HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
Enablers for the Future Human Missions (7)

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SUSTAINMENT TECHNOLOGY ENABLERS FOR FUTURE NASA MISSIONS UTILIZING ARES 1 SUPPORTABILITY ENGINEERING AND SUSTAINABILITY LESSONS LEARNED

Abstract

This paper addresses the quintessential problem of incorporating operations' needs during the early design phase of a program, explaining the innovative approach to Launch Site logistics that was planned for the Ares I Program. It will provide a review of the overall approach to the design of Ares I with an emphasis on a more affordable, supportable, and sustainable launch vehicle. It will explain the requirements development, technology identification, design influence, support concept alternatives, Integrated Logistics Support (ILS) approach and a Logistics Support Analysis (LSA) planning, analyses and trades performed, and overall ILS implementation. The Ares I Program placed an early emphasis on an affordable and sustainable Ares I rocket for supporting both Human ISS and Lunar missions. As a result, we implemented a supportability engineering approach, as an integral part of the system engineering process. We developed meaningful supportability requirements and Technical Performance Measurements, and we identified new technology approaches to meet the program objectives. The Ares I Program initiated an LSA process to provide a path forward for a systems design approach that included supportability engineering and analysis activities. This LSA process provided a system engineering approach in the development of the Ares I supportability requirements, and development of alternative support concepts that streamlined the program operations long term and developed meaningful supportability requirements to meet Constellation mission(s) objectives. Trade-off analyses were conducted to determine the most affordable Ares support system alternative(s) and their associated risks for the Ares I Program. These analyses provided the best alternative that meets the support, design, and operation requirements while also having the best balance among cost, schedule, performance, readiness, and supportability. The analyses and trades conducted for Ares I include: 1) On-pad repair (Remove Replace) vs. repair at Vehicle Assembly Building, 2) Sparing an integrated Upper Stage (US) at KSC vs. transporting one from MAF, 3) Maintenance Engineering Analysis (MEA), and 4) Support System Alternatives. An Operability Assessment Team was established to collect innovative ideas and to ensure full consideration by the hardware design engineering community. Maintenance Engineering Analyses were utilized to optimize maintainability design considerations early in the design phase and to evaluate significant cost savings for long term sustainment of the Constellation Program. Innovative ideas included: significant maintainability improvements to the integrated design and specific hardware components. An ILS Working Group was established to provide strategic partnership sustaining engineering activates between the designers and the Ground Operations expertise.