

SPACE SYSTEMS SYMPOSIUM (D1)  
System Engineering Tools, Processes & Training (I) (3)

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ARES 1 DESIGN FOR OPERABILITY

**Abstract**

As part of the Constellation Program, engineers at NASA's Marshall Space Flight Center in Huntsville, Alabama are working to design and build the Ares I, the first of two large launch vehicles to return humans to the Moon and beyond. A deliberate effort is being made to ensure a high level of operability in order to significantly increase safety and availability as well as reduce recurring costs of this new launch vehicle. It is the Ares Project's goal to instill operability as part of the requirements development, design and operations of the vehicle. To support this intent, the Constellation Program defined NASA Goals, and Objectives (NGO) encapsulating project direction to optimize the vehicle design for efficiencies in production, operations, testing and maintenance. The NGO's provided the framework for "Operability" requirements and design guidance for operable influences regarding the vehicle

This paper will document the past and current design phases and the supporting processes, tools, and methodology for designing operability into the Ares I Launch Vehicle. The content will address the key operability requirements, system readiness activities, international launch vehicle benchmarking activities, operability assessments, and lessons learned. We will discuss the interrelationships within the Ares I Project organization as well interdependencies with the Constellation Program. Based on lessons learned, the last section of this paper will describe proposed organizational and process improvements, and tool enhancements for future projects/programs. Content of Paper:

1. Influencing the Ares I vehicle for operability during the Design phases
2. Accounting of the Operability activities and the process and tools prescribed and used
3. Organizational interfaces within the Ares I project and the Constellation Program
4. Operability solutions that transpired over the development phase
5. Lessons Learned
6. Recommendations going forward for future programs

Further content description: The operability activities that started at SRR thorough the various design phases going into CDR and the interactions between level 2 Constellation Program and the Level III Ares I Launch Vehicle Project. Additional information would describe operationally derived requirements, the Kaizen Lean event for ground processing, Discrete Event Simulator (DES), Post PDR 90 day Operability Assessment, the Constellation Operability Optimization List (COOL) , Bench Marking activities with the International Launch Vehicles, and the Operability Assessment Tool encompassing the Operability Action List (OAL), Operability Design Guidelines (ODG), and the Operability Assessment Report (OAR).