

MWI 8060.4

REVISION B

EFFECTIVE DATE: May 18, 2015

EXPIRATION DATE: August 7, 2025

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# MARSHALL WORK INSTRUCTION

## ED01

# NON-FLIGHT AND NON-FACILITY DESIGN AND DEVELOPMENT

**COMPLIANCE IS MANDATORY**

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<b>Marshall Work Instruction ED01</b>		
<b>Non-Flight and Non-Facility Design and Development</b>	<b>MWI 8060.4</b>	<b>Revision: B</b>
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### DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Change/ Revalidation/ Canceled)	Document Revision/ Change	Effective Date	Description
Baseline		1/9/2013	Converted MPR 8060.2 Rev J to MWI format, clarified existing requirements, and provided acceptable records examples in Appendix D.3.1 and D.3.2.
Change	1	9/27/2013	On 9/27/2013, at the request of the OPRD, an administrative change was made to remove MPR 8060.2, Rev. J that was cancelled.
Revision	A	8/7/2014	Removed MPR 8040.1 from, and added MPR 7123.1 to section 4. Added MGM 8040.1, "MSFC Configuration Management Guidance" to Appendix E. Rewrote 5.5 to reference MPR 7123.1, section 2.2.14 and added note referencing MGM 8040.1, section G.5.5.
Revision	B	5/18/2015	Reworded 2.5, 2.5.3, 2.6. 5.1, and 5.2 to improve clarity. Corrected section reference to MPR 1280.1 in 5.2. Replaced the release process requirement in 5.5 (to comply with MPR 7123.1 section 2.2.14) with a requirement to elaborate the release process in an OI.
Revalidation	B	8/7/2020	Conducted thorough review of directive. Responsibilities, requirements, and process are current and correct as written. Removed page numbers in Table of Contents, quotation marks from around document titles, and indented and italicized notes as required by NPR 1400.1.

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## 1. PURPOSE

To provide instructions for non-flight and non-facility design and development activities as required by MPR 1280.10.

## 2. APPLICABILITY

2.1 This MWI 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.)

2.2 This MWI applies to the Michoud Assembly Facility.

2.3 This MWI 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.

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

2.5 All requirements in section 5 of this MWI apply to non-flight and non-facility design and development activities:

2.5.1 Whose product is hardware or software that directly interfaces with flight hardware and is used for such purposes as testing, manufacturing, processing, and handling of the flight hardware; or

2.5.2 Where failure to ensure the quality of the output or product from that activity could adversely affect a critical mission objective such as the development or production of a piece of hardware or software or meeting a schedule milestone; or

2.5.3 When the Program/Project Manager or requester requires the use of this MWI or requires the highest level of design and development control for the output or product produced from that activity.

*Note: Sound engineering rationale should be employed by the design organization in evaluating the applicability of 2.5. As an example, designs for manufacturing or development aids (such as alignment jigs, holding fixtures, electronic signal converters, and electronic checkout boxes) are excluded if the affected flight component subsequently undergoes sufficient test or inspection to find any errors introduced or overlooked by that aid.*

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2.6 When section 2.5 is not applicable to a design and development activity, adherence only to sections 5.2, 5.3, and 5.4 of section 5 is required.

### **3. AUTHORITY**

MPR 1280.10, Marshall Quality Management System

### **4. APPLICABLE DOCUMENTS AND FORMS**

4.1 NPR 7123.1, NASA Systems Engineering Processes and Requirements

4.2 NPR 7150.2, NASA Software Engineering Requirements

4.3 NRRS 1441.1, NASA Records Retention Schedules

4.4 MPR 1280.2, Process Control

4.5 MPR 1440.2, MSFC Records Management Program

4.6 MPR 8823.1, Design Control of Facilities

4.7 MWI 8715.15, Ground Operations Safety Assessment Program

### **5. INSTRUCTIONS**

5.1 The process for any design and development activity that meets the conditions specified in 2.5.1, 2.5.2, and 2.5.3 shall require further elaboration at the organizational level in an OI.

5.2 The process for any design and development activity that does not meet the conditions specified in 2.5.1, 2.5.2, and 2.5.3 shall require further elaboration in an OI that satisfies the minimum design and development requirements set forth in section 2.8.1 of MPR 1280.10 to ensure that appropriate and consistent practices are utilized and appropriate records of those practices are maintained.

5.3 Design and development OIs shall define the storage location, methodology, custodian, retention, and disposition of the records identified in Appendix D. (Reference MPR 1440.2 and NPR 1441.1).

5.4 Software records such as “Software Version Descriptions” and “Software Test Reports” shall be in accordance with NPR 7150.2.

5.5 The release process for design and development activities shall require further elaboration at the organizational level in an OI.

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*Note: MGM 8040.1, G.5.5 provides additional guidance on the recommended content for a release process.*

## 5.6 Design and Development Planning

<b>Actionee</b>		<b>Action</b>
Requester	5.6.1	Shall prepare and submit an Authority to Proceed (ATP) for each design and development activity to an organization that is equipped with adequate resources to perform the activity.  <i>Note: An ATP is not required when the Requester and Design and Development Personnel are the same.</i>
Requester and Design and Development Personnel	5.6.2	Shall determine design and development stages, the review, verification, and product validation appropriate for each stage, and responsibilities and authorities for design and development activities.
	5.6.3	Shall determine the interfaces between different groups which input into the design and development activity to ensure effective communication and clear assignment of responsibility.
	5.6.4	Shall update, as appropriate, any planning output as the design and development activity progresses.
Design and Development Personnel	5.6.5	Shall maintain the ATP as a record.

## 5.7 Design and Development Input

<b>Actionee</b>		<b>Action</b>
Requester and Design and Development Personnel	5.7.1	Shall determine functional, performance, applicable statutory and regulatory, safety, quality, and other essential input requirements utilizing, where applicable, information derived from previous similar design and development activities and input from those organizations that ultimately perform design and development verification (including hazard assessments per MWI 8715.15).  <i>Note: Design and Development Personnel often participate in the identification of input requirements since the Requester may not be familiar with all of the requirements that may govern design and development activities.</i>
	5.7.1.1	In those cases where the design product is hardware or software that directly interfaces with flight hardware, shall ensure that design requirements and hazard assessment specifically address those hazard controls necessary to ensure that the non-flight hardware/software does not damage the flight hardware.
Requester, Design and Development	5.7.2	Shall review input requirements for adequacy and resolve incomplete, ambiguous, or conflicting requirements.

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Personnel, and Verification Personnel		
Requester and Design and Development Personnel	5.7.3	<p>Shall ensure that all requested design and development input requirements are incorporated into the design and development output so that the released design and development output constitutes adequate documentation of these requirements.</p> <p><i>Note: Design and development input requirements may be recorded in the ATP, in test plans, test requirement documents, test procedures, within the design and development output, or by other means.</i></p>

## 5.8 Design and Development Output

<b>Actionee</b>		<b>Action</b>
Requester	5.8.1	Shall allow Design and Development Personnel to submit an unreleased document for fabrication, provided a review is held immediately after the document has been released to verify that the fabrication information in the unreleased and released documents is identical.
	5.8.1.1	Shall select the organization that performs this review as well as the method of concurrence.
Requester, Design and Development Personnel, or Verification Personnel	5.8.1.2	Shall perform this review at any point during the fabrication process, but before any fabricated hardware is put into service.
Requester and Design and Development Personnel	5.8.1.3	Shall resolve any discrepancies that result from this review either by modifying the design and development output to reflect the “as built” condition of the product or to remake the product.
Design and Development Personnel	5.8.2	Shall provide the output of the design and development activity in a form that enables verification against the design and development input requirements.
	5.8.3	Shall have design and development output approved, prior to release, with the methods for controlling (including output version control, traceability, and availability) and approving this output detailed in an OI or in an MWI.
	5.8.4	Unless directed otherwise in 5.7.1, shall ensure that all design and development output is released prior to submission for fabrication.
Requester, Design and Development Personnel, and	5.8.5	Shall ensure that the output:
	5.8.5.1	Meets all input requirements (as defined in 5.7).
	5.8.5.2	Contains or makes reference to acceptance criteria for the product (such as dimensional tolerances, required inspections, proof loads, and functional tests identified in 5.7).

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Verification Personnel	5.8.5.3	Identifies those characteristics that are essential to the safe and proper use of the product (including operation, storage, handling, maintenance, and disposal requirements identified in 5.7).
	5.8.5.4	Provides appropriate information for purchasing, production, and for service provision.
Design and Development Personnel	5.8.6	Shall maintain design and development output as a record.

### 5.9 Design and Development Review

<b>Actionee</b>		<b>Action</b>
Requester, Design and Development Personnel, and Verification Personnel	5.9.1	Shall systematically conduct reviews of the output at appropriate stages of the design and development activity to evaluate the ability of the output to fulfill requirements and to identify any problems or propose necessary actions.
	5.9.2	Shall include in the review process, representatives of all functions concerned with the activity stage being reviewed.
	5.9.3	As a minimum, shall perform a final review of the output at the 100 percent stage.
Requester and Design and Development Personnel	5.9.4	Shall ensure that all review results are incorporated into the design and development output.

### 5.10 Design and Development Verification

<b>Actionee</b>		<b>Action</b>
Verification Personnel	5.10.1	Shall perform verification at appropriate stages of the design and development activity to ensure that the verification-stage output meets the verification-stage input requirements.
	5.10.2	As a minimum, shall perform a final verification of the output at the 100 percent stage.  <i>Note: Verification may be satisfied in whole or in part by the design review process in 5.9. Verification is where assessments such as those for stress, materials, and safety occur.</i>
Requester, Design and Development Personnel, and Verification Personnel	5.10.3	Shall ensure that all verification results are incorporated into the design and development output.

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### 5.11 Product Validation

<b>Actionee</b>		<b>Action</b>
Requester	5.11.1	Shall perform product validation, as required in 5.6.2, to ensure the product is capable of fulfilling the requirements for the specified or known intended use or application.
	5.11.2	Shall ensure that validation is completed prior to the actual use of the product wherever practicable.
	5.11.2.1	Where validation cannot be performed prior to use, the requesting organization shall ensure appropriate procedures and controls are in place for the product's first use. Also see MPR 1280.2.
	5.11.3	Shall ensure that all validation results are recorded.  <i>Note: The Requester is only required to record the results of validation that has actually been performed by the Requester. Agency or Center-wide requirements for validation, such as the proof loading of lifting equipment, may be the responsibility of others and are outside the scope of this MWI.</i>

### 5.12 Design and Development Changes

<b>Actionee</b>		<b>Action</b>
Requester	5.12.1	Shall identify any changes and provide the necessary information to design and development personnel.
	5.12.2	Shall resubmit an ATP, if required by the design and development organization.
	5.12.3	Shall revalidate, before actual product use, when changes affect the product's original validation.
Design and Development Personnel and Verification Personnel	5.12.4	Shall document, review, verify, and approve (by authorized personnel) all changes before actual product use.
	5.12.5	Shall ensure that reviews of changes include evaluation of the effects of the changes on constituent parts and delivered products.
Requester, Design and Development Personnel, and Verification Personnel	5.12.6	Shall ensure that all changes are incorporated into the design and development output.

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## **6. CANCELLATION**

MWI 8060.4 Revision A, Non-Flight and Non-Facility Design and Development dated August 7, 2014.

*Original signed by*

Patrick E. Scheuermann  
Director

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## **APPENDIX A.**

### **DEFINITIONS**

**Authority to Proceed (ATP).** Documentation, such as a Collaborative Work Plan (CWP), Request for Service, memo, transcribed verbal instructions, or organization-level form that authorizes an organization to perform a design and development activity and identifies the requester, the activity to be performed, input requirements, resources (such as a funding source or valid cost code), the initiation date, a requested timeframe to perform the activity, contacts (any personnel or organization(s) whose input is necessary to perform the activity), and authorization (signature or other means) to commit the necessary government funds and/or resources to perform the design activity.

**Design and Development Activity.** An organized effort to create design and development output that satisfies (or is used to produce a product that satisfies) a requester's requirements.

**Design and Development Output.** The documented, sometimes interim, results of a design and development activity such as sketches, drawings, procedures, specifications, analyses, computer programming code (i.e., software), or reports.

**Design and Development Personnel.** Any person, NASA or contractor, who is tasked with performing a design and development activity such as engineers, designers, draftsmen/detailers, and software programmers.

**Non-Facility.** Design and development activities that do not meet the applicability of MPR 8823.1.

**Non-Flight.** Design and development activities that produce hardware and software design products that are not the operational end products of the program/project/activity, but rather they are the life-cycle enabling products as defined in NPR 7123.1. These enabling products typically include equipment/systems that are part of the institutional infrastructure such as manufacturing tooling, test equipment, and test software.

**Organizational Issuance (OI).** A document providing instructions for internal use within an organization. OIs may provide instructions for two or more organizations if issued jointly by the heads of the organizations involved. OIs may also provide instructions to external organizations for interfacing with the issuing organization, such as specifying the forms to fill out for requesting work/support from the issuing organization. (Reference MPR 1410.1)

**Product.** The final outcome of any design and development activity that satisfies the requester's requirements such as software or the hardware that is fabricated, procured, and/or assembled from the information contained in the design and development output (reference 2.5 for product types addressed by this MWI).

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**Release.** The process used in a design and development activity to formally distribute design and development output for use after all required approvals have been obtained.

**Requester.** The person who initiates and monitors the design and development activity.

**Validation.** Confirmation by examination and provision of objective evidence that particular requirements for a specific use of a product are fulfilled. Validation is typically applicable only where a product (hardware or software) can be functionally tested prior to use.

**Verification.** Confirmation by examination and provision of objective evidence that specified requirements of design and development activity output have been fulfilled.

**Verification Personnel.** Any person, NASA or contractor, who is tasked with the verification of a design and development activity including personnel who perform evaluations for stress, thermal effects, safety, quality, materials and processes suitability, and producibility.

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**APPENDIX B.**  
(Reserved for Acronyms)

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**APPENDIX C.**  
(Reserved for Verification Matrix)

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## **APPENDIX D.**

### **RECORDS**

The records requirements outlined in this MWI are to be incorporated into a Design and Development OI (reference 5.1, 5.2, and 5.3). As a minimum, the implementation of this MWI creates the following records:

D.1 Design and Development Planning (reference section 5.6.5).

D.2 Design and Development Input Design and Development Personnel maintain ATPs and design and development outputs as input records. The other potential types of design input documents noted under section 5.7.3 are maintained by the requester (reference section 5.7.3).

D.3 Design and Development Output/Review/Verification/Changes (reference sections 5.8.6, 5.9.4, 5.10.3, and 5.12.6, respectively).

D.3.1 For drawings and other printed forms of design and development output, signatures and/or initials from the reviewing representative(s) in appropriately-labeled locations are acceptable evidence of review, verification, and changes.

D.3.2 For other non-printable forms of design and development output, an e-mail (either a printed copy or stored separately in a file) or a signed statement of concurrence (that adequately identifies the output and/or revision level) from the reviewing representative(s) are acceptable evidence of review, verification, and changes.

D.3.3 For software records such as “Software Version Descriptions” and “Software Test Reports” (reference section 5.4).

D.3.4 For sections D.3.1, D.3.2, and D.3.3 above, the original (or a copy of the original) design and development output or statement of concurrence is maintained by personnel performing the design and development activity.

D.4 Product Validation (reference section 5.11.3).

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## **APPENDIX E.**

### **REFERENCES**

MPR 1410.1, “Organizational Issuances”

MGM 8040.1, “MSFC Configuration Management Guidance”