

The background of the slide is a detailed illustration of the Orion spacecraft in orbit around the Moon. The spacecraft is shown from a side-on perspective, with its service module and crew module clearly visible. Two large, circular solar panel arrays are deployed from the service module, one at the top and one at the bottom. The Moon's surface, covered in craters, is visible in the background. The Earth is partially visible in the upper right corner. The title text is overlaid on the right side of the image.

Summary

DSG-RQMT-007, Initial Baseline

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Purpose: Provide background to the CR for initial baseline of DSG-RQMT-007, Gateway Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment Document

- **This presentation is**
 - ✓ Information
- **Topics:**
 - Background/Document History
 - Program Equivalents
 - Summary of Changes from MIL-STD-461
 - Applicability
 - Product Review
 - Forward Work

- MIL-STD-461 is designed to be tailored at the integrated system level, not at the component or subsystem level
 - Incorrect tailoring at Level III can lead to significant vehicle impacts
 - Can have repercussions on the use of ISS and Orion hardware as well as commercial off-the-shelf use
- Providing a NASA-tailored version of MIL-STD-461 obviates the need of each element developing a set of EMI requirements
 - Maintains interoperability among the various elements
- Tailoring at the element level using MIL-STD-461 as baseline can lead to incompatibilities with other elements
 - Elements without radio receivers may have relaxed radiated emissions limits that could result in interference with communications systems on adjacent elements
 - Elements without radio transmitters may experience interference issues from adjacent element transmitters due to incorrect radiated susceptibility tailoring
 - Incorrect tailoring of conducted emissions and susceptibility limits and test methods can lead to noise issues or malfunction of Gateway hardware
- Requirements development leverages lessons learned from ISS, Orion, and SLS E3 requirements development
- **Gateway Design Integration Team concurred with development of DSG-RQMT-007**



- Equivalent document type (has not undergone meets/exceeds evaluations)
 - ISS
 - o SSP 302237 – uniquely tailored version of MIL-STD-461C (significantly different version than MIL-STD-461F)
 - Orion
 - o CEV-T-025000 – uniquely tailored version of MIL-STD-461F
 - SLS
 - o Core Stage – D201-10084-1 – uniquely and independently tailored version of MIL-STD-461F
 - o Booster – TR96525-AS-020 – uniquely and independently tailored version of MIL-STD-461F
 - o ICPS (ULA Upper Stage) - EN-TCD-057 – uniquely and independently tailored version of MIL-STD-461F
 - o Engine
 - (Adaptation) – RSJ00584 - uniquely and independently tailored version of MIL-STD-461F
 - (Restart) – RJ325423 - uniquely and independently tailored version of MIL-STD-461F

Summary of Change from MIL-STD-461



- **Extends conducted emissions limits to 10 MHz to protect EPS Power Quality**
 - MIL-STD-461 limits do not address Gateway power quality/ripple voltage concerns
- **Adds bulk current emissions limit and test method not currently in MIL-STD-461**
 - Application of Shuttle test method limit to protect sensitive circuits/cabling from crosstalk; allows small cable separation spacing
- **Adds voltage transient immunity requirement to protect avionics during fault recovery conditions**
 - Similar requirement contained in -461F for Navy subsurface ships; deleted in -461G
- **Modifies bulk current injection limit (CS114) to provide avionics immunity to EPS ripple voltages**
 - MIL-STD-461 CS114 limit is meant to demonstrate immunity to electric field coupling to cabling, including power cabling
 - o Less stringent than that needed for Gateway EPS
- **Adds cross-correlation immunity requirements for receivers; prevents interference from VV transmitters**
 - Unique requirement not contained in MIL-STD-461
- **Adds Static (dc) magnetic field requirements**
 - Unique requirement not contained in MIL-STD-461 but utilized on ISS

Summary of Change from MIL-STD-461 (continued)



- **Heavily tailors radiated emissions and radiated susceptibility limits**
 - MIL-STD-461F&G can start as low as 10 kHz and extends only to 18 GHz
 - o Gateway and VV use the RF spectrum between 200 MHz and 27.55 GHz
 - o Reduces testing and waiver processing while extending protection to Gateway/VV receivers
 - MIL-STD-461F&G RS103 limits do not differentiate between internal and external environments
 - MIL-STD-461F&G does not address Ka-Band emitters
 - o Current -461 limits lower than those expected at Gateway.

- Requirements and verifications are applicable to Gateway elements systems, subsystems, and equipment
- Does not contain requirements on program/project processes
- Does not contain data item requirements
 - Expectation is data item requirements handled through BDEALS and other agreements
- Applicable to vehicle subsystems (EPS, Thermal, Avionics, ECLSS, GN&C, C&T, Propulsion, etc.)
- Applicable to Level 3 projects (HALO, EVR, Logistics, Habitat, Airlock, IP elements)
 - Expectation is Level 3 projects and IPs may propose alternate/equivalent standards
 - Suitability of alternate/equivalent standards determined through meets/exceeds evaluations



- **Document developed with input from GRC, JSC, and MSFC E3 communities, including those supporting PPE and HALO**
- **Draft underwent NASA/IP E3 discipline community review**
 - 71 comments received and dispositioned
 - Nearly all technical comments addressed error in limits or test methods, which were incorporated
 - Many comments expressed confusion over limits or rationale for limits
 - o Those comments were incorporated into App. C
- **Received inputs from EPS and Communications SMEs to address EMI-related requirements of interoperability standards**
- **Document is in Gateway format and completed Export Control/EAR Review**
 - Classified as publicly available via DAA TN 72653.

- **Forward Work**

- TBR – Radiated susceptibility limits based on notional transmitter systems
 - o Radiated susceptibility limits are highly dependent upon on board and visiting vehicle transmitters. Once these transmitter systems are baselined, this TBR will be closed
 - o ECD estimated 6/20 (PPE BCR)