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SCHUMANN: DESIGN AND DEVELOPMENT OF A FUNCTIONAL SATELLITE MODULE FOR REFUELING APPLICATIONS

Abstract

SCHUMANN is a Horizon Europe research initiative aiming to strengthen the foundations of a future space ecosystem based on satellite standardization and modularity. This will be achieved through the development of Functional Satellite Modules (FSM) offering different operational functionalities for satellites and missions.

In the shape of Orbital Replacement Units (ORUs), FSM will present a generic design and standardized hardware and software interfaces, to be compatible with a pre-defined eco-system. The modules will offer the possibility for late stage satellite integration, or to be replaced or added during the satellite mission's lifetime. This addresses critical needs in New Space with more sustainable, flexible and cost-effective satellite operations, a step change in the way satellites are managed and maintained in space. Moreover, it will favor the emergence of a new space economy, with the possibility for FSM developers to offer faster produced, interoperable and more affordable solutions, in a wide range of applications.

One of the key objectives of SCHUMANN is to perform the technical maturation of a Functional Satellite Module up to TRL-6, as a contribution to the future space ecosystem. This relies on the maturation of previous European space technologies building blocks development (ESROCOS operating system, HOTDOCK standard interface, I3DS sensor suite) and the use of available commercial space hardware components. Concretely, as part of SCHUMANN, the selected FSM takes the shape of a Refueling Tank (RTa) module, as a mean to offer refueling and life extension solutions to satellites. This paper provides a comprehensive overview of the project's activities and results that include:

- The analysis of the reference mission scenarios and CONOPS, with a focus on refueling applications
- The detailed design of the RTa flight module, covering the generic FSM components, the refuel subsystem;
- the adaptation of the HOTDOCK standard interface for high-pressure gas based refueling;
- The description of the model philosophy and testing methodology/strategy with the results obtained on the Engineering;

- the perspectives on the Engineering Qualification Model (with TVAC and vibration testing);
- The conclusions and perspectives of growth potential towards the flight model development and opportunities for In-Orbit-Demonstration (IOD).