

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Mr. Christian Eger  
ArianeGroup, Germany

Dr. Jan-Hendrik Meiss  
Airbus DS GmbH, Germany

BRINGING THE PROPULSION SYSTEM OF THE FIRST ORION-ESM FLIGHT UNIT TO LIFE

**Abstract**

The Orion Multi-Purpose Crew Vehicle (MPCV) is the next generation spacecraft that NASA currently develops to send humans and cargo to the moon and beyond and return them back to earth safely. The vehicle, which will be launched by the new Space Launch System (SLS), is designed to support long-duration deep space missions. The first exploration mission is planned to take place end of 2019 as an uncrewed lunar flyby mission followed by a second exploration mission in 2023 taking astronauts to the moon. The MPCV resembles its Apollo predecessors and will consist of a habitable Crew Module (CM) and a disposable European Service Module (ESM) that provides power, life support, and in-space propulsion. The ESM is subcontracted to ESA with Airbus DS GmbH as industrial partner being responsible for its development.

This paper presents details of the design of the propulsion subsystem (PSS) and provides a summary of the acceptance testing of the PSS performed in the Bremen Integration Facility prior to handing over the ESM to the United States for further testing and mating with the crew module adapter and the crew module itself.

The PSS acceptance testing represents the first activation of the flight system after final integration of the ESM and includes individual calibration and end to end testing of all sensors and autonomous activation of mechanical equipment such as flow control valves and isolation valves. In addition the overall functional chain of the electrical pressurization concept of the flight unit is tested for the first time, combining pressure readings, evaluation via a dedicated pressure regulation unit and activation of Helium flow control valves via a bang-bang regulation concept.

The paper concludes with overall findings of the acceptance tests, which will be conducted in spring 2018, and provides lessons learned for future testing.