



National Aeronautics and  
Space Administration



**Introducing the:**

**ELECTRICAL, ELECTRONIC, AND  
ELECTROMECHANICAL (EEE) PARTS  
MANAGEMENT AND CONTROL REQUIREMENTS  
FOR SPACE FLIGHT HARDWARE &  
CRITICAL GROUND SUPPORT EQUIPMENT**

**....aka...The NASA EEE Parts Standard**





# Acronyms



Acronym	Definition
ARC	
COTS	Commercial Off The Shelf
EEE	Electrical, Electronic, and Electromechanical
EPARTS	Electronic Parts Applications Reporting and Tracking System
EPMCP	EEE Parts Management and Control Plan
ESA	European Space Agency
GRC	Glenn Research Center
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
OSMA	Office of Safety and Mission Assurance
PEMS	Plastic Encapsulated Modules



# Current Policy Documents



## ➤ NPD 8730.2 NASA Parts Policy

- Control Risk and Enhance Reliability
- Covers
  - EEE Parts, Electronic Packaging and Interconnect Systems
  - Mechanical parts and Manufacturing Materials

## ➤ NPR 8705.4 Risk Classification for NASA Payloads

- Appendix B: Guidance on acceptable risk levels
- Appendix C: Recommended SMA – Related Requirements
  - Critical Single Point Failures
  - EEE Part Levels
  - Reliability

## ➤ Center EEE Part Documents

- GSFC: EEE-INST-002
- MSFC-STD-3012
- Others



<https://spinoff.nasa.gov/network.html>



# Gap Analysis of Documents



## ➤ Comparison of Agency and Center Documents

- Topics from all source documents used for cross-reference
- No one document covered all topics (portion shown below)
- Agency level documents had most gaps
- Goal was to make Agency level document that covered all topics

TOPICS	Agency	Agency	JPL	MSFC	GSFC	JSC/ISS	LaRC	ARC	GRC	KSC
	NPD 8732.2C (Revalidated 12/6/13)	NHB 5300 Vol 1F July 1989	See column O	MSFC-STD-3012 Rev A 2012	EEE-INST-002, Apr 2008	SSP 30312 Vol I, Rev K, Sep 1, 2011	EEE-INST-002, Apr 2008	APR 8730.2 June 2009	GLPR 7120.5.30 Nov 3, 2009	KSC-PLN-5406 Oct 22, 2013
Part Types (applicability)			78157 1.0	4	5.1	1.3 & 1.4	5.1	1	5.2	5
Part Grades		1F301.2	78157 2.0	4.1	2.0 & 6.0	3.2.1.2...	2.0 & 6.0	7.1	5.2.2	6
Commercial grade			78157 Table 3	5.5.1	6.7.1	3.2.1.5	6.7.1		5.2.2.a	7
Criticality Categories		Appdx A & 1F301.1	78157 Table 1	S&MA Requirement		3.2.1.2...				6.2.2
COTS assemblies		1F301.4	57732 Appdx A	5.2.2 & 5.9.2	6.2.7	3.16	6.2.7			7
Parts Control Documnt	5.b.(1) & 5.f.(1)	1F203	78157	5.1		3.1.1		7.1.3	5.2.1	
Parts Control Board		1F201	58792	5.1.2	6.1	5.1	6.1	6.2 & 7.1.2		3.2
Shipping		1F310.1	57252						8.13	
Derating	5.f.(4)	1F306	78157 3.2.2.2 (invokes 34885)	5.4.1 & 5.6.4	6.5	3.8	6.5	7.1.1	5.2.5	12
Failure Analysis			78157 3.5			3.19				
NSPAR		1F201 & 1F301.4c		5.6.3		3.3		7.1.4		7.1



# Goals



## ➤ Create Agency-Level Document

- Capture list of issues that must be addressed
- Single document referenced in Agency contracts
- Not overburden “higher risk” projects with excessive requirements
- Not require changes to Center documents

## ➤ Maintain Center-to-Project relationship

- Center still has ample control
- Project still assumes the risk



# Details



## ➤ Applicability

- Flight hardware - Launch vehicles - Critical ground support equipment (GSE) - Critical ground test systems
- Category 1 and Category 2 projects as defined by NPR 7120.5, NASA Space Flight Program and Project Management Requirements
- Class A, B, C or D payloads as defined by NPR 8705.4, Risk Classification for NASA Payloads, Appendix A.

## ➤ Non – Applicability

- Institutional projects as defined by NPR 7120.7, NASA Information Technology and Institutional Infrastructure Program and Project Requirements
- Research and Technology Development Programs and Projects as defined by NPR 7120.8, NASA Research and Technology Program and Project Management Requirements

## ➤ Tailoring

- Individual NASA Centers may establish program/project-specific **requirements** and/or guidelines, as appropriate. To do this, individual provisions of this standard **may be tailored** (i.e., modified or deleted) by contract or program specifications **to meet specific constraints and program/project needs**.
- **Formally documented** as part of program or project requirements and **approved by the Technical Authority** in accordance with procedures in NPR 8715.3, NASA General Safety Program Requirements & and NASA-STD-8709.20, Management of Safety and Mission Assurance Technical Authority





# More Details...



- Every EEE part intended for use in space flight and critical ground support equipment shall be reviewed and approved for compatibility with the intended environment and mission life, as applicable.
- Parts shall be selected so that flight hardware meets all performance and reliability requirements in the worst-case predicted mission environment

## EEE Part Grade Description

GRADE	SUMMARY	RELIABILITY	RISK	MTBF	COST	TYPICAL USE
1	Space quality class qualified parts, or equivalent.	Highest	Very Low	Longest	Very High	Spaceflight
2	Full Military quality class qualified parts, or equivalent.	Very High	Low	Very Long	High	Space flight or critical ground support equipment
3	Low Military quality class parts, and Vendor Hi-Rel or equivalent. Screened automotive grade (AEC) EEE parts	Medium	Medium	Variable	Moderate	Space flight experiments, aeronautical flight experiments, critical ground support equipment, test demonstrations and ground support systems
4	"Commercial" quality class parts. Qualification data at manufacturer's discretion. No government process monitors incorporated during manufacturing.	Variable	High	Variable	Lowest	Aeronautical flight experiments noncritical ground support equipment, ground support systems, test demonstrations and prototypes. Limited critical GSE.



# ESA and JAXA EEE Parts



- **Extensive qualification programs for manufacturers and individual parts along with qualified parts lists**
  - Similar to the DLA QML and QPL programs
  - Space grade parts
  - Includes periodic audits and process review
  - Category 1 and Category 2 projects as defined by NPR 7120.5, NASA Space Flight Program and Project Management Requirements
  - Class A, B, C or D payloads as defined by NPR 8705.4, Risk Classification for NASA Payloads, Appendix A.
  
- **Recommendation for NASA Projects/programs to review screening and qualification requirements**





# More Details...



## ➤ Parts Assurance

- Qualification
  - Part Level
  - Assembly Level
- Screening
- Receiving and Inspection

## ➤ Parts Selection

- Reliability
  - Criticality
- Derating
- Environment
  - Radiation
- COTS / PEMS

## ➤ Parts Management

- Procurement
- Obsolescence
- Counterfeit Avoidance



# Documentation



- **Program / Project EEE Parts Management and Control Plan (EPMCP)**
  - Plan can be stand-alone documents or part of Project Product Assurance Plan
  - Specific Issue Plans may be contained in EPMCP or stand alone doc's
- **Parts Lists**
  - (EPARTS recommended)
  - As Designed Parts List
  - Approval Record
  - As Built Parts List
- **Analyses**
  - Derating Analysis
  - Parts Obsolescence



# Documentation (continued)



## ➤ Specific Issue Plans

- **Radiation Hardness Assurance Plan**



Source: NASA MSFC

- **Counterfeit Control Plan**



Source: NASA GSFC

- **Prohibited Materials Plan**



- **Red Plague Control Plan**



Source: NASA JSC



# Current Status

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- Draft document is written
- Final Work Group review finished
- HQ OSMA Document Review – Finished
  - Agency-wide Stakeholder Review – In Progress
    - Other Agency Organizations
  - Publish and Publicize

