

MWI 8040.4

REVISION B

EFFECTIVE DATE: July 10, 2000

EXPIRATION DATE: July 10, 2005

MARSHALL WORK INSTRUCTION

ED01

APPLICATION GUIDANCE FOR TRACEABILITY

CHECK THE MASTER LIST at
<https://repository.msfc.nasa.gov/directives/directives.htm>
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 2 of 10

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		5/14/99	Document converted from MSFC-P08.2-CO1 to a Directive. Previous history retained in system as part of canceled or superseded ISO Document files.
Revision	A	8/20/99	Changes made to reflect new MSFC reorganization. Paragraph 3.c. was changed to NHB 5300.4(1F) as previously referenced in the baseline of MWI 8040.4. Paragraphs 6.1.1 and 6.1.3: reference to MSFC-STD-3012 changed to NHB 5300.4(1F).
Revision	B	7/10/00	<p>Changed OPR to ED01.</p> <p>1.Chgd to read: "The purpose of this MWI is to provide consistent application guidance to establish traceability for flight hardware/software and associated ground support equipment as specified in MPG 8040.3." Deleted second paragraph.</p> <p>2. Reworded first sentence: "This MWI applies to MSFC organizations involved in the management and design of MSFC projects."</p> <p>3.a: Deleted.</p> <p>3.a: Added MPG 8040.2.</p> <p>3.c: Document cancelled. Replaced with MSFC-STD-3012, "EEE Parts Management and control for MSFC Space Flight Hardware"</p> <p>5. Added statement: (The definitions in MPG 8040.2 apply.)</p> <p>5.7: First sentence deleted "(EPL),MSFC Form 420."</p> <p>5.8: Changed "crack" to "defect."</p> <p>5.9: Deleted "EPL's.)</p> <p>5.11, 5.14,5.14.a,5.14.b: - Deleted and renumbered paragraphs.</p> <p>6.1 Changed to read: "Specifies appropriate levels of part and material traceability for hardware/software in compliance with the requirements of MPG 8040.3 and section 6.4 of this document."</p> <p>6.3: Changed "Attachment B" to "Attachment A."</p> <p>6.4.1: Chgd title to Identification Numbers and deleted reference to NHB 5300.4(1F) (obsolete document).</p> <p>6.4.2 Deleted numbers from title, EPL's acronym, and added "serialized:" at end of sentence.</p> <p>6.4.3.1 and 6.4.4: Replaced obsolete NHB 5300.4 with MSFC-STD-3012.</p> <p>6.4.4: Changed: "Engineering Documentation" to "Configuration Documentation."</p> <p>6.5: Added: "The developing software organization will establish and control traceability requirements for software end items."</p> <p>7. Changed NOTES to "None."</p> <p>9. Changed to read: "See MPG 8040.3."</p> <p>[Footer URL updated 01/14/2004 by Directives Manager.]</p>

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 3 of 10

1. PURPOSE

The purpose of this Marshall Work Instruction (MWI) is to provide consistent application guidance to establish traceability for flight hardware/software and associated ground support equipment, as specified in MPG 8040.3.

2. APPLICABILITY

This MWI applies to Marshall Space Flight Center (MSFC) organizations involved in the management and design of MSFC projects. It applies to MSFC contractors to the extent specified in procurement documents.

3. APPLICABLE DOCUMENTS

- 3.1 MPG 8040.2, "Product Identification"
- 3.2 MPG 8040.3, "Product Traceability"
- 3.3 MSFC-STD-3012, "EEE Parts Management and Control for MSFC Space Flight Hardware"
- 3.4 MSFC-STD-555, "MSFC Engineering Documentation Standard"

4. REFERENCES

None

5. DEFINITIONS (The definitions in MPG 8040.3 apply.)

5.1 Article. A unit of hardware or software or any portion thereof required by the contract.

5.2 Assembly. A number of parts or subassemblies or any combination thereof joined together to perform a specific function.

5.3 Certificate of Conformance (COC). A contractor's written statement certifying that supplies or services comply with contract requirements. The certificate of conformance may be used instead of source inspection at the discretion of the contracting officer.

5.4 Chemical and Physical Analysis.

5.4.1 Actual. Material test reports that certify and document that actual chemical and physical attributes meet the raw

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 4 of 10

material specification. This includes specific percentages of each chemical element and physical tensile strength results for each lot/batch.

5.4.2 Typical. Material test reports that certify the chemical and physical attributes of a raw material fall within the specified range as denoted in the material specification for each lot/batch.

5.5 Component. A combination of parts, devices, and structures, usually self-contained, which performs a distinctive function in the operation of the overall equipment; e.g., a "black-box," transmitter, encoder, or cryogenic pump.

5.6 Date Code. A number which indicates a specific date in code. A date code may consist of a series of numbers that indicate day, week, month, or year.

5.7 Engineering Parts List (EPL). An engineering document that identifies part/parts information including release authority, part/parts numbers, quantities, weights, traceability requirements, and part/parts descriptions required to build the respective assemblies and subassemblies.

5.8 Fracture Critical. A classification which assumes that fracture or failure of the part/component resulting from the occurrence of a defect will result in a catastrophic hazard which could lead to loss of flight vehicle or crew.

5.9 Material Traceability Levels. A numerical code ranging from 1 to 4, used to identify material traceability requirements on Engineering Parts Lists. It identifies traceability requirements for individual parts, assemblies, or subassemblies.

5.10 Mill Markings. Physical item identification markings applied to raw materials in accordance with Federal Standards issued pursuant to the Federal Property and Administrative Services Act of 1949, as amended (i.e., for nickel and nickel-base alloys, Federal Standard No. 182B applies; for aluminum, magnesium and titanium, Federal Standard No. 184B applies).

5.11 Part. One piece or two or more pieces joined together, which are not normally subject to disassembly without destruction.

5.12 Trace Number. A number assigned to raw material for identification prior to fabrication and subsequent lot or serial number assignment.

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 5 of 10

6. INSTRUCTIONS

<u>Actionee</u>	<u>Action</u>
Program/Project Manager 6.1	Specifies appropriate levels of part and material traceability for hardware/software in compliance with the requirements of MPG 8040.3 and section 6.4 of this document.
Systems Engineer 6.2	Recommends appropriate levels of part and material traceability to the program/project manager and ensures implementation of those requirements within the program/project.
Design Organizations 6.3	As required by the program/projects' traceability needs, will specify traceability requirements on the lowest-level drawings and Engineering Parts Lists per MSFC drawing standard requirements (MSFC-STD-555).
	Traceability requirements and material traceability levels will be specifically identified during design and evaluated at design reviews to ensure that the proper level of traceability is identified and that the identification method, type, and location are properly specified. Appendix A shows a typical sequence used in specifying traceability requirements on engineering drawings.

6.4 Application Guidance.

6.4.1 Identification Numbers. Part identification numbers shall be used to identify parts and assemblies built to MSFC engineering drawings. Part and assembly identification for contracted or purchased parts and assemblies will be in accordance with requirements specified in procurement documents. Serial numbers and lot numbers/date codes shall be

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 6 of 10

recorded/documented and, as practical, physically affixed to the equipment/hardware.

6.4.2 Serialization. The following types of equipment/hardware and their next higher assemblies, which are identified on engineering drawings/Engineering Parts Lists as requiring traceability, will be serialized:

6.4.2.1 Electro-mechanical, Electrical, Electronic (EEE), and mechanical assemblies and subassemblies which are replaceable or repairable such as valves, actuators, pressure vessels, batteries, telemetry multiplexers, amplifiers, transducers, modules, printed circuit boards, etc.

6.4.2.2 Structural items having critical design significance which must be controlled and for which test and inspection records are required and maintained (e.g., fracture-critical parts, pressure vessel assemblies, forgings, castings, extrusions, etc.).

6.4.2.3 Articles or assemblies subject to time-cycle variation limitations, periodic checkout, calibration, servicing and maintenance, and reinspection.

6.4.2.4 Articles requiring selective fits for matched sets of functional assemblies.

6.4.3 Lot Number and/or Date Codes. The following types of equipment/hardware identified on engineering drawings/EPL as requiring traceability will have lot number and/or date codes and applicable manufacturer's Commercial and Government Entity (CAGE) Code applied:

6.4.3.1 Electronic parts, such as transistors, resistors, diodes, capacitors, switches, connectors, and relays. Additional traceability requirements for electronic parts are addressed in MSFC-STD-3012.

6.4.3.2 Items fabricated from a common lot of raw material, heat, batch, or process, such as noncritical forgings and castings, fittings, or items which are subjected to destructive acceptance sampling such as fasteners and pyrotechnic devices.

6.4.3.3 Raw materials such as plastic molding powder and molded parts, electrical potting compounds, paints, greases, adhesives, welding rod or wire, and gasket materials.

6.4.4 Material Traceability Levels. Hardware and materials for which traceability is required. Design engineers will recommend

**CHECK THE MASTER LIST at <https://repository.msfc.nasa.gov/directives/directives.htm>
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 7 of 10

traceability levels to the systems engineer. Final determination of material traceability levels rests with the program/project manager. Applicable traceability levels, listed below, shall be specified on the configuration documentation. Emphasis should be placed on consequences of hardware failure over payload classification when determining material traceability levels. Specific traceability requirements for EEE parts will be in accordance with MSFC-STD-3012.

6.4.4.1 Level 1: Requires (a) records containing actual chemical and physical material verification test results, (b) Certificates of Conformance (COC), (c) detailed process, inspection, and discrepancy records traceable to the material from which fabrication originated, and (d) in-house chemical and physical verification testing.

The requirement for Level 1 material traceability is appropriate for hardware whose failure will result in loss of life, overall mission, Class A/B payload, or "launch vehicle." Level 1 material traceability requirements provide the highest degree of traceability confidence by requiring in-house chemical and physical verification testing in addition to other stringent traceability documentation requirements.

6.4.4.2 Level 2: Requires (a) records containing actual chemical and physical material verification test results, (b) Certificates of Conformance (COC), and (c) detailed process, inspection, and discrepancy records traceable to the material from which fabrication originated.

The requirement for at least level 2 material traceability is appropriate for hardware whose failure will result in loss of life, overall mission, Class A/B payload or launch vehicle (the same class of hardware as level 1), and for which in-house testing is not justified. Level 2 traceability requirements provide a high degree of material traceability confidence without the added cost of in-house chemical and physical verification testing.

6.4.4.3 Level 3: Requires (a) Certificates of Conformance (COC's) and (b) limited in-house chemical and physical verification testing or typical chemical and physical material verification test results. In-house chemical and physical testing, as determined by the design organization, can be used to ensure that material is in compliance with material/drawing specifications in the event that a COC is unavailable.

The requirement for level 3 material traceability is appropriate for hardware whose failure will not result in loss of life,

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 8 of 10

overall mission, class A/B payload or launch vehicle (i.e., hardware within a class C/D payload whose failure will affect only that C/D payload). Limited in-house testing on test specimens (i.e., hardness testing, conductivity testing, portable mass spectrometry testing) is appropriate at this level of traceability.

6.4.4.4 Level 4: Requires a COC, mill marking, or trace number as defined by this instruction.

The requirement for level 4 material traceability is appropriate for hardware for which it is not feasible or not deemed necessary to require detailed raw material traceability (i.e., computer chips which would be traceable by lot number/or date code only; raw material for which available traceability is limited to mill markings, etc.) and whose failure will not result in loss of life, overall mission, class A/B payload, or launch vehicle. Level 4 material traceability is also appropriate for use in addressing traceability for commercial parts and off-the-shelf hardware for which no formal traceability exists.

6.4.5 Exempted Equipment. Prototype equipment used in-house for engineering evaluation only (at the discretion of the systems engineer), manufacturing tooling, transportation, and facility-type equipment that does not require maintenance of traceability.

6.5 The developing software organization will establish and control traceability requirements for software end items.

7. NOTES

None

8. SAFETY PRECAUTIONS AND WARNING NOTES

None

9. RECORDS

See MPG 8040.3.

10. PERSONNEL TRAINING AND CERTIFICATION

None

11. FLOW DIAGRAM

None

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 9 of 10

12. CANCELLATION

MWI 8040.4A dated August 20, 1999

Original Signed by
Sidney P. Saucier for

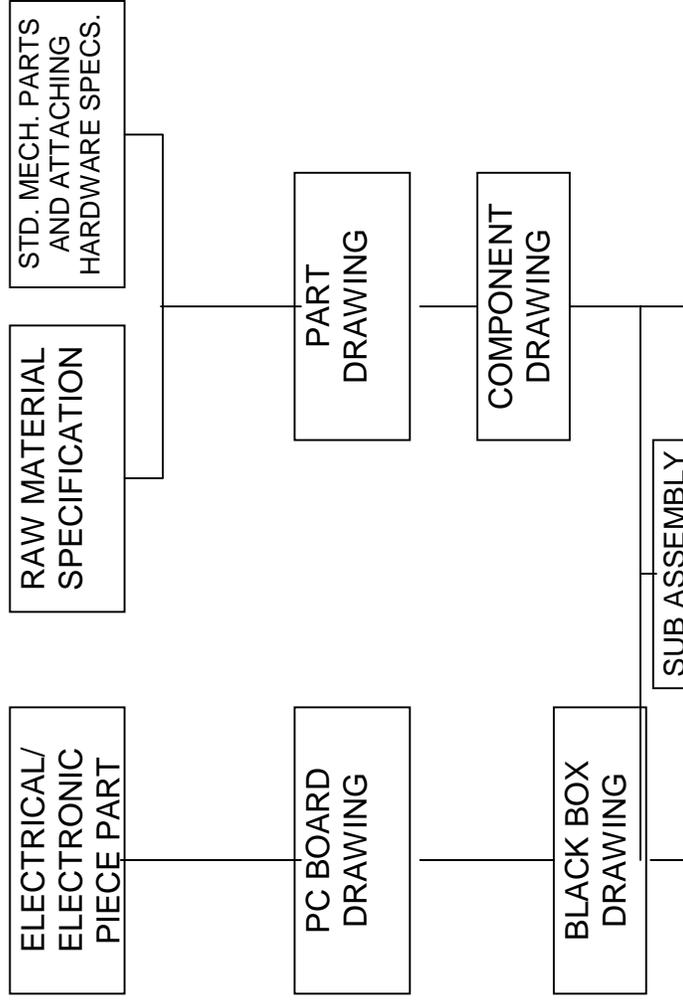
A. G. Stephenson
Director

Marshall Work Instruction ED01		
Application Guidance for Traceability	MWI 8040.4	Revision: B
	Date: July 10, 2000	Page 10 of 10

APPENDIX A

Typical Sequence for Specifying Traceability Requirements on Engineering Drawings

ELECTRICAL



The engineering drawings shall contain requirements identification for:

- Serialization, materials traceability, and lot/date traceability as required. per MWI 8040.4.”
- The method of attaching Identifying Numbers (metal stamp, ink stamp, paint, etch, etc.).
- The type of Product Identifying Number to be used (part number, MFG’s name, or CAGE code, and associated date code and/or lot number, serial number, etc).

TYPICAL EXAMPLES:

Body of the drawing near the title block, select and specify from below:

* Lot/date traceability per MWI 8040.4 is required (Release Desk assign numbers for in-house lots only).

* Material traceability level (1, 2, 3, or 4) per MWI 8040.4

* Serialization per MWI 8040.4 is required (Release Desk shall assign numbers).

GENERAL NOTES:

Specify the application method(s) for the identification of the above requirements.