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# ORION EUROPEAN SERVICE MODULE PROPULSION SUBSYSTEM AFTER QUALIFICATION TESTING PRIOR ESM-2 DELIVERY AND ESM-3 INTEGRATION

**Abstract**

The ORION spacecraft is a multi-purpose crew vehicle designed to support missions beyond low Earth orbit. ORION will be launched by the Space Launch System (SLS). NASA, ESA, European and US Industry are working together to develop the ORION spacecraft. ESA is responsible for the European Service Module (ESM) and awarded a contract to Airbus DS GmbH for its development and qualification as well as the production of two flight units. The European Service Module provides translational thrust and 3 axis attitude control for the spacecraft, stores life support consumables for the crew module (oxygen, nitrogen and water), and provides thermal control and power. In January 2017 the Propulsion Subsystem Qualification (PSS) Model (PQM) was shipped from Sweden to the White Sands Test Facility of NASA in New Mexico, United States of America. After mounting of the test article to the sea-level test bench and performance of the acceptance test program the hot firing test program was started in August 2017 in blow-down mode operation. With the successful accomplishment of the acceptance test hot firings of all thrusters the PQM the second phase was initiated in pressure regulated operation. During this phase saturated as well as un-saturated propellants were used. The qualification hot firing tests were completed in January 2019. This paper presents the main results of the Orion ESM PSS hot firing qualification program with a brief summary of the main lessons learned. In parallel the production of the first flight units is ongoing. The first ESM-1 model was delivered in November 2018 to the Kennedy Space Center in Florida, USA. Further integration of the second flight model is continuing in the Airbus DS GmbH facilities in Bremen, Germany. Finally the third flight model is in production. This paper presents also the configuration changes for PSS w.r.t. ESM-2 and ESM-3 and the associated qualification approach and provides an outlook of the batch preparatory program considering ESM-4 up to ESM-9 units.