Paper ID: 35713
oral

HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Human Spaceflight Global Technical Session (9-GTS.2)

Author: Mr. Scott Norris
Lockheed Martin Space Systems Company, United States

Mr. Paul Marshall
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States
Mr. Timothy Cichan
Lockheed Martin Corporation, United States
Dr. Roger McNamara
United States
Mr. Bryce Cox
United States

ORION: LESSONS FROM EFT-1 AND EM-1, AA-2, AND EM-2 STATUS

Abstract

Orion, the Multi-Purpose Crew Vehicle, is a key piece of the NASA human exploration architecture for beyond earth orbit (BEO). Lockheed Martin was awarded the contracts for the design, development, test, and production planning for Orion through the Exploration Mission 2 (EM-2) in 2021. Numerous lessons have been learned from this development program and allowed NASA and Lockheed Martin to optimize the Orion design for future flights to increase crew safety, lower mass, lower cost, and shorten production schedules.

On December 5, 2014, NASA and an industry team led by Lockheed Martin achieved a remarkable advancement in our nation's human deep space exploration capability with the launch of Orion's Exploration Flight Test-1 (EFT-1). In a 4.5 hour, 60,000 mile that flew 15 times higher than the International Space Station, the Orion EFT-1 team carried out many of the riskiest in-flight events critical to making Orion the safest spacecraft possible for crewed deep space missions.

Data provided from more than 1200 sensors measured every aspect of the spacecraft's performance, including avionics and software; separation events; attitude control and guidance; entry, descent and recovery operations; parachute deployment; aerodynamic and aero-thermal performance; and other critical mission and ground operations. This data helped identify specific improvements to enable more efficient processes and operations concepts for the following Exploration Mission One (EM-1) production. The Orion EFT-1 Team not only collaborated on manufacturing innovations, but also process innovations that reshaped traditional oversight/insight functions and increased affordability.

The next three flight tests for the Orion program will be EM-1, Ascent Abort two (AA-2), and EM-2. These final tests will validate the improved designs and certify the Orion for operational use. Work on these missions is well underway. The EM-1 critical design review was completed at the end of 2015 and the European Service Module Critical Design review is scheduled for April 2016. The EM-1 pressure vessel was delivered to the Kennedy Space Center (KSC) Operations and Checkout (OC) facility in early 2016 and is being prepared for all crew module subsystems integration.

This paper will discuss the EFT-1 lessons learned and optimization plans for the future Exploration Mission configurations and tests.