances to the appropriate ISS Program control board in the form of a major waiver in accordance with the requirements documented in SSP 41170.

3.7.3.5 The authorized MRB has the authority to approve recommended dispositions for minor nonconformances only. MRB approval authority is limited to minor nonconformances that are not likely to materially reduce the usability of the supplies or services for their intended purpose. For minor nonconformances, the MRB shall make one of the following dispositions and specify the action in the nonconformance document:

- Use-as-is.
- Repair.
- Scrap.

3.7.3.6 Minor nonconformances that are dispositioned either through a use-as-is determination or MRB nonstandard repair shall require a minor waiver. The MRB is authorized to approve minor waivers. Completed documentation signed and approved by the authorized MRB shall be considered an approved minor waiver.

3.7.3.7 Approval of recommended dispositions of minor nonconformances by the MRB requires unanimous agreement. Decisions shall be based on intended use and criticality of the hardware, record review of earlier PR actions, materials, and techniques used for repair, and retest requirements necessary to revalidate functional acceptability. When a unanimous agreement is not met by the MRB, the nonconformance shall be referred to the appropriate ISS Program control board.

3.7.3.8 Requirements pertaining to MRB use-as-is dispositions are as follows:

3.7.3.8.1 Until the use-as-is disposition has been approved, the nonconforming material shall not be further processed nor used without prior MRB authorization, or unless controlled by methods approved by the MRB or Contractor quality organization.

3.7.3.8.2 The appropriateness of a documentation change and the method for accomplishing any recommended change (i.e., design change, changes to technical documentation including drawings, specifications, or recommended changes to Government specifications) should be considered in lieu of a use-as-is disposition. Note that a documentation change that removes the nonconforming condition alleviates the need for a Government -approved use-as-is disposition.

3.7.3.9 Requirements pertaining to repair dispositions are as follows:

3.7.3.9.1 Proposed repair methods (other than previously approved SRPs) shall be submitted to the MRB for approval prior to accomplishing the repair action. MRB

approval of the repair technique does not compromise the Government's right to reject the article or material after completion of the repair.

3.7.3.9.2 Instructions for reprocessing of articles or material after completion of repair and before its release shall be included in the SRP or other repair procedure. These procedures shall include the requirement for contractor inspection and test.

3.7.3.9.3 Contractor shall review SRPs periodically to ensure that they are complete, up-to-date relative to current process capability and state-of-the-art, and being properly applied under conditions defined for their use.

3.7.3.9.4 Nonconforming articles or material to which an SRP has been satisfactorily applied is subject to Government inspection when specified in the SRP.

3.7.3.10 Scrapped material shall be conspicuously identified and controlled to preclude its use in a contract item unless approved by an MRB or ISS Program Board, as appropriate.

3.7.3.11 Contractor may delegate MRB responsibility to a subcontractor upon determining that the subcontractor meets the MRB requirements of this document.

3.7.4 PRE-DELIVERY GFE PROVIDER NONCONFORMANCE DISPOSITIONS

3.7.4.1 Government nonconformance reporting systems that support the ISS Program but are not under the control and authority of the ISS Program (e.g., JSC 28035, NSTS 08126) shall disposition nonconformances for hardware/ software prior to delivery to the ISS Program in accordance with requirements specific to their nonconformance systems.

3.7.5 OEM/DEPOT CONTRACTOR POST PRODUCTION SUPPORT NONCONFORMANCE DISPOSITIONS

3.7.5.1 For ISS hardware delivered to and accepted by the Government [i.e., post-DD250] that fails to conform to requirements or is overstressed during Contractor Post Production Support (PPS) operations, repair, and maintenance activities, a nonconformance report shall be generated and processed in accordance with the appropriate Original Equipment Manufacturer (OEM)/Depot Contractor nonconformance system.

3.7.5.2 For PPS hardware in the control of an OEM/Depot Contractor, the Contractor may be delegated OEM/Depot MRB authority.

3.7.5.3 During PPS operations, repair, and/or maintenance authorized by the ISS Program, the OEM/Depot MRB shall approve only physical nonconformances that fall within the approved fair wear and tear criteria or System Problem Resolution Team (SPRT) approved Standard Repairs per the specific box level/end material as identified in SSP 50276, Annex 5.

3.7.5.4 Standard Repair. If a repair is possible using an existing SRP baselined in SSP 50276, Annex 5 or approved by an authorized SPRT the repairs may be accomplished in accordance with the approved SRP. Modifications to the SRP shall require approval from the responsible SPRT.

3.7.5.5 Scrap. If the article or material is unfit for use, and is below the Government approved cost threshold, the OEM/Depot MRB may approve the recommended disposition of scrap and authorize disposal after appropriate failure investigation has been conducted. For scrap dispositions over the allowable cost threshold, refer to paragraph 3.7.6 of this document.

3.7.5.6 The OEM/Depot MRB shall be comprised of at least one representative whose primary responsibility is OEM/Depot engineering, one representative of the OEM/Depot QA organization, and a designated Government QA representative.

3.7.5.7 Fair wear and tear criteria shall be documented and approved by the Government.

3.7.6 GOVERNMENT POST PRODUCTION SUPPORT NONCONFORMANCE DISPOSITIONS

3.7.6.1 For ISS hardware delivered to and accepted by the Government [i.e., post-DD250] that fails to conform to requirements or is overstressed during PPS operations, repair, and maintenance activities and cannot be dispositioned via an OEM/Depot contractor MRB, or is under control of the government (e.g., ORU spares, on-orbit hardware), the resulting nonconformance shall be dispositioned under requirements described in SSP 30223, Problem Reporting and Corrective Action for the Space Station Program.

3.7.7 PROBLEM REPORTING

3.7.7.1 A closed-loop system shall be provided for reporting and correcting of problems. Detailed requirements for problem reporting, analysis, and resolution shall be in accordance with SSP 30223, Problem Reporting And Corrective Action (PRACA) Process For The International Space Station and contract data requirements or the International Partner/Participant bilateral agreement that meets or exceeds SSP 30223.

3.8 METROLOGY

Metrology shall be in accordance with MIL-STD-45662, or with the following provisions (3.8.1 through 3.8.5):

3.8.1 METROLOGY CONTROLS

A documented metrology system shall be established and maintained to ensure that measurement standards and equipment provide objective evidence that articles and materials produced or procured are in compliance with specifications, drawings, and program and contractual requirements. All new or repaired measurement standards

and equipment shall be inspected and/or tested prior to use. Documentation of this effort shall be maintained and made available for review by the designated Customer QA representative.

3.8.2 CALIBRATION RECORDS

Individual records of measurement standards and equipment calibration shall be maintained. These records shall include, but are not limited to, the following:

3.8.2.1 Identification of standard or equipment to be calibrated.

3.8.2.2 Identification of standard or equipment and calibration procedure used in the calibration process.

3.8.2.3 Calibration intervals.

3.8.2.4 Dates and results of each calibration.

3.8.2.5 Due date of next calibration.

3.8.2.6 Individual(s) performing calibration.

3.8.2.7 Calibration facility.

3.8.2.8 Degree of nonconformance of standards or equipment received for calibration.

3.8.3 MEASUREMENT ACCURACY

Random and systematic errors in any calibration measurement shall not exceed 25 percent of the tolerance of the parameter being measured. The supplier's calibration system description may include provisions for deviating from the uncertainty requirements provided the adequacy of the calibration is not degraded. All deviations shall be recorded.

3.8.4 CALIBRATION CONTROLS

3.8.4.1 Facility. Each organization shall have its own facility for calibrating measurement standards and equipment or shall use the services of an outside facility which meets the requirements of this paragraph.

3.8.4.2 Traceability. All measurements standards shall be traceable to standards maintained by the National Institute of Standards and Technology or their values shall be derived from a controlled measurement process utilizing a fundamental constant of nature.

3.8.4.3 Handling, Storage, and Transportation. All measurement standards and equipment shall be handled, stored, and transported in accordance with documented procedures which shall preclude equipment damage or degradation of accuracy.

3.8.4.4 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.

3.8.4.5 Calibration Intervals. Calibration intervals shall be established, documented, and periodically reviewed. Intervals shall depend upon the use, accuracy, type of standard or equipment, and other conditions affecting the measurement process.

3.8.4.6 Recall System. All standards and equipment used in measurement processes shall be recalled and recalibrated at established intervals. Standards and equipment not recalibrated on or before the recall due date or damaged in use shall be removed from service or otherwise restricted from use. Authorization for exception shall be obtained from the Customer.

3.8.4.7 Environmental Requirements. Environmental conditions (i.e. temperature, humidity, vibration, cleanliness) shall be compatible with the requirements of the article and material and calibration measurement process.

3.8.5 REMEDIAL ACTION AND RECURRENCE CONTROL

Recurrence control shall be taken relative to nonconforming measurement standards or equipment. The calibration authority shall notify program using team(s) to the extent of nonconforming measurements. The responsible using team(s) shall perform a risk assessment for articles or materials previously measured using such equipment, specifically identifying articles or materials by part name, part number, and serial number, if applicable.

3.9 STAMP CONTROLS

QA shall establish and maintain documented stamp and marking material control systems with procedures that provide for the following:

3.9.1 STAMP AND MARKING MATERIALS

Stamps, decals, seals, torque wax, paints, signatures, and other marking devices or materials shall be used, as appropriate, to identify that articles and materials have undergone source and receiving inspection; in-process fabrication and inspection; end-item fabrication and inspection; and end-item testing, storage, and shipment.

3.9.2 STAMP TRACEABILITY

Stamps shall be traceable to individuals responsible for their use, and records shall be maintained to identify individuals with specific stamps. Un-issued stamps shall be kept secure to prevent unauthorized use. Stamps issued to personnel being transferred or terminated shall be returned and shall not be reissued for a period of at least six months. Worn or damaged stamps shall be destroyed at the time replacements are issued. The identification symbols (e.g., numbers and letters) of lost stamps shall be withdrawn from use. The use of any stamp by an individual other than the holder of

record is specifically prohibited. Periodic checks shall be made to assure that stamps are in possession of the individual to whom they are issued and that they are not worn or damaged.

3.9.3 STAMP APPLICATION

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

3.9.4 ELECTRONIC DATA CONTROL

Verification/validation/acceptance requirements for computerized data entry and retrieval systems and computer generated drawings and documents shall address alternatives to stamp use for certification.

3.9.5 STAMPING/MARKING APPLICATION

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

3.9.6 STATUS STAMPING

Stamps indicating that fabrication, inspection, or test operations have been performed may be applied directly to articles and materials, when allowable.

3.9.7 STAMPING METHODS

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

3.9.8 STAMP SIGNIFICANCE

An up-to-date description and explanation of the significance of all stamps shall be maintained.

3.9.9 SUPPLIER STAMP DESIGNS

The design of supplier's stamps shall be such that fabrication and inspection stamps are distinctly different. Supplier stamps shall not exhibit the designation NASA, abbreviations of any NASA installation, or the designation or abbreviations of the International Partner's/Participant's government without NASA or IP/P consent.

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

3.10.1 PROCEDURES AND INSTRUCTIONS CONTROL

QA shall review and approve, prior to their release, all technical documents pertaining to handling, storage, preservation, marking, labeling, packaging, and shipping operations.

3.10.2 HANDLING, HOISTING OR LIFTING

3.10.2.1 Handling equipment used to handle program critical hardware (as defined in the ISS Program Reliability & Maintainability Critical Items List) shall be prominently marked to indicate the maximum load capacity. Handling equipment used for handling non-program critical hardware does not require maximum load capacity marking.

3.10.2.2 Hoisting, or lifting equipment (e.g., slings) shall be prominently marked to indicate the maximum load capacity and the due date of the next rated or periodic load test. QA personnel will verify that the required test and maintenance are accomplished within the specified frequency.

3.10.3 STORAGE

Storage areas for articles and materials shall be controlled. The controls shall include the following:

3.10.3.1 Controlled acceptance into and withdrawal from the storage area.

3.10.3.2 Positive identification of limited-life material and removal of materials with expired shelf life.

3.10.3.3 Periodic inspection of stored material, housekeeping, and record keeping.

3.10.3.4 Systematic inspection and/or testing necessary to ensure maintenance of preservation including special environments.

3.10.4 PRESERVATION

QA shall verify that articles and materials subject to deterioration, corrosion, or contamination are preserved by documented methods.

3.10.5 PACKAGING AND PACKING

3.10.5.1 QA shall verify that packaging and packing material, procedures, and instructions are used.

3.10.5.2 Special attention shall be directed toward critical, sensitive, dangerous, and high-value articles. Reusable containers shall be inspected prior to each use.

3.10.6 MARKING AND LABELING

QA shall verify that marking and labeling for packaging, storage, and shipping of articles and materials are performed in accordance with applicable drawings, specifications, contract requirements or bilateral agreement. Special attention shall be given to critical, sensitive, dangerous, and high-value articles.

3.10.7 SHIPPING

3.10.7.1 Control. QA shall verify the following:

3.10.7.1.1 Articles and materials have been prepared and packaged in accordance with applicable procedures and requirements and have been properly identified and marked. In the absence of special packing and marking requirements, packing and marking shall comply with Interstate Commerce Commission (ICC) rules and regulations.

3.10.7.1.2 Accompanying documents have been properly identified as to inspection status by appropriate inspection stamps and the data package is complete.

3.10.7.2 Unscheduled Removal. The Provider shall notify the designated procuring agency or organization QA representative in the event of any unscheduled removal of an article or material from its container. The extent of reinspection and retest shall be authorized by procuring agency or organization QA representative.

3.11 SAMPLING PLANS, STATISTICAL PLANNING, AND ANALYSIS

3.11.1 SAMPLING PLANS

Sampling plans may be used when inspection test are destructive or when data, inherent characteristics, or the noncritical application of an article or material indicates that a reduction in inspection or testing will not jeopardize quality, reliability, or design intent. When sampling techniques are to be employed, MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes, or MIL-STD-414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective, whichever is appropriate, shall be used. Sampling plans, other than those contained in MIL-STD-105 and MIL-STD-414, may be used after approval by the designated Customer QA representative.

3.11.2 STATISTICAL ANALYSIS

Statistical analysis techniques may be used where such use will provide effective control over fabrication and inspection operations especially in those areas where special processes and equipment are difficult to control.

3.12 CONTROL OF NASA AND INTERNATIONAL PARTNER/PARTICIPANT PROPERTY

3.12.1 CONTRACTOR/SUPPLIER RESPONSIBILITY

Contractor and Supplier QA shall ensure that a documented system for controlling NASA and International Partner/Participant (IP/P) property and associated documentation has been established and is maintained as follows:

3.12.1.1 Upon receipt, contractor/supplier shall notify the NASA QAR for participation in receiving inspection activity. QA shall inspect NASA and IP/P property to detect damage in transit and to verify that the article and its ADP are complete and as specified in the shipping documents. Articles found to be serviceable shall be re-preserved and repackaged unless the articles are to be used immediately. Should there be evidence of damage in transit, the article shall be inspected to determine the extent of damage and a report of the damage provided to the designated NASA and IP/P representative (as appropriate for IP/P property). Receiving inspection results shall be recorded in the historical record for the article.

3.12.1.2 When functional testing is performed on NASA and IP/P property during receiving inspection or prior to installation into the next level of assembly, the designated NASA and IP/P representative (as appropriate for IP/P property) shall be notified and may participate in the testing activity.

3.12.1.3 Documented procedures shall describe the control of approved storage areas for NASA or IP/P property. Controls shall include the following:

- Limited personnel access

- Controlled receipt and withdrawal

- Identification of article status

- Inventory list of articles in the area

- Scheduled inspection of the area and periodic verification of the inventory list

- Controls for items that must be environmentally protected

3.12.1.4 The contractor/supplier shall provide for the protection, maintenance, calibration, periodic inspection, segregation, and controls necessary to ensure that quality of NASA and IP/P property is maintained and that damage and deterioration do not occur during handling, storage, installation, or shipment.

3.12.1.5 NASA and IP/P property shall not be diverted or loaned from its assigned purpose without the prior approval of the designated NASA or IP/P representative.

3.12.2 UNSUITABLE NASA OR INTERNATIONAL PARTNER/PARTICIPANT PROPERTY

NASA and IP/P property found to be damaged or otherwise unsuitable for its intended use shall be identified as nonconforming, segregated to the extent practicable, held for review, and analyzed to ascertain the probable cause of damage/unsuitability. When cause is determined to be in the contractor's/supplier's operations or activities, action shall be taken to prevent recurrence. Disposition shall not be assigned to discrepant NASA and IP/P property nor shall this property be reworked, repaired, modified, or replaced without the specific written authorization of NASA or the appropriate IP/P.
NOTE: Paragraph 3.7.6 may apply.

4.0 SOFTWARE QUALITY ASSURANCE

In addition to the QA requirements as specified herein, SQA shall also be in accordance with DOD-STD-2168, and the following additions:

4.1 OPERATIONS AND MAINTENANCE

SQA shall assure that a process is established for the planning and evaluation of software operation and sustaining engineering activities. The process shall ensure the retention of quality attributes and that changes will not adversely affect the required system failure tolerance.

4.2 DEVIATIONS AND WAIVERS

SQA shall evaluate deviation and waiver requests to ISS baselined software requirements for potential impacts affecting quality, and recommend dispositions for management concurrence.

4.3 FAILURE REPORTING AND RECURRENCE CONTROL (FRRC)

Detailed requirements for problem reporting, analysis, and resolution shall be in accordance with SSP 30223. SQA shall ensure that problems are entered in the appropriate software nonconformance database for assessment, tracking, corrective action, and closure. SQA shall ensure that procedures are in place to evaluate the impact of a reported problem, the resources required for corrective action, and the impact of not taking corrective action. The procedures shall include requirements for retesting the software and a process for incorporating the correction in new versions of the software.

4.4 SECURITY AND PRIVACY ASSURANCE

SQA shall ensure that system security and privacy requirements for the SS have been implemented in accordance with NASA Policy Directive (NPD) 2810.1 and NASA Procedures and Guidelines (NPG) 2810.1.

APPENDIX A

ACRONYM LIST

ADP	Acceptance Date Package
AR	Acceptance Review
CAGE	Contractor and Government Entity
DR	Data Requirements
EEE	Electrical, Electronic, and Electromechanical
ESD	Electrostatic Discharge
FE	Factory Equipment
FMEA/CIL	Failure Modes and Effects Analysis/Critical Items List
FSE	Flight Support Equipment
GSE	Ground Support Equipment
GSI	Government Source Inspection
ICC	Interstate Commerce Commission
ICD	Interface Control Document
IP/P	International Partner/Participant
ISS	International Space Station
JPD	Joint Program Directive
MAR	Maintenance Action Request
MER	Mission Evaluation Room
MIP	Mandatory Inspection Point
MRB	Material Review Board
NASA	National Aeronautics and Space Administration
NDE	Nondestructive Evaluation
OEM	Original Equipment Manufacturer
ORU	Orbital Replacement Unit

OSE	Orbital Support Equipment
PALS	Program Automated Library System
PCA	Physical Configuration Audit
PDS	PRACA Data System
PPS	Post-Production Support
PRACA	Problem Reporting and Corrective Action
QA	Quality Assurance
QAR	Quality Assurance Representative
S&MA	Safety & Mission Assurance
SPRT	System Problem Resolution Team
SQA	Software Quality Assurance
SRP	Standard Repair Procedure
SS	Space Station
SSP	Space Station Program
SSPCB	Space Station Program Control Board
TSE	Test Support Equipment

APPENDIX B

GLOSSARY

Acceptance - The act of an authorized agent of the Customer by which the Customer assents to ownership of existing and identified contract items or approves specific services rendered as partial or complete performance of a contract or agreement.

Calibration - Comparison of two instruments or measuring devices, one of which is a standard of known accuracy traceable to national standards, to detect, correlate, report, or eliminate by adjustment any discrepancy in accuracy of the instrument or measuring device being compared with the standard.

Certification - The formal written act whereby a responsible official attests to the satisfactory accomplishment of specified activities and authorizes the specified hardware/software, procedures, facilities, and/or personnel for program usage.

Characteristic - A physical, chemical, visual, functional, or any other identifiable property of a product of material.

Contractor – An individual, partnership, company, corporation, association or other service having a contract with the procuring activity for the design, development, manufacture, maintenance, modification or supply of items under the terms of a contract. A Government activity performing any or all of the above functions is considered to be a contractor for configuration control purposes.

Corrective Action - Change to processes, work instructions, workmanship practices, training, inspection, tests, procedures, specifications, drawings, tools, equipment, facilities, resources, or material that result in preventing, minimizing or eliminating nonconformances.

Critical Characteristics - Any physical attribute of an article or material which if defective can cause loss of life or equipment, can result in hazardous or unsafe conditions ,or make the article or material nonfunctional.

Defect - Any nonconformance of a characteristic with specified requirements or any state or condition of nonconformance to requirements.

Depot - A NASA-owned storage, repair and maintenance facility/installation for ISS equipment and supplies

Deviation - Specific written authorization, granted before the fact, to depart from a particular performance or design requirement, specification, or related document for a specific number of units or a specified period of time.

Disposition – The process of evaluating a nonconforming condition for recommendation of corrective action, further clarification, hold/segregation, or acceptance.

Fit – The ability of an item to physically interface or interconnect with or become an integral part of another item.

Form – The defined configuration of an item including the geometrically measured configuration, density, and weight or other visual parameters which uniquely characterize an item, component or assembly. For software, form denotes the language, language level and media.

Function – The action or actions which an item is designed to perform.

Inspect - Independent, hands on inspection.

Inspection - The examination and testing of supplies and services (including, when appropriate, raw materials, components, and intermediate assemblies) to determine compliance with specified requirements. Inspection uses standard methods such as visuals, gauges, etc., to verify compliance with requirements.

Lot - Articles produced in a given time sequence with no change in materials, tooling, processes, personnel, techniques, or configuration.

Major Nonconformance – A nonconformance that is likely to result in failure, or to materially reduce the usability of the supplies or services for their intended purpose.

Material Review Board (MRB) –The formal Provider-Customer Board established for the purpose of reviewing, evaluating, and disposing of specific nonconforming supplies or services; and, for assuring the initiation and accomplishment of corrective action.

Minor Nonconformance – A nonconformance that is not likely to materially reduce the usability of the supplies or services for their intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the supplies or services.

Monitor - Less than 100% witnessing or inspection.

Nonconformance - A condition of any article, item, part, supplies, product, material or service in which one or more characteristics do not conform to requirements specified in the contract, drawings, specifications or other approved product description. Includes failures, discrepancies, defects, and malfunctions.

Nondestructive Evaluation – Inspection procedures developed to assure satisfactory quality levels for parts classified as fracture critical. Inspections performed to part-specific procedures. Specialized multi-technique methods and redundant inspections may be applied.

Original Equipment Manufacturer – Facility/organization that produced equipment (i.e., ORU, sub-assembly) from components usually bought from other manufacturers.

Part - One or more pieces joined together which are not normally subject to disassembly without destruction.

Post-Production Support – Contractor support required for the maintenance and repair of NASA-owned, Contractor-furnished hardware and integrated GFE hardware. Post-production Support (PPS) facilities include approved and designated Original Equipment Manufacturers and NASA Depot/Maintenance facilities.

Pre-Award Survey - An evaluation of a prospective supplier's capability to perform under the terms of a proposed contract.

Preliminary Review (PR) – An evaluation by designated personnel to determine the disposition of nonconforming material after its initial discovery and prior to referral to the MRB. PR may result in an authorized disposition of the nonconforming material without referral to the MRB for final disposition.

Problem - Any nonconformance which is or which is suspected of fitting one of the following categories:

— Failure or unsatisfactory condition occurring, during or subsequent to production acceptance testing.

— Failure or unsatisfactory condition which occurs prior to acceptance testing that will affect or has the potential of adversely affecting safety, will contribute to schedule impact or launch delay, or will result in the need for design change, or indicates a generic EEE parts concern (trend).

Problem Reporting and Corrective Action (PRACA) - A controlled technique for identifying, reporting, analyzing, explaining, and preventing recurrence of problems.

Procurement Documents - Such documents as purchase orders, subcontracts, statements of work, technical specifications, and incorporate work orders required to define articles, materials, and services being procured and the terms and conditions imposed.

Quality - The composite of all the attributes or characteristics, including performance of an item or product that bear on its ability to satisfy stated or implied needs.

Quality Assurance - A planned and systematic pattern of all actions necessary to provide adequate confidence that the item or product conforms to established technical requirements.

Quality Assurance Representative (QAR) - The individual directly charged with performance of the Government contract quality assurance function at a supplier facility.

Recurrence Control - Action taken to prevent repetition of a nonconformance.

Remedial Action - Action to correct a nonconformance.

Repair - Operations performed on a nonconforming article or material which reduces but does not completely eliminate a nonconformance to place the article or material in a usable and acceptable condition; requires review and concurrence by an authorized Material Review Board, additional written procedures and additional operations.

Rework - The procedure applied to articles and materials that will completely eliminate the nonconformance and result in complete conformance to drawings, specifications, procedures, contract or bilateral agreement. Requires only normal operations to complete the article or material in accordance with the applicable documents and does not require additional written procedures.

Sample - One or more units of product drawn from a lot or batch, the units of the sample being selected at random without regard to their quality.

Scrap – Nonconforming material or article that is not usable for its intended purpose and which cannot be economically reworked or cannot be repaired in a manner acceptable to the Government.

Standard Repair Procedure (SRP) – A documented technique for repair of a type of nonconformance which has been demonstrated to be an adequate and cost-effective method for repair when properly applied. SRPs are developed by the provider, reviewed and concurred in by the authorized MRB, and approved by the Government for recurrent use under defined conditions. Defined conditions shall include an expiration date or a finite limit on the number of applications, or both.

Supplier – The terms subcontractor, supplier, vendor, seller, or any other term used to identify the source from which the prime contractor obtains support are considered to be synonymous for the purpose of this document.

Use-as-is – A disposition of material or article with one or more minor nonconformances determined to be usable for its intended purpose in its existing condition. All use-as-is dispositions must be approved by the Government.

Verify - To inspect, test, check, audit, review recorded data (inspection, test, etc.) to establish and document the conformance of items, processes, services or documents to specifications, drawing requirements, etc.

Verification - A process which determines that the SS hardware and software systems meet all design, performance, and safety requirements. The verification process includes analysis, test, inspection, demonstration, or a combination thereof.

Waiver - A written authorization, granted after the fact, for use or acceptance of an article which does not meet specified requirements, but is considered suitable for use “as is” or after repair by an approved method.

Witness - To observe a test or process to verify that correct procedures and processes are followed for a specific action.