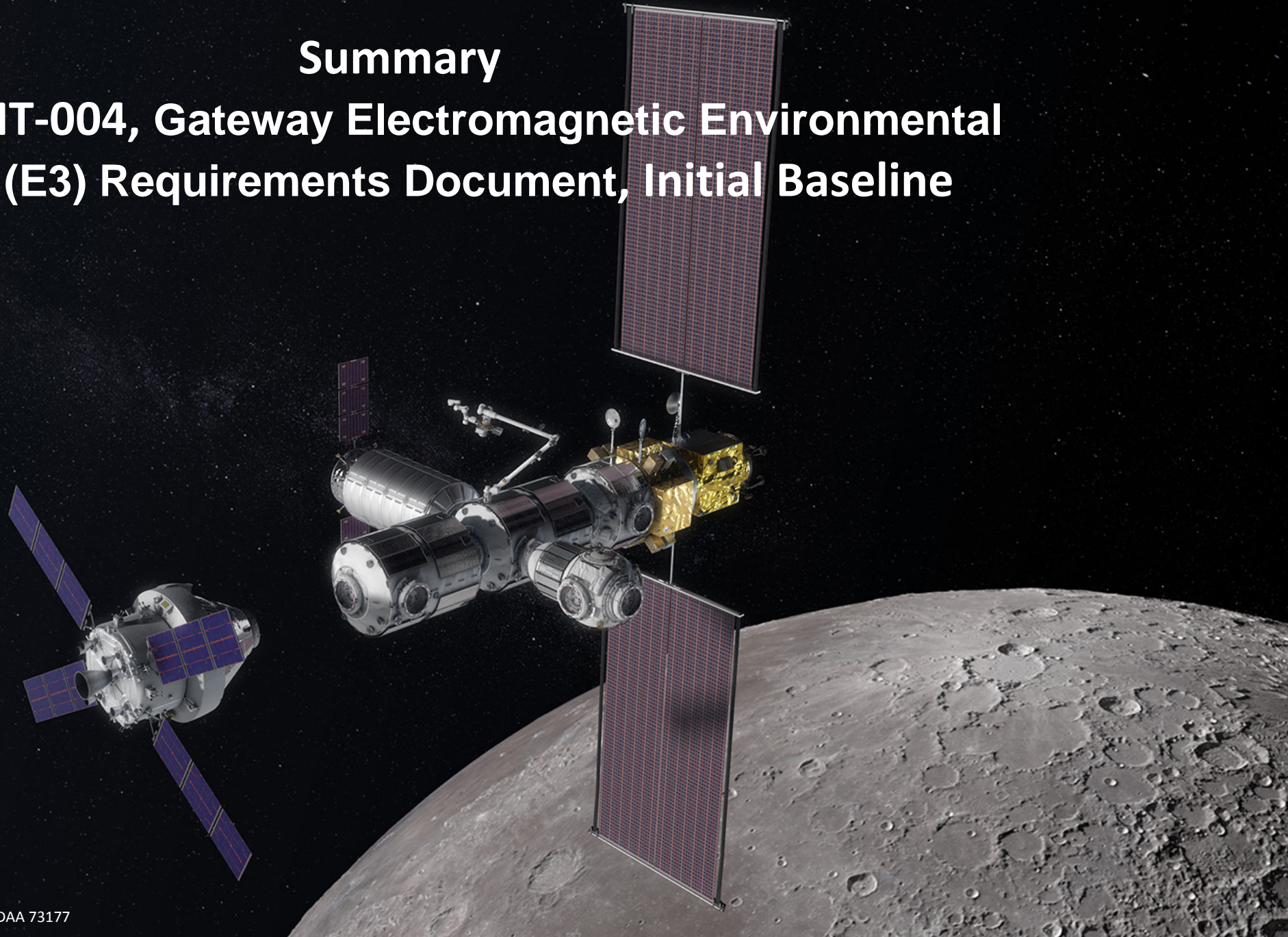


Summary

DSG-RQMT-004, Gateway Electromagnetic Environmental Effects (E3) Requirements Document, Initial Baseline

Matt McCollum
Jonette Stecklein
9/5/19





- **Purpose:** Provide background to the CR for initial baseline of DSG-RQMT-004, Gateway Electromagnetic Environmental Effects (E3) Requirements Document
- **This presentation is:**
 - ☑ Information
- **Topics:**
 - ✓ Background/Document History
 - ✓ Program Equivalents
 - ✓ Change Summary/Document Review
 - ✓ Significant Comments
 - ✓ Forward Work



- MIL-STD-464, Electromagnetic Environmental Effects Requirements for Systems, is imposed on Gateway through HEOMD-003 and the Engineering Technical Authority Evaluation of MIL-STD-464 showed:
 - MIL-STD-464 contains E3 requirements that are clearly not applicable for a space system
 - MIL-STD-464 is missing E3 requirements that should be applicable to space systems in general
 - MIL-STD-464 contains E3 requirements that are vague or ill-defined such that compliance with said requirements could lead to incompatibilities with other Gateway elements or Visiting Vehicles
- MIL-STD-464 was tailored by the NASA E3 community creating DSG-RQMT-004 and to provide:
 - Requirements that are custom-tailored for Gateway mission
 - Requirements that address MIL-STD-464 shortcomings
- Requirements development leverages lessons learned from ISS, Orion, and SLS E3 requirements development



- Equivalent document type (has not undergone meets/exceeds evaluations)
 - ISS
 - SSP 30243 – uniquely tailored version of MIL-E-6051 (MIL-STD-464 predecessor)
 - Orion & Ground Systems
 - MPCV 70080 – uniquely tailored version of MIL-STD-464A
 - SLS
 - SLS-RQMT-040 – uniquely tailored version of MIL-STD-464A

Summary of Change from MIL-STD-464



- **Adds spacecraft charging mitigation and control not addressed by MIL-STD-464**
- **Adds solar array charging control not addressed by MIL-STD-464**
- **Adds high voltage design/corona prevention not addressed by MIL-STD-464**
- **Adds electrical ground referencing requirements (Single point ground concept) not addressed by MIL-STD-464**
 - The EPS Interoperability Standard has a requirement for a single point ground reference for EPS but is not addressed in other IOS documents such as the Avionics Interoperability Standard
 - Single point ground referencing is a key noise control element especially when integrating GFE, CFE and Commercial Off-The-Shelf hardware
- **Adds requirements for electromagnetic compatibility of cable/wiring for crosstalk/interference control not addressed by MIL-STD-464**
 - Does not address cable and harness shielding and shield termination requirements
 - A significant number of NASA EMI issues traced to improper shielding and shield terminations
- **Adds detailed verifications and guidance not provided in MIL-STD-464**



- Requirements and verifications are applicable to:
 - Gateway integrated vehicles
 - Individual Gateway elements
 - 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 Integrated Stack
 - Will impact disciplines (Structures & Mechanisms, Materials & Processes, HSIR, etc.)
- Applicable to Level 3 projects (HALO, Airlock, EVR, Logistics, Habitat, 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 as well as PPE Project Office representatives
- Draft was submitted as part of FSR
 - No comments received
- Received inputs from EPS and Communications SMEs to address E3-related requirements of interoperability standards
- Document is in Gateway format and completed Export Control/EAR Review
 - Classified as publicly available via DAA TN 72653.



- TBDs
 - The specific field level from onboard, visiting vehicle, or nearby emitters will be defined as Gateway RF system design matures
 - Completion of TBD requires baselining of Communications Subsystem specification and identification of transmitter frequencies, power levels, and antenna locations
- TBRs
 - Determine appropriate margins for safety critical systems, subsystems, and equipment
 - This requires a balance between program costs and risks to achieve an adequate margin that is not unduly burdensome to the Gateway Program
 - Resolution of TBR dependent on resolution of LOC/LOM TBDs in DSG-RQMT-001
 - Determine on orbit RF environment due to ground based emitters
 - The NASA E3 community is working to obtain a more up-to-date set of data from the Joint Spectrum Center in which to define the on orbit environment
- TBDs/TBRs should not inhibit DSG-RQMT-004 baselining
 - Baselining DSG-RQMT-004 with TBDs and TBRs allows Level III and IPs to implement DSG-RQMT-001 (which invokes DSG-RQMT-004)
 - Allows Level III and IPs to move forward with incorporation into Level III specs and/or development of alternate/equivalent standards
 - Small number of TBDs and TBRs, document more than 95% complete