



George C. Marshall Space Flight Center  
Marshall Space Flight Center, Alabama 35812

QS-A-005  
REVISION: BASELINE  
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# ORGANIZATIONAL INSTRUCTION

## Professional Development Roadmap (PDRM) for System Safety Engineers

OPR (s)

QS01, QS40

OPR DESIGNEE

Kerry Warner

<b>Organizational Instruction</b>		
<b>Title: Professional Development Roadmap (PDRM) for System Safety Engineers</b>	<b>QS-A-005</b>	<b>Revision: Baseline</b>
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**DOCUMENT HISTORY LOG**

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## Professional Development Roadmap for S&MA System Safety Engineers

### 1. PURPOSE, SCOPE, APPLICABILITY

1.1. Purpose - The purpose of this Organizational Instruction (OI) is to establish a voluntary training and development roadmap for System Safety Engineers within the Marshall Space Flight Center (MSFC) Safety and Mission Assurance (S&MA) Office. This OI identifies the minimum level of training, knowledge and skills that MSFC S&MA System Safety Engineers should acquire in developing their engineering discipline expertise.

1.2. Scope - This OI is meant to serve as a development roadmap for System Safety Engineers who support MSFC programs and projects. It provides a comprehensive list of training, knowledge requirements and on-the-job (OJT) experience needed by MSFC S&MA System Safety Engineers to effectively execute their duties.

This roadmap establishes an entry level (Apprentice) and three achievement levels (Novice, Journeyman and Expert), and provides a process for progressive Qualification at each level.

This roadmap will be used in conjunction with Individual Development Plans (IDP) to encourage System Safety specialists to pursue development activities most appropriate to their specialty. The intent is to use the roadmap to guide the development of IDPs for S&MA System Safety Engineers.

1.3. Applicability - This OI applies to all MSFC S&MA personnel who seek to provide MSFC S&MA System Safety Engineering services, both in-house and off site, and who choose to participate. Mission support contractor personnel are also encouraged to participate in this voluntary program (or in a tailored mission support contractor program approved by the S&MA Director).

Personnel must satisfy the prerequisites specified in this OI before participating in this roadmap process.

### 2. DOCUMENTS

#### 2.1. Applicable Documents

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2.1.1 MPG 3410.1 Training

2.1.2 Individual Development Plan Instruction (Being revised)

## 2.2 Reference Documents

2.2.1 Organizational Instruction: Professional Development Roadmap (PDRM) for Reliability and Maintainability Engineers, Safety and Mission Assurance, Marshall Space Flight Center.

2.2.2 Organizational Instruction: Professional Development Roadmap (PDRM) for Quality Engineers, Safety and Mission Assurance, Marshall Space Flight Center.

## 3. DEFINITIONS AND ACCRONYMS

3.1 The Professional Development Roadmap (PDRM) identifies and documents the minimum training, knowledge requirements and on-the-job (OJT) experience needed by MSFC S&MA personnel at three levels of their discipline expertise development.

3.2 Individual Development Plan (IDP) - is a document developed jointly by the employee and supervisor to plan the employee's training and development needs as well as to identify possible training solutions. The plan will focus on immediate and short-term goals that are in line with the longer-term goals of both the employee and the organization. The IDP focuses on enhancing the competencies the employee needs to improve the Center's, and ultimately, the Agency's effectiveness.

3.3 Qualification - the act of verifying and documenting that personnel have completed required training, medical requirements as required, and have demonstrated specified proficiency.

3.4 Qualification levels - are defined as:

- Apprentice: A candidate for Novice Qualification.
- Novice: The lowest recognizable level (Appendix A).
- Journeyman: Intermediate level of expertise (Appendix B).
- Expert: The highest level of expertise (Appendix C).

3.5 Qualification Criteria - are specified in Appendix A (Novice), Appendix B (Journeyman) and Appendix C (Expert) and include three categories of accomplishments that demonstrate

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discipline expertise:

- Training - traditional, online and computer based.
- Reference documents - demonstrating understanding.
- On the Job training (OJT) - demonstrating specific skills.

3.6 Prerequisites - that must be satisfied prior to becoming an Apprentice and participating in the PDRM process are specified in Appendix A.

3.7 Application for Qualification: - must be submitted by the candidate seeking Qualification at the completion of the requirements at each level. Application consists of:

- Completed and approved application Form (Appendix D).
- Completed and approved copy of Appendix A, (for Novice Qualification), Appendix B (for Journeyman Qualification) or Appendix C (for Expert Qualification).

3.8 Implementation requirements - are specific actions required to initially implement this OI. (See section 4.1).

3.9 Qualification of Experienced Personnel - may be earned by documenting candidate's previously completed training and development. (See section 4.3).

3.10 Qualification by Designation (Grandfathering) - is qualification prior to completion of the required PDRM line items. This will be done only during initial process implementation stages to create Discipline Champion and Mentors. Personnel certified qualified in this manner are expected to document their qualifications as soon as possible thereafter. (See section 4.4).

3.11 Equivalent Training Criteria - are classes or experiences that may be substituted for those specified in the Appendices. During initial stages of the program, or when new employees are transferred into S&MA, previously completed items may be substituted with approval of the Champion. Thereafter, the Champion must approve all equivalent criteria in advance.

3.12 Personnel and Roles - required to implement this OI are defined below:

3.12.1 Candidate - is an employee or mission support contractor who seeks qualification via the PDRM process.

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3.12.2 Supervisor - the organizational line manager who provides supervisory functions and responsibilities for employee positions requiring training and/or qualification. The supervisor helps create, and approves, the candidate's IDP, verifies completion of the OJT requirements, and recommends the candidate for qualification.

3.12.3 Mentor - is an experienced System Safety Engineer who is selected as, and who agrees to perform as, a coach to the candidate in the PDRM qualification process. Mentors are also responsible for verifying candidate's understanding of the required reference documents.

Mentors are normally required to be certified qualified at least at the Journeyman Level (Expert level if mentoring a candidate for Expert qualification).

A System Safety Engineer who does not meet the qualification requirement, but who has extensive and relevant experience, may be approved to serve as Mentor on a case-by-case basis. This exception requires approval by the candidate's supervisor and the Discipline Champion.

3.12.4 System Safety Engineering Discipline Champion - is an individual recognized as a key leader in the S&MA System Safety discipline, and is designated by the S&MA Director (or his/her designee). The Champion is responsible to the S&MA Training Manager for technical content of this PDRM, approval of any "equivalent" criteria, selecting and training Mentors, and participation in the Qualification Review Board.

3.12.5 Qualification Review Board - is responsible for reviewing and approving qualification applications. The Board will consist of the S&MA Director (or his/her designee), the Discipline Champion, and others selected by the S&MA Director. The Board will also review and approve any changes to this OI.

3.13 PDRM Designation Memorandum - a document signed by the Director of S&MA that identifies S&MA personnel who are authorized to serve as Discipline Champion, Mentors and Qualification Review Board members.

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#### 4. INSTRUCTIONS

4.1 Implementation Requirements - Implementation of this OI will begin upon approval by the S&MA Director, and will require the following additional actions:

- Selecting the System Safety Engineering Discipline Champion, and designating (grandfathering) him/her to be certified qualified at the Expert level.
- Selecting System Safety Engineering Discipline Mentors, and designating (grandfathering) them to be certified qualified at the Journeyman or Expert level.
- Appointing Qualification Review Board Members.
- Publishing the PDRM Designation Memorandum.
- Authorizing and initiating a work task for the Champion and/or Mentors to prepare a set of checklists and sample questions to be used as guidelines for demonstrating candidate knowledge of the reference documents.
- Formalizing and baselining the in-house courses identified in the appendices that are currently taught informally by NASA employees and mission support contractors
- Communicating to all personnel of the existence, purpose, expectations, process and names of key personnel associated with this OI.

4.2 Qualification Process (Normal) - A candidate seeking qualification will use the following process. This process is further illustrated in the flow chart in Section 11.

4.2.1 Candidate declares S&MA specialty as System Safety Engineer. Supervisor approves.

4.2.2 Candidate documents completion of prerequisites utilizing a completed copy of the application form (Appendix D). The candidate becomes an Apprentice.

4.2.3 Supervisor seeks/assigns Mentor (with support from the

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Discipline Champion).

4.2.4 Apprentice works with Supervisor to develop an IDP containing appropriate items from the PDRM (Appendix A).

4.2.5 Apprentice pursues the required developmental activities per the PDRM and IDP.

4.2.6 Upon completion of each developmental activity, the Apprentice obtains the proper signature on the PDRM (Appendix A) as shown in the following table:

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Criteria Type	Required Activity	Verifying Signature
Training Classes	Complete successfully	Training Department
Reference Documents	Demonstrate understanding	Mentor
OJT Experiences	Complete successfully	Supervisor

4.2.7 Upon completion and documentation of all required activities for qualification, Apprentice completes the application form, obtains signature from the Discipline Champion and submits completed package to his/her Supervisor.

4.2.8 Supervisor signs the application and forwards it to the S&MA Director for action by the Qualification Review Board.

4.2.9 The Qualification Review Board reviews the application, and makes the approval decision.

4.2.10 A Novice may earn Journeyman qualification by continuing the above process using Appendix B.

4.2.11 A Journeyman may earn Expert qualification by continuing the above process using Appendix C.

4.3 Qualification of Experienced Personnel - Existing S&MA personnel and new personnel hired/transferred into S&MA, who are experienced in the System Safety Engineering discipline, may seek qualification at any level for which they qualify by documenting their previously completed achievements and using the following process. This process is further illustrated in the flow chart in Section 11.

4.3.1 Candidate documents previously completed training classes and OJT achievements on the appropriate appendices (e.g. a candidate applying for Expert qualification must complete Appendix A, B and C):

- Equivalent training and experiences may be substituted for the criteria specified in the appendices with the approval of the Discipline Champion.

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- The training department will verify training classes. Candidates are responsible for providing proof (e.g. copies of certificates, grade reports and/or transcripts) of non-NASA training to the training department.
- OJT will be verified by signature of the Supervisor.

4.3.2 Candidate must demonstrate his/her understanding of the reference documents using the normal qualification process (See section 4.2).

4.3.3. Upon completion and documentation of all required activities for qualification, candidate completes the application form (Appendix D), obtains Discipline Champion approval and submits the package to his/her Supervisor for approval.

4.3.4 Supervisor approves the application and forwards it to the Qualification Review Board for action.

4.3.5. The Qualification Review Board reviews the application and decides the qualification level to be granted.

4.4 Qualification by Designation (Grandfathering) - During the initial PDRM process implementation, the S&MA Director (or his/her designee) may certify the Discipline Champion and Mentors prior to their completion of the PDRM application. Any personnel so certified qualified are expected to document their qualifications per the PDRM process for experienced personnel (section 4.3) as soon as possible thereafter.

4.5 Maintaining Qualification - It is expected that personnel certified qualified at the Expert level will (1) continue training (at least 40 hours per year in their discipline) and (2) continue to perform OJT activity at the level described in Appendix C.

4.6 Process Measurement - will be accomplished by baselining the number of personnel certified qualified at each level, and thereafter measuring the progress toward qualification by S&MA personnel. The baseline will be created 6 months after implementation. Measurements will be made semi-annually thereafter. Each semi-annual measurement will count the number of individuals certified qualified at each level, and estimate

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the progress (percent complete) of each participating individual toward the next level. Department Mangers will report this measurement at the next scheduled monthly status review.

4.7 Amendments - Changes to this Organizational Instruction are made per the documented Organizational Instruction Change Process. The Qualification Review Board will review proposed changes to this PDRM prior to submitting them to the MSFC Director of S&MA for approval. The custodial responsibility for this PDRM shall be assigned to the Safety, Reliability, and Quality Assurance Policy, Assessment & Integration Department (QS40).

## 5. NOTES

5.1. OI Replacement - None

## 6. SAFETY PRECAUTIONS AND WARNING NOTES

None

## 7. APPENDICES, DATA, REPORTS, AND FORMS

- A - PDRM for System Safety Engineers: Novice
- B - PDRM for System safety Engineers: Journeyman
- C - PDRM for System Safety Engineers: Expert
- D - Qualification Application Form

## 8. QUALITY RECORDS

<u>Quality Record</u>	<u>Repository</u>	<u>Period of Time</u>
Completed PDRM (Official Course completion information will be kept by the MSFC Training Office)	S&MA Training Officer	5 years (Documentation of the appropriate PDRM will be kept by the MSFC Training Office.)

## 9. TOOLS, EQUIPMENT, AND MATERIALS

None

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## 10. PERSONNEL TRAINING REQUIREMENTS

See Appendix A - C

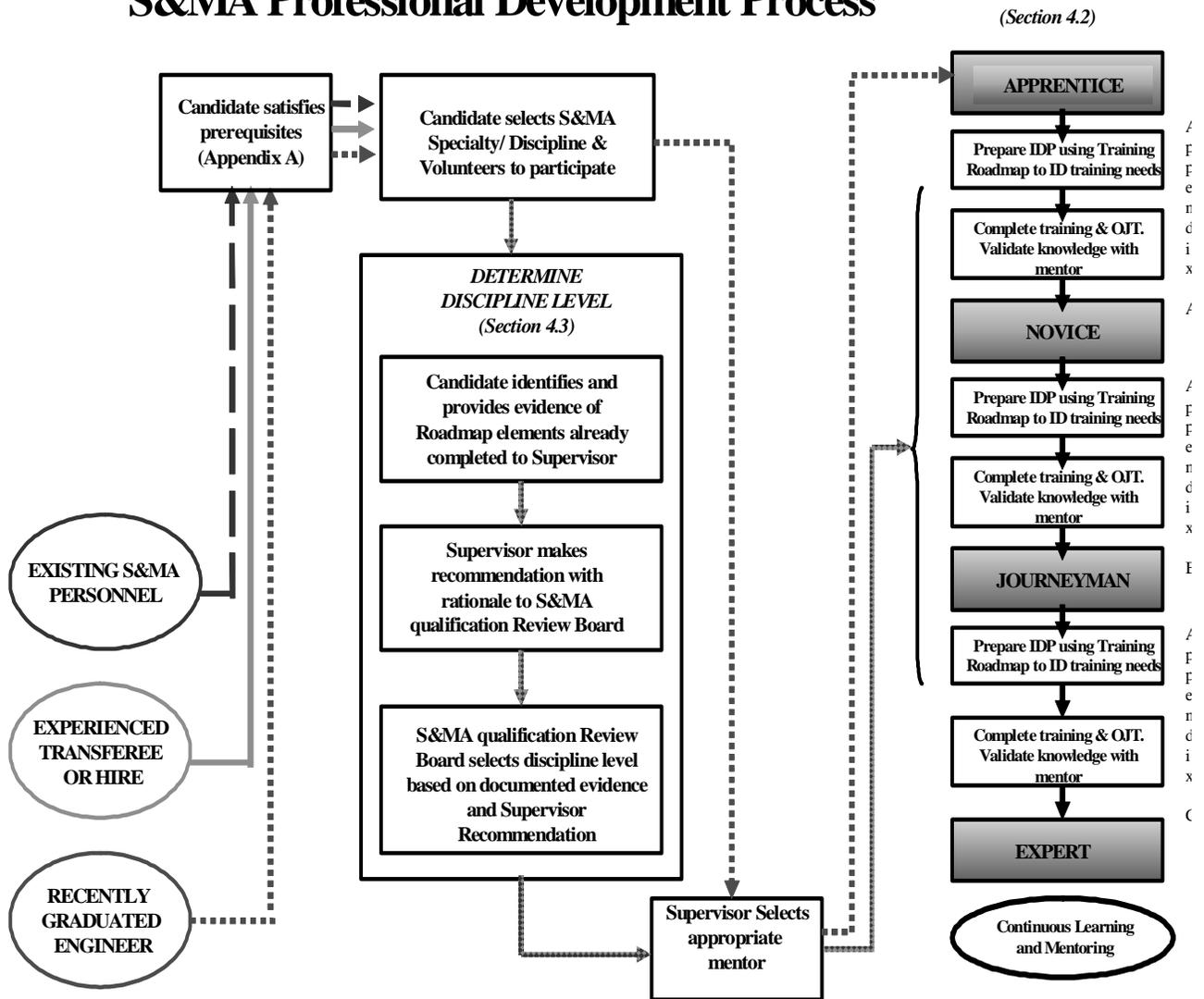
## 11. FLOW DIAGRAM

The flow diagram (Figure 11-1) illustrates the PDRM qualification process described in this OI.

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Figure 11-1

## S&MA Professional Development Process



Notes:

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1. Qualification Review Board is the decision authority for qualification levels and approvals.

## **APPENDIX A: PDRM for System Safety Engineers: NOVICE Qualification Requirements**

### **A.1 Objective:**

This Appendix provides the qualification criteria for System Safety Engineers to be certified qualified at the Novice level, using the process described in the body of the Organization Instruction.

### **A.2 Prerequisites:**

Prior to beginning the process, the candidate must qualify as an Apprentice System Safety Engineer by satisfying the following prerequisites:

1. Candidate must be an Aerospace Technology Professional (AST) with an appropriate engineering/scientific degree (chemical, electrical, electronic, industrial, mechanical, system, or equivalent)
2. Candidate must volunteer to participate in the PDRM qualification program, declare his/her specialty as System Safety Engineer, and obtain approval of his/her immediate supervisor.
3. Candidate must complete the S&MA Overview Orientation Class (currently a 4 hour internal class instructed by Lisa Bonine)
4. Candidate must complete a program specific overview orientation class for the candidate's assigned program, including the S&MA aspects of that program.
5. Candidate must be skilled in the use of the MS Office Suite including Word, Excel and PowerPoint, and must show evidence of capability to make an effective presentation.

### **A.3 Experience:**

Candidate must have at least 1 to 3 years of relevant experience in the discipline prior to earning the Novice Qualification.

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

<b>TRAINING CLASS REQUIREMENTS</b> Equivalent classes may be substituted with approval by the Discipline Champion. Sequence is suggested but not mandatory.		<b>SIGNATURE/ DATE COMPLETE</b>	
System Safety: Solar - SMA-066-01		_____	_____
System Safety Fundamentals: NSTC 002 (5 days)		_____	_____
System Safety Basics: MSFC S&MA class (2 hours)		_____	_____
Characteristics of Effective Hazard Reports: MSFC S&MA class (2 hours)		_____	_____
Lessons Learned Information System (LLIS): Web based training class #ZQLLIS.		_____	_____
S&MA Documentation: Solar - SMA-058-01		_____	_____
Project specific System Safety Class (Note 1) such as: -Payload Safety Review and Analysis (Payloads only): NSTC 011 (4 days) OR - Equivalent class for Space Shuttle, OSP, or ISS Elements.		_____	_____
System safety Management: University of Washington, Seattle Washington (estimated 1 week)		_____	_____
Foundations of Project Management: APPL class (4 days)		_____	_____
Failure Modes Effects Analysis & Critical Items List: - Solar: SMA-017-01 (1 hour estimated) - In House Component (Note 2), (4 hours)		_____	_____

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

<p>Systems Management: APPL Class (4 days) plus:          - Pre-class session at MSFC to discuss relevant questions regarding System Safety role in systems engineering (led by Champion) (2 hours)          - Post class student feedback to the S&amp;MA System Safety team (2 to 4 hours)</p>		<p>_____ Signature</p> <p>_____ Date</p>
<p>Microsoft Project-Introduction: MSFC video class, Building 4200 (Number TBD) OR MSFC Professional Development Class (2.5 days). (OPTIONAL)</p>		<p>_____ Signature</p> <p>_____ Date</p>
<p>Technical Writing: Class to be identified by candidate and mentor (1 day)</p>		<p>_____ Signature</p> <p>_____ Date</p>
<p>Influencing Others: MSFC Organizational Development Class (1 day)</p>		<p>_____ Signature</p> <p>_____ Date</p>
<p>Conflict Management: MSFC Professional Development Class (2 days)</p>		<p>_____ Signature</p> <p>_____ Date</p>

Notes:

1. One project specific class appropriate to the candidate's job assignment is required; Additional ones are optional.
2. Classes identified as "In House" must be formally registered with the training department.

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

REFERENCE MATERIALS Demonstrate familiarity with key concepts as defined by the Discipline Champion		SIGNATURE/ DATE COMPLETE
NPG 8715.3: NASA Safety Manual		_____ Signature                      date
NPD 8700.1: NASA Policy for Safety and Mission Success. (pages to be identified by Discipline Champion)		_____ Signature                      date
MSFC-HDBK-3173: Project Management and Systems Engineering Handbook (pages to be identified by Discipline Champion)		_____ Signature                      date
SP-6105: NASA Systems Engineering Handbook (pages to be identified by Discipline Champion)		_____ Signature                      date
MWI 1700.2: System Safety Program		_____ Signature                      date
MWI 8715.15: MSFC Safety Assessment Program		_____ Signature                      date
NASA Reference Publication 1358: Systems Engineering "Toolbox" for Design-Oriented Engineers (pages to be identified by Discipline Champion)		_____ Signature                      date
NPG 8000.4: Risk Management Procedures and Guidelines		_____ Signature                      date
MWI 7120.6: Program/Project Risk Management		_____ Signature                      date
DOD MIL-STD-882: System Safety Program Requirements		_____ Signature                      date
NPG 7120.5: NASA Program		_____ Signature                      date

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

and Project Management Processes and Requirements		Signature _____ date _____
NASA-STD-8719.13 Software Safety NASA Technical Standard		Signature _____ date _____
<p>Shuttle Safety Requirements (Note 2):</p> <ul style="list-style-type: none"> <li>- NSTS 07700: Space Shuttle Program Definition and Requirements</li> <li>- NSTS 5300.4 (ID-2): Space Shuttle Safety, Reliability, Maintainability and Quality Provisions</li> <li>- NSTS 08117: Requirements and Procedures for Qualification of Flight Readiness</li> <li>- NSTS 08126: Problem Reporting and Corrective Action (PRACA) System Requirements</li> <li>- NSTS 22254: Methodology for Conduct of NSTS Hazard Analyses</li> </ul>		Signature _____ date _____
<p>ISS Element System Safety Requirements and Process (Note 2):</p> <ul style="list-style-type: none"> <li>- SSP 50021: ISS Safety Requirements Document</li> <li>- SSP 30599: ISS Safety Review Process</li> <li>- SSP 30309: Safety Analysis and Risk Assessment Requirements Document</li> <li>- SSP 50038: Computer-Based Control System Safety Requirements</li> </ul>		Signature _____ date _____
Shuttle and ISS Payloads		

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

<p>System Safety Requirements and Process standards (Note 2):</p> <ul style="list-style-type: none"> <li>- NSTS 1700.7: Safety Policy and Requirements for Payloads Using the Space Transportation System</li> <li>- NSTS 1700.7, Addendum 1: Safety Policy and Requirements for Payloads Using the ISS</li> <li>- KHB 1700.7: Space Shuttle Payload Ground Safety Handbook</li> <li>- NSTS 13830: Payload Safety Review and Data Submittal Requirements</li> <li>- NSTS 18798: Interpretations of NSTS/ISS Payload Safety Requirements</li> <li>- JSC 26943: Guidelines for the Preparation of Payload Flight Safety Data Packages and Hazard Reports for Payloads Using the Space Shuttle</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>Expendable launch Vehicles Safety Requirements and Process Standards (Note 2):</p> <ul style="list-style-type: none"> <li>- KHB 1710.2: KSC Safety Practices Handbook</li> <li>- CSTCR 127-1: Consolidated Space Test Center Regulation</li> <li>- EWRR 127-1: Eastern and Western Range Regulation</li> <li>- NASA-STD-8719.8: Expendable Launch Vehicle Payload Safety Review Process Standard</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>DOT Advisory Circular AC</p>		

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

431.35-2: Reusable Launch and Re-entry Vehicle - System Safety Process (FAA Requirement)		<hr/> Signature <hr/> date
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Notes:

1. The Discipline Champion is responsible for identifying specific level of understanding required (See section 4.1).
2. Program specific standards: Be aware of all, but be familiar with key concepts of those that apply to your assignment.

**APPENDIX A: PDRM for System Safety Engineers:  
NOVICE Qualification Requirements**

<b>ON THE JOB TRAINING</b> <b>Complete the following</b> <b>activities</b>		SUPERVISOR SIGNATURE/ DATE COMPLETE
Under appropriate supervision, observe/support completion of a System safety checklist in support of a NASA project or program		_____ Signature                      date
Under appropriate supervision, observe/support conduct of hazard analysis in support of a NASA project or program		_____ Signature                      date
Observe a team creating a fault tree in support of a NASA project or program		_____ Signature                      date
Observe/support at least two different types of design reviews in support of a NASA project or program		_____ Signature                      date
Join and participate in relevant professional society (e.g. System Safety Society) by attending meetings and participating in discussions and activities.		_____ Signature                      date
Observe a Safety Review in support of a NASA project or program.		_____ Signature                      date

Notes:

1. Candidate should work with his/her Supervisor to identify specific applicable assignments. Discipline Champion may be consulted to ensure proposed assignment will satisfy the qualification requirements.

## **APPENDIX B: PDRM for System safety Engineers: JOURNEYMAN Qualification Requirements**

### **B.1 Objective:**

This Appendix provides the qualification criteria for System Safety Engineers to be certified qualified at the Journeyman level, using the process described in the body of this Organization Instruction.

### **B.2 Prerequisites:**

Prior to beginning the process, the candidate must be certified qualified as a Novice System Safety Engineer per the requirements in Appendix A.

### **B.3 Years of Experience:**

Candidate should have at least 3 to 5 years of relevant experience in the discipline prior to being certified qualified at the Journeyman level.

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

<b>TRAINING CLASS REQUIREMENTS</b> Equivalent classes may be substituted with approved by the Discipline Champion. Sequence is suggested but not mandatory		<b>SIGNATURE/ DATE COMPLETE</b>	
Basic System Safety Practices: NSTC 020 (5 half days)		_____ Signature	_____ date
Software System Safety: Solar - SMA-062-01		_____ Signature	_____ date
Software System Safety: NSTC 025 (4 days)		_____ Signature	_____ date
Auditing and Evaluating Safety Programs and Safety Metrics: SQAESP, IBT - Level B		_____ Signature	_____ date
Keys to Successful Project Support: MSFC Class		_____ Signature	_____ date
Root Cause Analysis: NSTC 049 (3 days)		_____ Signature	_____ date
Hazard and Operability Analysis (HAZOP) Methodology: NSTC 028 (2 days)		_____ Signature	_____ date
Mission Assurance Planning: Solar - SMA-037-01		_____ Signature	_____ date
Systems Requirements: NET Class (4 days)		_____ Signature	_____ date
System Safety and Reliability Analysis: University of Washington, Seattle, WA. Tailored version on site at MSFC. (10 days) (Note 1)		_____ Signature	_____ date
Leading from the Inside Out: MSFC Professional Development Class (2 days)		_____ Signature	_____ date
Communicating For Results: MSFC Professional Development Class (2 days)		_____ Signature	_____ date
Team Development in the Workplace: MSFC			

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

Organizational Development Class (3 days)		_____	_____
Mentoring: MSFC Organizational Development Class (1 day). Suggested at end of qualification for Journeyman		Signature	date
		_____	_____
		Signature	date

Notes:

1. The Discipline Champion will define tailoring requirements for University of Washington class.

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

REFERENCE MATERIALS Demonstrate working knowledge with contents as defined by the Discipline Champion		MENTOR SIGNATURE/ DATE COMPLETE
NPG 8715.3: NASA Safety Manual		_____ Signature                      date
NPD 8700.1: NASA Policy for Safety and Mission Success. (pages to be identified by Discipline Champion)		_____ Signature                      date
MSFC-HDBK-3173: Project Management and Systems Engineering Handbook (pages to be identified by Champion)		_____ Signature                      date
SP-6105: NASA Systems Engineering Handbook (pages to be identified by Discipline Champion)		_____ Signature                      date
MWI 1700.2: System Safety Program		_____ Signature                      date
MWI 8715.15: MSFC Safety Assessment Program		_____ Signature                      date
NASA Reference Publication 1358: Systems Engineering "Toolbox" for Design-Oriented Engineers (pages to be identified by Discipline Champion)		_____ Signature                      date
NPG 8000.4: Risk Management Procedures and Guidelines		_____ Signature                      date
"A History of Aerospace Problems, Their Solutions, Their Lessons" by Robert S. Ryan: NASA Technical Paper 3653.		_____ Signature                      date
DOD MIL STD-882: System		

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

safety Program Requirements		<hr/> <div style="display: flex; justify-content: space-between;"> <span>Signature</span> <span>date</span> </div>
<p>Shuttle Safety Requirements (Note 2):</p> <ul style="list-style-type: none"> <li>- NSTS 07700: Space Shuttle Program Definition and Requirements</li> <li>- NSTS 5300.4 (ID-2): Space Shuttle Safety, Reliability, Maintainability and Quality Provisions</li> <li>- NSTS 08117: Requirements and Procedures for Qualification of Flight Readiness</li> <li>- NSTS 08126: Problem Reporting and Corrective Action (PRACA) System Requirements</li> <li>- NSTS 22254: Methodology for Conduct of NSTS Hazard Analyses</li> </ul>		<hr/> <div style="display: flex; justify-content: space-between;"> <span>Signature</span> <span>date</span> </div>
<p>ISS Element System Safety Requirements and Process (Note 2):</p> <ul style="list-style-type: none"> <li>- SSP 50021: ISS Safety Requirements Document</li> <li>- SSP 30599: ISS Safety Review Process</li> <li>- SSP 30309: Safety Analysis and Risk Assessment Requirements Document</li> <li>- SSP 50038: Computer-Based Control System Safety Requirements</li> </ul>		<hr/> <div style="display: flex; justify-content: space-between;"> <span>Signature</span> <span>date</span> </div>
Shuttle and ISS Payloads		

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

<p>System Safety Requirements and Process standards (Note 2):</p> <ul style="list-style-type: none"> <li>- NSTS 1700.7: Safety Policy and Requirements for Payloads Using the Space Transportation System</li> <li>- NSTS 1700.7, Addendum 1: Safety Policy and Requirements for Payloads Using the ISS</li> <li>- KHB 1700.7: Space Shuttle Payload Ground Safety Handbook</li> <li>- NSTS 13830: Payload Safety Review and Data Submittal Requirements</li> <li>- NSTS 18798: Interpretations of NSTS/ISS Payload Safety Requirements</li> <li>- JSC 26943: Guidelines for the Preparation of Payload Flight Safety Data Packages and Hazard Reports for Payloads Using the Space Shuttle</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature</p> <p style="text-align: right;">_____</p> <p style="text-align: right;">date</p>
<p>Expendable launch Vehicles Safety Requirements and Process Standards (Note 2):</p> <ul style="list-style-type: none"> <li>- KHB 1710.2: KSC Safety Practices Handbook</li> <li>- CSTCR 127-1: Consolidated Space Test Center Regulation</li> <li>- EWRR 127-1: Eastern and Western Range Regulation</li> <li>- NASA-STD-8719.8: Expendable Launch Vehicle Payload Safety Review Process Standard</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature</p> <p style="text-align: right;">_____</p> <p style="text-align: right;">date</p>
<p>DOT Advisory Circular AC</p>		

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

431.35-2: Reusable Launch and Re-entry Vehicle - System Safety Process (FAA Requirement)		<hr/> Signature <hr/> date
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Notes:

1. Discipline Champion is responsible for identifying specific level of understanding required for each document. (See section 4.1).
2. Program specific standard: Read all; demonstrate working level understanding of those applicable to your assignment.

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

ON THE JOB TRAINING Complete the following activities in any sequence		SUPERVISOR SIGNATURE/ DATE COMPLETE
Complete (or contribute to a team completing) a system safety checklist in support of a NASA project or program		_____ Signature                      date
Participate on a team conducting a FMEA/CIL in support of a NASA project or program, and demonstrate understanding of relationship to a hazard analysis.		_____ Signature                      date
Conduct (or participate in a team conducting) a hazard analysis in support of a NASA project or program.		_____ Signature                      date
Create (or contribute to a team creating) a fault tree in support of a NASA project or program		_____ Signature                      date
Perform (or participate on a team performing) at least three different types of design reviews (including at least one PDR or later in the project life cycle) in support of a NASA project or program.		_____ Signature                      date
Contribute to relevant professional society (e.g.: System Safety Society) activity via discussions, committee/sub-committee work or writing/presenting a paper.		_____ Signature                      date
Participate in inter-program or inter-center coordinating activity to enhance MSDC and/or NASA expertise in your discipline		_____ Signature                      date
Work toward professional qualification		_____ Signature                      date
Participate in a System Safety Review at JSC or KSC in support of a NASA project or program.		_____ Signature                      date

**APPENDIX B: PDRM for System safety Engineers:  
JOURNEYMAN Qualification Requirements**

Mentor other personnel in your discipline to help them improve their skills and expertise. This can be as a mentor to others in this PDRM process or as an informal coach in your daily work.		<hr/> <p style="text-align: center;">Signature                      date</p>
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Notes:

1. Candidate should work with his/her supervisor to identify specific applicable assignments. Discipline Champion may be consulted to ensure proposed assignments will satisfy qualification requirements.

## **APPENDIX C: PDRM for System Safety Engineers: EXPERT Qualification Requirements**

### C.1 Objective:

This Appendix provides the qualification criteria for System Safety Engineers to be certified qualified at the Expert level, using the process described in the body of the Organization Instruction.

### C.2 Prerequisites:

Prior to beginning the process, the candidate must be certified qualified as a Journeyman System Safety Engineer per the requirements of Appendix B.

### C.3 Years of Experience:

The candidate must have at least 8-10 years of relevant discipline experience prior to becoming certified qualified at the Expert Level.

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

<b>TRAINING CLASS REQUIREMENTS</b> Equivalent classes may be substituted with approval by the Discipline Champion. Sequence is suggested but not mandatory		<b>SIGNATURE/ DATE COMPLETE</b>
Fault Tree Analysis: Solar - SMA-080-02R		_____ Signature                      date
Quality Program Basics: MSFC Class		_____ Signature                      date
Comprehensive Systems Skills: NET Class (5 days)		_____ Signature                      date
Advanced System Safety Practices: NSTC 021		_____ Signature                      date
MORT-Based Mishap Investigation: NSTC 006		_____ Signature                      date
Design for Availability: NSTC 017		_____ Signature                      date
Failure Modes Effects Analysis and Critical Items List: - Solar - SMA-017-01 (1 hour) - HEI Component (Bob Fuerst, 4 hours)		_____ Signature                      date
Advanced Topics in System Safety Workshop: New class, facilitated by subject matter expert to allow in-depth discussions of important topics in system safety. Must be developed and tailored (3 days) (Note 1)		_____ Signature                      date
Crossing Department Lines: NASA HQ Class, Agency Leadership and Development Programs (5 days).		_____ Signature                      date
Problem Solving and Decision Making: MSFC Organizational Development		_____

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

Class (3 days)		Signature	date
Leadership/Teamwork Class Elective: To be selected by candidate		_____	_____
		Signature	date

Notes:

1. Advanced Topics in System safety Workshop is a new class to be developed/tailored. Suggested source is NSTC.

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

REFERENCE MATERIALS Demonstrate comprehensive knowledge of contents as defined by the Discipline Champion		MENTOR SIGNATURE/ DATE COMPLETE
NPG 8715.3: NASA Safety Manual		_____ Signature                      date
NPD 8700.1: NASA Policy for Safety and Mission Success		_____ Signature                      date
MSFC-HDBK-3173: Project Management and Systems Engineering Handbook		_____ Signature                      date
SP-6105: NASA Systems Engineering Handbook		_____ Signature                      date
MWI 1700.2: System safety Program		_____ Signature                      date
MWI 8715.15: MSFC Safety Assessment Program		_____ Signature                      date
NASA Reference Publication 1358: Systems Engineering "Toolbox" for Design-Oriented Engineers		_____ Signature                      date
NPG 8000.4: Risk Management Procedures and Guidelines		_____ Signature                      date
DOD MIL_STD-882: System Safety Program Requirements		_____ Signature                      date

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

<p>Shuttle Safety Requirements (Note 2):</p> <ul style="list-style-type: none"> <li>- NSTS 07700: Space Shuttle Program Definition and Requirements</li> <li>- NSTS 5300.4 (ID-2): Space Shuttle Safety, Reliability, Maintainability and Quality Provisions</li> <li>- NSTS 08117: Requirements and Procedures for Qualification of Flight Readiness</li> <li>- NSTS 08126: Problem Reporting and Corrective Action (PRACA) System Requirements</li> <li>- NSTS 22254: Methodology for Conduct of NSTS Hazard Analyses</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>ISS Element System Safety Requirements and Process (Note 2):</p> <ul style="list-style-type: none"> <li>- SSP 50021: ISS Safety Requirements Document</li> <li>- SSP 30599: ISS Safety Review Process</li> <li>- SSP 30309: Safety Analysis and Risk Assessment Requirements Document</li> <li>- SSP 50038: Computer-Based Control System Safety Requirements</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>Shuttle and ISS Payloads System Safety Requirements and Process Standards (Note</p>		

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

<p>2) :</p> <ul style="list-style-type: none"> <li>- NSTS 1700.7: Safety Policy and Requirements for Payloads Using the Space Transportation System</li> <li>- NSTS 1700.7, Addendum 1: Safety Policy and Requirements for Payloads Using the ISS</li> <li>- KHB 1700.7: Space Shuttle Payload Ground Safety Handbook</li> <li>- NSTS 13830: Payload Safety Review and Data Submittal Requirements</li> <li>- NSTS 18798: Interpretations of NSTS/ISS Payload safety Requirements</li> <li>- JSC 26943: Guidelines for the Preparation of Payload Flight Safety Data Packages and Hazard Reports for Payloads Using the Space Shuttle</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>Expendable Launch Vehicles Safety Requirements and Process Standards (Note 2) :</p> <ul style="list-style-type: none"> <li>- KHB 1710.2: KSC Safety Practices Handbook</li> <li>- CSTCR 127-1: Consolidated Space Test Center Regulation</li> <li>- EWRR 127-1: Eastern and Western Range Regulation</li> <li>- NASA-STD-8719.8: Expendable Launch Vehicle Payload Safety Review Process Standard</li> </ul>		<p>_____</p> <p style="text-align: center;">Signature                      date</p>
<p>DOT Advisory Circular AC 431.35-2: Reusable Launch and Re-entry Vehicle -</p>		

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

System Safety Process (FAA Requirement)		_____ Signature	_____ date
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Notes:

1. Discipline Champion is responsible for identifying specific level of understanding required for each document. (See section 4.1).
2. Program specific standard: Demonstrate in-depth knowledge of those that apply to your assignment, and demonstrate an understanding of the differences between standards for different programs.

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

<p><b>ON THE JOB TRAINING</b> Complete the following activities in any sequence (Note 1)</p>		<p><b>SUPERVISOR SIGNATURE/ DATE COMPLETE</b></p>
<p>Lead a team creating system safety "Checklists" in support of a NASA project or program.</p>		<p>_____ Signature                      date</p>
<p>Lead a team conducting a hazard analysis in support of a NASA project or program</p>		<p>_____ Signature                      date</p>
<p>Participate in, and contribute leadership to, a team creating a Fault Tree in support of a NASA project or program.</p>		<p>_____ Signature                      date</p>
<p>Demonstrate in depth understanding of the purpose of a FMEA/CIL, and the relationship to a hazard analysis.</p>		<p>_____ Signature                      date</p>
<p>Become a mentor for others in System Safety. Guide other team members, including design team members, to understand the importance and benefits of upfront System Safety efforts, to influence the design and to provide high value contribution to the program.</p>		<p>_____ Signature                      date</p>
<p>Participate in activity to establish guidelines and processes for a stronger system safety Discipline at NASA.</p>		<p>_____ Signature                      date</p>
<p>Conduct, lead or contribute significantly to benchmarking studies within NASA, DOD and other Industries to achieve</p>		<p>_____ Signature                      date</p>

**APPENDIX C: PDRM for System Safety Engineers:  
EXPERT Qualification Requirements**

superior S&MA system safety processes.		Signature	date
Regularly lead or proactively participate in design reviews, and support program and project reviews		_____ Signature	_____ date
Obtain relevant external professional qualification (e.g. Certified safety Professional from the System Safety Society). (Highly recommended, but not required at this time).		_____ Signature	_____ date
Provide leadership to professional society or inter-program or inter-center activities (e.g.: working groups defining standards, coordinating groups to achieve cross organizational standards, society committees/ subcommittees doing work to advance the discipline).		_____ Signature	_____ date

Notes:

1. Candidate should work with his/her supervisor to identify specific applicable assignments. Discipline Champion may be consulted to ensure proposed assignments will satisfy qualification requirements.

**APPENDIX D: PDRM for System Safety Engineers:  
Application for Qualification**

This application is for (Check One):

\_\_\_ Entry into the PDRM Qualification process as an Apprentice;  
All prerequisites identified in Appendix A have been satisfied

\_\_\_ NOVICE Qualification  
Appendix A is Attached and approved

\_\_\_ JOURNEYMAN Qualification  
Appendix B is attached and approved

\_\_\_ EXPERT Qualification  
Appendix C is attached and approved

Name of Candidate: \_\_\_\_\_

Organization: \_\_\_\_\_

Building/Location: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

Signatures:

Candidate Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Discipline Champion: \_\_\_\_\_ Date: \_\_\_\_\_

Supervisor Signature: \_\_\_\_\_ Date: \_\_\_\_\_

S&MA Director: \_\_\_\_\_ Date: \_\_\_\_\_