MPR 5330.2
REVISION F
EFFECTIVE DATE: March 31, 2015
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MARSHALL PROCEDURAL REQUIREMENTS

QD01

NASA ENGINEERING AND QUALITY AUDIT (NEQA)

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Change/ Revalidation/ Canceled)	Document Revision/ Change	Effective Date	Description
Baseline		5/14/99	Document converted from MSFC-P06.1-C10 to a Directive. Previous history retained in system as part of canceled or superseded ISO Document files. The sample forms (formerly Appendix B) and all references to Appendix B were deleted.
Revision	A	8/20/99	Document updated to reflect new MSFC reorganization.
Revision	B	11/15/2004	Numbered document to conform to MPR 1410.2. Updated requirement statements per HQ action, throughout document. 4. – Added reference document. 5. - Added definitions. 6.1.1-Clarified Statement. 6.2 – Updated responsibilities. 6.3.1.1.a.(1)- Clarified Statement. 6.3.1.3.a.(2)(c)-Strengthened Category Description. 6.3.1.3.a.(2)(d)-Strengthened Category Description. 6.3.2.1.g-Clarification. A.3.2.3-Process Requirements Clarified Statement. A.5.1-Process Requirements Clarified Statement. Deleted 2 flow charts showing process options and replaced with 1 flow chart of NEQA process. Removed the configuration Management from the document. Moved the checklist to Appendix Z. Added Definitions. Clarified Categories.
Revision	C	11/7/2006	Major rewrite. Clarified, added, and deleted definitions. Changed titles of categories and clarified them. Clarified the closure process in 6.3.2.1.f. Integrated process requirements and methodology from Appendix A into instructions. Updated flowchart to reflect changes in process. This revision addresses corrective action for NCRs 827 and 828.
Revision	D	2/23/2007	Revised Sections 6.2.3.4, 6.9 and 9 to address NQA NCR's 827 and 917. Correction made to Applicable Document title for NPR 1441.1.
Revision	E	12/08/2008	Revised applicability statement. Minor editorial changes and renumbering. [On 2/18/10, at the request of the ORPD, an administrative change made at 4.2 to update title name of NPR 7120.5.]
Revision	F	3/31/2015	This revision addresses NCR #1623. Converted MWI 5330.2 F to MPR 5330.2. Included appropriate Applicability Statements to comply with template. Items in Section 6 of the MWI were moved to Chapter 2 with the exception of Responsibilities which was moved to Chapter 1. The NEQA Flow diagram is now in Appendix E. References are now located in Appendix F. Renamed Appendix Z to Appendix G.
Revalidation	F	3/27/2020	Directive reviewed for currency as it expires 3-31-20. Requirements, responsibilities, and processes are found to still be current and accurate.

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PREFACE

P.1 PURPOSE

a. The purpose of this Marshall Procedural Requirements (MPR) is to establish procedures and specific responsibilities for planning and conducting a NASA Engineering and Quality Audit (NEQA) at contractor facilities and to ensure consistent evaluations of contractor compliance with NASA contractual safety and mission assurance and engineering requirements according to NPR 8735.2, 1.2.5 d.

b. NEQAs are structured and completed as defined in this MPR. This MPR establishes requirements and provides the methodology for selection, planning, scheduling, preparation, performance, reporting, and closeout of NEQAs conducted of prime contractors, subcontractors, and vendors when contractually required. A NEQA Flow Diagram and a NEQA Sequential Checklist for audit conduct are included as Appendices E and G.

c. This MPR provides requirements for the implementation of NEQA at facilities and locations involved in manufacture, assembly, testing, and processing of hardware. This audit provides indicators of generic system anomalies that cause or contribute to the inability of the product to satisfy specified requirements as well as specific problems in documentation or performance of required manufacturing and assembly operations.

P.2 APPLICABILITY

a. This MPR applies to Center personnel, programs, projects, and activities, including contractors and resident agencies to the extent specified in their respective contracts or agreements. (“Contractors,” for purposes of this paragraph, include contractors, grantees, Cooperative Agreement recipients, Space Act Agreement partners, or other agreement parties.)

b. This MPR applies to the Michoud Assembly Facility.

c. This MPR applies the following: all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms: “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

e. This MPR applies the following: all document citations are assumed to be the latest version unless otherwise noted.

f. This MPR is applicable to all personnel who serve as chairperson, team members, or facilitator for NEQAs, which are subdivided into Phase I (contractor self-assessment) and Phase II (NASA review/assessment) and to NASA contractors, both internal and external that perform work involving NASA policies, procedures and requirements on hardware, software, materials, and process equipment and have NEQA as part of their contractual agreement.

P.3 AUTHORITY

NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts

P.4 APPLICABLE DOCUMENTS AND FORMS

NRRS 1441.1, NASA Records Retention Schedules

P.5 MEASUREMENT/VERIFICATION

None.

P.6 CANCELLATION

MWI 5330.2E, NASA Engineering and Quality Audit (NEQA), dated December 8, 2008

Original signed by

Patrick E. Scheuermann
Director

CHAPTER 1. RESPONSIBILITIES

1.1 <u>NASA Program/Project offices or organizations responsible for the contract</u> shall:

1.1.1 Ensure implementation of NEQA.

1.1.2 Determine the need for the audit, its scope, depth, and focus.

1.1.3 Define, schedule, and implement corrective actions in conjunction with the contractor project office.

1.1.4 Provide a senior team member and other personnel as appropriate based on the specific processes to be audited.

1.1.5 Appoint Chairperson and notify Contractor of scheduled Audit.

1.1.6 Assign NASA Representative in collaboration with Engineering and Safety and Mission Assurance (SMA).

1.1.7 Serve as the NASA Representative for finding closure if requested.

1.2 <u>NASA Engineering or other technical organizations</u> shall:

1.2.1 Provide technical support to the NEQA through critical assessments of the supplier's engineering processes.

1.2.2 Provide recommendations for audits where evidence depicts necessity.

1.2.3 Assist in scheduling and determining audit scope, depth, and focus.

1.2.4 Participate in audit when requested by Program/Project.

1.2.5 Provide a senior team member and other personnel as appropriate based on the specific processes to be audited.

1.2.6 Collaborate with Program/Project and SMA on assigning NASA Representative.

1.2.7 Serve as the NASA Representative for finding closure if requested.

1.3 <u>NASA Safety and Mission Assurance (SMA)</u> shall:

1.3.1 Serve as NEQA Facilitator.

1.3.1.1 Provide overall quality assurance and safety assessments of NEQA results and assist in corrective action evaluations, tracking and closure, and audit scheduling.

1.3.1.2 Establish procedure for scheduling, planning, conducting, and reporting the audit.

1.3.1.3 Serve as the NASA Representative for finding closure if requested.

1.3.1.4 Maintain documents pertaining to audit.

1.3.2 SMA Chief Safety Officer (CSO)/Quality Engineer (QE)

1.3.2.1 Participate in audit.

1.3.2.2 Collaborate with Program/Project and SMA on assigning NASA Representative.

1.3.2.3 Serve as the NASA Representative for finding closure if requested.

1.3.2.4 Provide recommendations for audits where evidence depicts necessity.

1.4 <u>NASA Representative</u> shall:

1.4.1 Represent/Sign for the Program/Project during the NEQA process.

1.4.2 Evaluate audit finding responses for effective and efficient corrective actions and verify contractor implementation.

1.4.3 Sign each audit finding form after verifying completion of corrective action.

1.5 <u>NEQA/Audit Chairperson</u> shall:

1.5.1 Schedule, plan and implement the audit process.

1.5.2 Serve as lead of the audit.

1.5.3 Ensure audit results are documented and actions are taken.

1.6 <u>NEQA Team Members</u> shall:

1.6.1 Conduct the audit and document results in their assigned areas.

1.6.2 Provide summary of Phase I process results to Phase II.

1.6.3 Analyze results of Phase I and determines appropriate methods for implementing Phase II.

CHAPTER 2. PROCEDURES

2.1 Objective. The overall objective of this MPR is to ensure that all manufacturing and assembly operations provide quality hardware that is safe and reliable. This requires contractors to have accurate and readily-understood planning and associated documentation, adequate training and certification of operators and inspectors, compliance to formal work authorization documents, and the assurance that the application of an operator's or inspector's stamp or signature is a personal warranty that work performed satisfies the literal requirements of the work documents.

2.1.1 The objectives of the audit is to ensure:

a. Planning documents correctly reflect the current released version of the specification and drawing requirements.

b. Proper levels of controls are in place to establish planning requirements.

c. Appropriate levels of authority are involved in the review and approval of planning.

d. Training and certification are adequate to support the required tasks.

e. Planning and instructions are clear, correct, accessible, and easily executed and can be verified.

f. Conformance to contract requirements through traceability of the product to engineering specifications and drawings.

g. Disciplined compliance to work authorization documents, specifications, control documents, and other requirements.

h. Inspection stamps provide warranty of satisfactory completion and verification of operations.

i. Adequate controls are in place and properly utilized to ensure that correct materials and components are delivered from stores to the manufacturing floor.

2.2 NEQA Kickoff process.

2.2.1 A NEQA may be performed under any of the following conditions:

a. Program/Project request.

b. Significant changes to operations.

c. Significant discrepancies.

d. Numerous discrepancies.

e. Adverse trends.

f. Quality escapes.

2.2.2 The Program/Project and SMA Directorate, in cooperation with Engineering, shall collect and analyze data for scheduling and planning an audit, evaluating trend data, metrics, process, product or personnel changes, quality escapes, performance measurement data, and other material deemed applicable.

2.2.3 The Program/Project manager or their designee shall assign an audit chairperson.

2.2.4 A contractor or subcontractor shall be scheduled for audit at the Program/Project manager's recommendation or based on data indicating numerous or significant discrepancies, adverse trends, quality escapes, and/or significant changes to the contractor's operation.

2.2.5 The Program/Project office shall notify the contractor in writing at least 15 workdays prior to Phase I of the audit.

2.2.5.1 The notification shall include the audit dates for Phase I and Phase II (allowing time between phases for the Phase I findings to have corrective actions defined and possibly implemented) and necessary contractor support.

2.2.6 Subcontractor or vendor audits shall involve the prime contractor.

2.2.7 The chairperson shall identify the hardware (Section 2.3.1) and/or areas to be audited through evaluation of problems/trends and in coordination with the Program/Project office, engineering organization, and SMA.

2.3 Audit Scheduling and Planning.

2.3.1 Hardware Selection. Hardware selected for an audit shall be a major assembly, subassembly, component or an individual part.

2.3.1.1 Selection shall be done prior to the audit or at the opening session of the audit.

2.3.1.2 The audit team shall review the manufacturing flow from material receipt to acceptance for the selected parts or systems.

2.3.1.3 The following criteria shall be considered for hardware selection:

a. Audit objectives including adverse trends.

b. Particular process to be evaluated.

c. An item that involves several critical processes.

d. Hardware availability.

e. Items that can be traced from acceptance to receiving inspection, including raw material certification.

f. Items that allow the audit to evaluate many manufacturing/assembly functions, (e.g., fabrication controls, nonconformance reporting, metrology, configuration/change control, and other areas deemed applicable).

2.3.1.4 An effort should be made to select parts which involve a maximum number of manufacturing processes and is near the end of manufacturing.

2.3.1.5 Part numbers and serial numbers of parts selected shall be recorded.

2.4 Audit. The audit shall be conducted in two parts: Phase I and Phase II.

2.4.1 Phase I Audit Actions (contractor self-assessment). Phase I shall be a candid self-assessment by the contractor of their work.

2.4.1.1 The assessment shall establish a baseline to be used in Phase II; therefore, it is necessary to adequately cover a significant sampling of work documentation (process procedures, Work Authorization Documents (WADs), etc.). The preferred method is to complete all planned operations prior to Phase II. It is recognized, however, that given availability of personnel and other considerations, a smaller sampling may be considered.

a. When a representative sample is used, samples shall be chosen from tasks/operations that are in process during Phase I.

b. Samples shall include various types of operations.

2.4.1.2 Plan. Prior to initiation of Phase I, a plan shall be established that identifies the product areas to be covered and the audit method.

2.4.1.3 Personnel. The team shall be made up of Government and contractor personnel.

a. Personnel selected to perform the audit shall be practitioners of the process.

b. Clear and concise guidelines shall be provided for their use.

Note: It is also important that one or two individuals who are knowledgeable of the process (but are no owners of the process) be included on the team.

2.4.1.4 Team Size.

a. No size restriction constrains the number of personnel used on the team(s). Team(s) shall be composed of individuals with all necessary expertise to cover the operation under review.

b. It is recommended that each team select a representative to document and report results of the audit.

c. Customer representation shall be considered.

2.4.1.5 Kickoff Meeting. A kickoff meeting shall occur with each Phase I team prior to initiation of the audit to review the audit method, operations to be covered, and the reporting criteria.

a. Team members shall be instructed to review each operation and the supporting documents with the focus on accuracy and their ability to perform and warrant each task as literally stated.

b. Selection of parts (Section 2.3.1) to be reviewed shall be made at this meeting if not previously selected.

2.5 Audit Method.

2.5.1 The team members shall review the tasks for personal warranty.

2.5.2 At a minimum, the following questions shall be addressed during the review:

a. Do drawings, specifications, and planning reflect current engineering practices?

b. Are operators and inspectors adequately trained?

c. Are the required parts and quantity correct?

d. Are allowable alternate parts clearly defined?

e. Is the full part number identified?

f. Are operation figures adequate?

g. Is the tooling adequate?

h. Are aids or other noncontrolled items used?

i. Is the operation sequenced correctly?

j. Is there a preferred sequence for operations allowing out-of-sequence work?

k. Are other documents referenced and is their application consistent with the text?

l. Is this a non-value-added operation or step?

m. Does the text clearly describe what is to be performed?

n. Is serialization entered at the time of installation?

o. Can the mechanic, technician, inspector, or engineer warrant the operation or step as literally stated?

p. Are measurement requirements clear and achievable?

q. Are references to drawings, drawing notes, specifications, procedures, and documentation, correct and necessary?

2.5.3 The audit team shall track the part through the manufacturing and assembly process.

2.5.3.1 Physical moves, machining, inspections, and tests shall be validated by reviewing documentation, personnel certifications, and governing engineering drawings.

2.5.4 Part Integrity. If the selected part is new hardware, the audit shall include tracking the selected parts back to raw material purchase/certification.

2.5.4.1 Procedure documents, receiving data, equipment/facility certifications, personnel qualifications and certifications, and other material deemed applicable shall be reviewed. If the selected part(s) is recycled hardware, traceability to raw material may not be achievable during the time constraints of the hardware audit.

2.5.4.2 The audit team and the manufacturer shall determine the boundary of the part integrity portion of the audit and clearly document the limits of the review.

2.5.5 Process Integrity. The audit team shall review in detail, line-by-line, the principal work authorization document, specifications, procedures, instructions, control documents, and other requirements being used to control operations on the part or assembly.

2.5.5.1 The objective of this process is to ensure the work is being done in accordance with authorized/released engineering documentation.

2.5.5.2 All referenced specifications, standards, procedures, drawings, special tools, and other material deemed applicable shall be traced to demonstrate that engineering requirements were achieved.

2.5.6 Shop Audit. The audit shall include an operational review of the manufacturing area.

2.5.6.1 Selected parts/assemblies shall be physically located/inspected and a line-by-line review for completeness and accuracy of all associated shop floor documentation shall be performed and documented.

2.5.6.2 At this point, the team shall broaden the scope of their review to include related hardware being processed, desk-level instructions, and other general inspections.

2.5.6.3 The audit team members are encouraged to utilize the NEQA Sequential Checklist (see Appendix G) to conduct the audit. Team members are free to pursue other areas as they deem appropriate.

2.6 Documentation of Audit Results. Team(s) shall redline documents with proposed changes and corrections during Phase I review process.

2.6.1 In addition to redlines, the team shall document observations using an Observation form or other applicable form.

2.6.2 Observations shall be categorized as:

a. Best Practice –requires no change.

b. Strength –requires no change.

c. Observed Concern – changes incorporated at next opportunity.

d. Corrected On The Spot (COTS) – document for trending purposes.

e. Finding, Noncritical – changes required prior to next application of the task/operation.

f. Finding, Critical – changes required immediately.

2.6.3 Contractor shall also document the condition in their nonconformance system and disposition any hardware per their management system.

2.6.4 Material Review and Unsatisfactory Condition Reporting. Contractual rules for material review and unsatisfactory condition reporting apply to critical findings.

2.6.4.1 Provisions shall be in place to initiate and process these documents as soon as the audit teams are confident that the problems are adequately described.

2.6.4.2 Flight rationale and hardware quality rationale shall be developed for each critical finding prior to review by the Phase II team.

2.6.5 Phase I Reporting. The teams' observations, the team members, and their job function and organization shall be documented for reporting at the Phase II opening meeting and inclusion in the Phase II final report.

2.6.6 Incorporation of Recommended Changes. When required, changes shall be incorporated by the contractor using existing systems with a final review by the review team prior to approval to ensure that all changes satisfy their intent.

2.7 Phase II Audit Actions (NASA Assessment, Hardware Audit).

2.7.1 The Phase II team shall gather and evaluate program requirements and available contractor documents to become familiar with the contractor's system.

2.7.2 The Phase II team shall review sample of the work/results of the Phase I team and perform a check audit using the same method of categorization and reporting as the Phase I team, to check the validity of the Phase I redline activity and/or to determine if an audit of other areas not addressed in Phase I is to be addressed during Phase II.

2.7.2.1 The number of hardware audits is dependent on the sample size determined by the Phase II team to satisfy their objectives.

2.7.2.2 As a minimum, members of the Phase II team and customer representatives shall be instructed to review a specific component or process.

2.7.2.3 The hardware audit initiates from the earliest point in the processing of the component and ends at its latest state.

2.7.2.4 Plan. Prior to initiation of Phase II, a plan shall be established that identifies the individuals and methods.

2.7.3 Personnel. Personnel selected for Phase II shall not be the same individuals involved in Phase I. A Phase I team member is permitted to serve as a consultant to a Phase II audit team during the process.

2.7.3.1 Phase II personnel shall include experts in the systems covered by Phase I, with excellent analytic skills to evaluate and penetrate generic system anomalies for root cause analysis.

2.7.3.2 Both NASA and contractor personnel shall be included.

2.7.3.3 The chairperson shall approve Phase II team members matching available expertise to product, process, or area to be reviewed.

2.7.4 Team Size. No size restriction constrains the number of personnel used on the team. In fact, a larger, more diverse cross-section is preferred.

2.7.5 Kickoff Meeting. A Kickoff Meeting shall occur prior to initiation of Phase II, led by the NEQA chairperson identified by the Program/Project manager or their designee.

2.7.5.1 A general discussion of the methods and recording rules shall occur.

2.7.6 Phase II Opening Meeting. During the Phase II opening meeting the NEQA chairperson shall introduce the Phase II team members.

2.7.6.1 The Phase I team shall make a presentation to the Phase II team covering all significant Findings with their corrective actions, and a sufficient sampling of Observed Concerns to allow the Phase II team to develop confidence in the proper classification. A preferred method of data presentation is the use of redlined planning copies. Review of one-line summaries is acceptable if there is a large quantity of changes to be reviewed.

2.7.6.2 If one-line summaries are employed, redline planning copies shall be available for the team to use at their discretion.

2.7.6.3 Listings of generic observations, findings, concerns, actions, and recommendations shall be developed during the process of reviewing the Phase I changes.

2.7.6.4 This information shall be distributed to the Phase I team(s), as it is developed, to aid in subsequent reviews and increase awareness.

2.8 Phase II Assessment of the Phase I Process Results.

2.8.1 Conclusions. The Phase II team, at the conclusion of reviewing all changes identified by the Phase I team(s) shall organize the data.

2.8.1.1 The Phase II team, shall identify symptoms of overall system problems.

2.8.1.2 Additional review of systems in question shall be reviewed at this time if necessary.

2.8.2 Additional Review. The Phase II team shall, at its discretion, identify further sampling or a complete re-audit of the Phase I team(s) sampling, if there are concerns for the level of review applied or significant system problems.

2.8.3 The NEQA chairperson shall provide a copy of all observation forms generated from this review to the contractor representative.

2.8.4 Review Process. The following are areas to penetrate and understand about the contractor during Phase II of NEQA:

2.8.4.1 Planning Activities

a. Personnel training and experience.

b. Release and change process.

c. Approvals and checking.

d. Planning.

e. Complexity level and warranty capability.

f. Accuracy of planning, drawings, and specifications.

g. Lines of authority, control, and responsibility for planning.

2.8.4.2 Personnel

a. Special skills identification and training.

b. Experience levels and tenure.

c. Propensity to follow planning and warranty elements.

2.8.4.3 Hardware Inventory, Controls, and Tooling

a. Kitting methods.

b. In-process hardware storage.

c. Tooling/test fixture and shop aid controls.

2.8.4.4 Manufacturing/Assembly

a. Use of shop practice inconsistent with formal manufacturing planning or use of uncontrolled documented procedures.

b. Level of independence of quality inspectors.

c. Identification of tasks which require special skills and training not currently being provided.

2.8.4.5 Documentation of Audit results.

a. Phase II team(s) shall document observations using an Observation form or other applicable form.

b. Observations shall be categorized as a:

(1) Best Practice – requires no change.

(2) Strength – requires no change.

(3) Observed Concern – changes incorporated at next opportunity.

(4) COTS – document for trending purposes.

(5) Finding, Noncritical – changes required prior to next application of the task/operation.

(6) Finding, Critical – changes required immediately. (Contractor shall also document the condition in their nonconformance system and disposition any hardware per their management system.)

2.8.5 Material Review and Unsatisfactory Condition Reporting. Contractual rules for material review and unsatisfactory condition reporting apply to critical findings.

2.8.5.1 Provisions shall be in place to initiate and process these documents as soon as the audit teams are confident that the problems are adequately described.

2.8.6 Corrective Action Recommendations. At the completion of the Phase II team assessment, the team shall recommend corrective actions, if applicable, with clearly-defined criteria for closure and assignment of personnel to ensure completion.

2.9 Phase II Reporting.

2.9.1 The NEQA chairperson, with the assistance of the audit team, shall prepare an exit briefing/report.

2.9.1.1 A copy of the exit briefing/report shall be given to the contractor representative at the closing meeting for the official record.

2.9.1.2 The exit briefing/report shall contain, as a minimum the following:

a. A short narrative summary of the audit results (highlighting the significant observations).

b. The names of the audit team members.

c. A count of observation forms, including Findings, Observed Concerns, COTS, Best Practices and Strengths.

2.9.2 The audit chairperson shall provide the contractor representative, a copy of all observation forms with appropriate recommendations from the audit team.

2.9.2.1 The observation forms shall be signed by the NEQA chairperson(s), the contractor representative and the originator (team member making the observation) as concurrence with the documented observation.

2.9.3 Findings and COTS shall be tracked to closure.

2.9.3.1 Observed Concerns, Best Practices and Strengths shall be documented on observation forms and provided to the Program/Project office and contractor but shall not be tracked.

2.9.4 The Phase I report presented at the Phase II opening meeting shall be included with the Phase II documentation for record.

2.9.4.1 The official record is maintained by the Contractor with a file copy maintained by the Audit Manager of the SMA Directorate.

2.9.5 Audit Closeout Procedures.

2.9.5.1 Root cause and corrective action shall be documented for each finding.

2.9.5.2 Audit findings shall be:

a. Tracked through closure.

b. Verified for completion of corrective actions.

c. Signed after completion of corrective actions.

Appendix A. DEFINITIONS

Best Practice. A process or policy that is not required but is value added and yields the most desirable results.

Corrected On The Spot (COTS). A minor isolated audit finding that can easily be rectified and requires no additional follow-up.

Critical. Any part, assembly, installation, process, or performance containing a characteristic whose failure, malfunction, or absence could cause a catastrophic failure potentially leading to loss of crew, loss of vehicle, loss of mission, or threat of safety to the public.

Finding. System deficiency or irregularity found in areas controlled by requirements, specification, or procedures that warrant improvement and has the potential to adversely affect safety or mission assurance if not resolved.

Observation. Statement of fact substantiated by objective evidence. An observation can be noted as a finding, observed concern, best practice, strength, or COTS.

Observation Form. Documents a finding, root cause, corrective action, and verification of implementation of corrective action. The same form is used to document observed concerns, COTS, best practices, and strengths. The form also includes the signatures of the originator, the contractor representative, the NEQA chairperson(s), and the NASA representative once a finding has been verified as corrected and closed.

Observed Concern. A condition that can lead to nonconformance and process changes requiring further study.

Recommendation. Preventive/Corrective actions and better practices proposed by the Assessment/Audit Team intended to improve manufacturing, assembly operations, testing, and processing of hardware.

Strength. Requirements being consistently met within a particular area or operation, thus making the overall process better.

Appendix B. ACRONYMS

COTS	Corrected On the Spot
CSO	Chief Safety Officer
MPR	Marshall Procedural Requirements
MR	Material Reviews
MRB	Material Reviews Board
MWI	Marshall Work Instruction
NEQA	NASA Engineering and Quality Audit
QE	Quality Engineer
SMA	Safety and Mission Assurance
WAD	Work Authorization Document

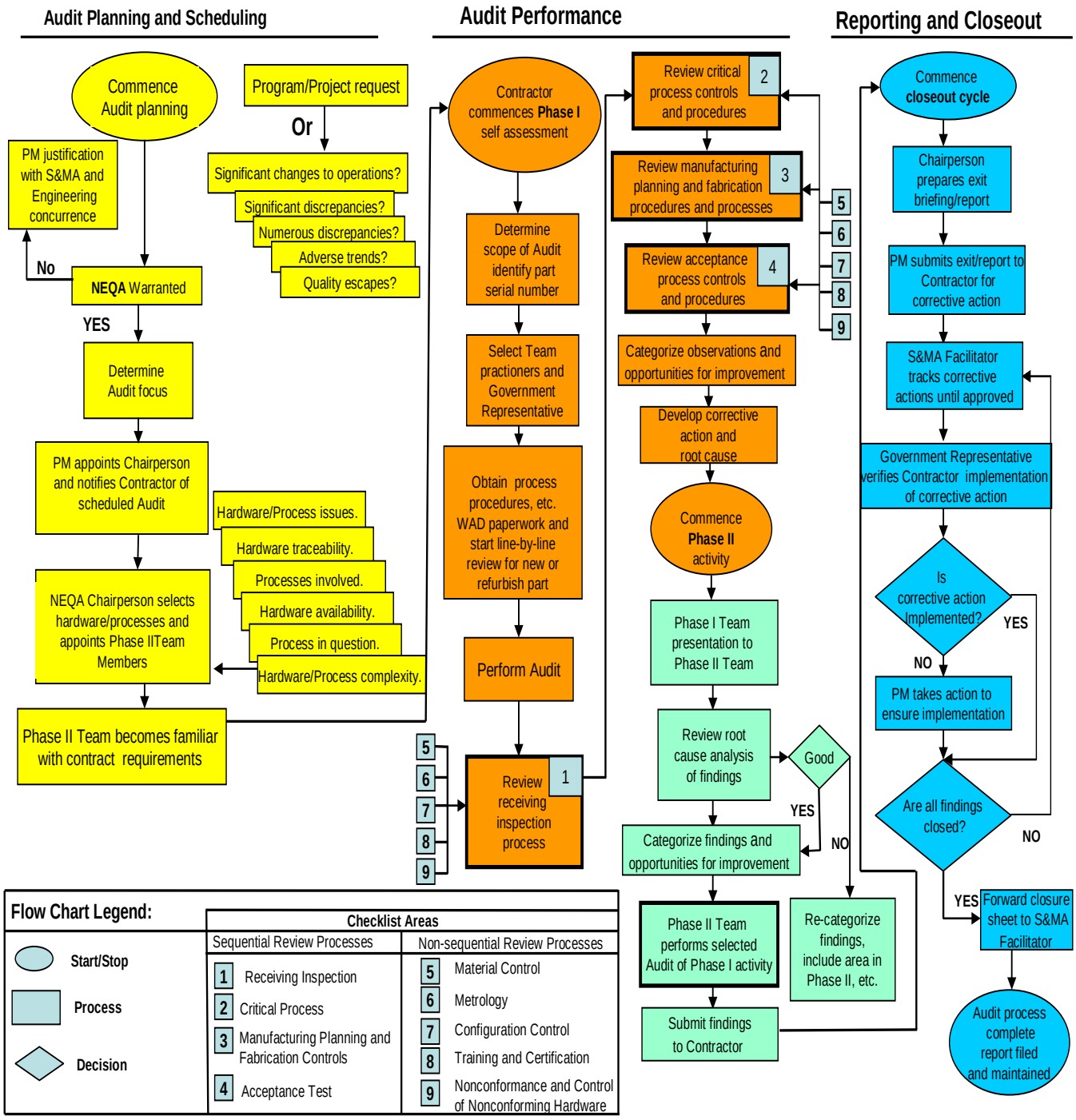
Appendix C. (Reserved for Verification Matrix)

Appendix D. RECORDS

D.1 The exit briefing/report, the Phase I summary presented to the Phase II team during the opening meeting, and the completed observation forms with the respective corrective action plans and closure thereof will be maintained as an official record by the Contractor.

D.2 A copy will be maintained by the Audit Manager of the SMA Directorate per NRRS 1441.1, 8/36.5/c/1; handle as permanent.

Appendix E. NEQA FLOW DIAGRAM



Appendix F. REFERENCES

NPD 8700.1, NASA Policy for Safety and Mission Success

NPR 7120.5, NASA Space Flight Program and Project Management Requirements

NPR 8735.2, Management of Government Quality Assurance Functions for NASA Contracts

Appendix G

GUIDELINES

G.1 NEQA Sequential Checklist.

G.1.1 Receiving Inspection.

G.1.1.1 Record the nomenclature and serial number of the selected audit material/hardware.

G.1.1.2 Compare selected hardware material procurement specification requirements with receiving records to verify compliance with specification requirements.

G.1.1.3 Verify that the selected material/hardware used in the fabrication of flight hardware is certified and accompanied with certification documentation.

G.1.1.4 Verify that accompanying material traceability documents for parts/material received by the contractor are complete, legible, and correct.

G.1.1.5 Verify that the selected hardware/material is inspected for proper identification (serial number, lot number, date code, etc.,) in the correct manner (etched, stamped, painted, tagged, etc.,) and located as specified in the drawings and procurement specifications.

G.1.1.6 Physically inspect storage area to ensure segregation of:

a. Flight and Nonflight material/hardware.

b. Material awaiting inspection and test sample results.

c. Accepted and rejected material.

G.1.1.7 Inspect Storage area to ensure access control.

G.1.2 Critical Manufacturing Processes.

G.1.2.1 Identify critical processes selected for audit and perform the following:

a. Line-by-line comparison of critical process with process specification and identify potential problem areas.

b. Spot-check interviews with personnel involved with manufacturing of the hardware to determine if requirements of specification are properly understood.

G.1.2.2 Verify that process control procedures are readily available for use by manufacturing personnel.

G.1.2.3 Verify procedures are in place for the certification of critical processes and personnel.

G.1.2.4 Evaluate contamination control procedures for selected hardware to ensure compliance with specification requirements.

G.1.2.5 Examine each inspection point for proper placement in the selected critical process sequence.

G.1.2.6 Verify compliance with required inspections by properly-certified inspectors.

G.1.3 Manufacturing Planning and Fabrication Controls.

G.1.3.1 Review the manufacturing planning documentation line-by-line for the selected hardware item and evaluate for compliance with specification. The audit includes the following:

a. Verification that the complete data packages are located with the hardware item.

b. Assurance that the item is protected physically and environmentally.

G.1.3.2 Verify that the planning documentation clearly defines the operation to be performed:

a. Sequence of operations.

b. Setups.

c. Equipment and tools.

d. Processes.

e. Detailed procedures.

f. Drawing numbers and revisions.

g. Test operations.

h. Specifications.

i. Raw materials.

j. Environment controls.

k. Handling equipment.

l. Identification of inspection points.

G.1.3.3 Verify that inspection points are properly placed to verify compliance with requirements.

G.1.3.4 Verify that approved inspection work instructions contain as a minimum:

a. Accept/reject criteria.

b. Inspection tools, gauges, equipment.

c. Drawing number, revision, and nomenclature.

d. Workmanship standards.

e. Details of specific inspections to be performed.

f. Inspection records.

g. Control of nonconforming material.

G.1.3.5 Verify that the manufacturing planning paper reflects that any out-of-sequence operational changes have been properly approved and that inspection points have not been omitted.

G.1.3.6 Ensure that the manufacturing planning paper reflects the latest engineering changes and that the changes are properly approved.

G.1.3.7 Identify approved procedures for disposition (marking and segregation) of rejected hardware. Has any material been rejected? If so, is a rejection tag attached to the material? Is the material identified and removed/segregated?

G.1.3.8 Verify that authority to move the hardware to the next manufacturing operation is defined.

G.1.3.9 Verify that workmanship standards are clearly defined.

G.1.3.10 Verify that closeout inspections are performed on items such as black boxes, gear boxes, and equipment containers.

G.1.3.11 Evaluate the contractor's identification and control of temporarily-installed equipment.

G.1.3.12 Verify that shipping, packaging, and handling are adequate to prevent rust, oxidation, deterioration, and damage.

G.1.4 Hardware Acceptance Test.

G.1.4.1 If possible, witness an acceptance test of the selected audit hardware item(s) or a similar item.

G.1.4.2 Conduct a line-by-line evaluation of the as-run test procedure and compare with the test plan and appropriate specification.

G.1.4.3 Verify that test equipment is controlled, maintained, and calibrated as specified in procedures.

G.1.4.4 Verify that the test environment is controlled to specified requirements.

G.1.4.5 Verify that nonconformances are properly documented prior to, during, and after testing.

G.1.4.6 Verify that records and data of testing are accurate and in sufficient detail to provide complete verification and evaluation.

G.2 Material and Hardware Control (Nonsequential Checklist).

G.2.1 Verify that the contractor has approved operating procedures for proper control of material stores, including Government-furnished material.

G.2.2 Compare material specification requirements with storage practices to verify compliance with specification requirements.

G.2.3 Evaluate controls to ensure correct material is delivered from stores to manufacturing floor.

G.2.4 Is there a system for continual identification of material for traceability and data retrieval?

G.2.4.1 Does the ability for data retrieval extend back to the lowest level specified?

G.2.4.2 Does the data retrieval system enable determination of the location of components with identification numbers (serialized, lot numbered, date coded)?

G.2.4.3 Do the identification methods ensure a unique part or type number for individual articles, lots of articles, or material?

G.2.4.4 Does the identification system preclude re-use of serial numbers of scrapped articles?

G.2.4.5 Are records of articles and materials retained in a safe and accessible location?

G.2.5 Verify that material hardware is properly segregated:

a. Material awaiting inspection and test sample results.

b. Acceptable and rejected material.

c. Flight and nonflight material/hardware.

G.2.6 Are age and shelf-life-limited materials/items adequately controlled?

G.2.7 Are Material Utilization Agreements current and properly approved?

G.2.8 Are procedures in place for identifying materials/hardware which have cyclic testing and/or processing limitations? Are applicable personnel familiar with the procedures?

G.2.9 Are limited-use items identified to avoid misuse?

G.2.10 Metrology.

G.2.10.1 Are procedures and plans in place for the calibration of measurement standards and equipment?

a. Are calibration standards used traceable to the National Institute of Standards and Technology? Does a review of the certification of each standard reveal calibration within the last year? Are measurement standards uniquely identified and labeled, tagged, or coded to indicate calibration status and due date of next calibration? If equipment is out of calibration is there a documented process to identify all affected hardware?

b. Is automatic test equipment under scheduled evaluation by the metrology organization?

c. Are procedures adequate and effective for the protection of test equipment during handling and storage (by metrology organization)?

G.2.10.2 Are all standards and equipment used in measurement processes required to be recalled and recalibrated at established intervals? Does an inspection of test equipment demonstrate that the calibration is current?

a. Are calibration records maintained?

b. Are metrology laboratory environmental requirements adhered to?

c. Evaluate the automatic inspection/testing equipment preventive maintenance program.

(1) Is the preventive maintenance program documented, including adequate schedules and implementing procedures?

(2) Does the contractor comply with these documented requirements?

(3) Is the equipment thoroughly tested, validated, or certified before putting it back in operation following maintenance?

(4) Are the proper tools and consumables available to correctly complete the maintenance actions?

(5) Are personnel performing the maintenance adequately trained and knowledgeable of the preventive maintenance procedures and requirements?

G.2.11 Training and Certification.

G.2.11.1 Are critical processes that require certification and training clearly defined?

G.2.11.2 Does the contractor have a well-defined personnel training and certification plan for personnel?

a. Do personnel have proof of certification for work they are performing?

b. Are recertification requirements defined and is the contractor in compliance?

c. Are accurate records maintained on the training and certification status of personnel?

G.2.12 Nonconformances and Control of Nonconforming Hardware.

G.2.12.1 Review documentation used to control nonconforming articles and materials, and determine on-the-floor compliance with this documentation.

G.2.12.2 Select a flight hardware item (selected audit item if possible) in process where nonconformances have been processed, and evaluate for the following:

a. Nonconformance paper.

b. Dispositions.

c. Verification of action taken.

d. Re-inspection.

e. Corrective action.

f. Recurrence control.

g. Is/was the hardware requiring disposition adequately controlled (tagged, segregated)?

G.2.12.3 Are failure trends analyzed for repetitive failure modes?

G.2.12.4 Select a sample (from selected audit item if possible) of Material Reviews (MRs) and review for:

a. Adequacy of discrepancy description.

b. Is rationale provided to justify dispositions? Is supporting data (stress analysis, lab reports, test data, etc.,) referenced on MR or attached?

c. Does disposition address all described defects?

d. Have applicable specifications been called out for the rework?

e. Were sufficient retest requirements identified?

f. Verify concurrence signatures of authorized personnel.

g. Is the action an appropriate Material Reviews Board (MRB) action or a deviation/waiver?

G.2.12.5 Evaluate the contractor's effort to reduce "use as is" MRB discrepancies.

G.2.12.6 Verify that the contractor has approved standard rework and repair procedures.

G.2.12.7 Are adequate procedures in place to rework, segregate, or dispose of nonconforming hardware?

G.2.12.8 Does the contractor have adequate procedures for purging obsolete/nonflight hardware from stores and shop areas?

G.2.12.9 Are obsolete/nonflight hardware items allowed in shop cabinets, individual tool boxes, or other shop areas?

G.2.12.10 Can obsolete/nonflight hardware be readily identified without examining part number or serial number?

G.3 Examples of Generic Classification and Possible Root Causes.

G.3.1 Generic Problem: Procedure/Specification Noncompliance - ROOT CAUSES:

a. Personnel did not think requirement necessary.

b. Lack of required effort to do quality job.

c. Personnel not knowledgeable of requirement.

d. Requirement not clear.

e. Human error.

f. Management pressure to meet schedule.

G.3.2 Generic Problem: Inadequate Procedure/Specification - ROOT CAUSES:

a. Lack of detail.

b. Coordination and review inadequate.

c. Specifications do not reflect current requirements.

G.3.3 Generic Problem: Inadequate Management Attention - ROOT CAUSES:

a. Insufficient management visibility.

b. Low priority.

c. Schedule/Resource pressure.

G.3.4 Generic Problem: Inadequate Inspection - ROOT CAUSES:

a. Inadequate Training.

b. Lack of attention to detail.

G.3.5 Generic Problem: Inadequate Manufacturing Planning - ROOT CAUSES:

a. Planner failed to recognize engineering requirements.

b. Human error.

c. Lack of timely update to on-the-floor planning.

G.3.6 Generic Problem: Inadequate Training - ROOT CAUSES:

a. Failure to recognize need.

b. Improper training program.