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Title

CALLISTO – on repurposing an expendable reaction control system (RCS) for a reusable demonstrator

Authors

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Abstract

CALLISTO (Cooperative Action Leading to Launcher Innovation in Stage Toss-back Operations) is a 13.5 meter high fully reusable launcher demonstrator scheduled to make its first flights from Guiana Space Centre in the near future. The demonstrator is a multi-national collaboration that builds on the concepts, studies and experience obtained through decades of research conducted in France (CNES), Germany (DLR) and Japan (JAXA) [1]. It aims at testing and maturing technology needed to advance in the field of reusable – earth to space – transportation.

Nammo Raufoss, Norway, became part of the project in 2017 through its green monopropellant technology to be used for the Reaction Control System (RCS) of the Callisto demonstrator. The technology, primarily being co-developed for the green RACS of the VEGA launcher family, aims at replacing hydrazine based attitude control systems with a safer and environmental friendly substitution using High Concentration Hydrogen Peroxide as a monopropellant (H202 at 87.5%), which creates only oxygen and water as bi-product. Nammo has invested substantially in the last years to support the development of such propulsion systems from both a system integrator and a component manufacturer point of view. This includes notably process qualification and development of testing capabilities for the main components as well as the full propulsion system.

The key functions needed for the Callisto RCS are pitch and yaw control in all phases of the flight from launch to landing, in addition to tilt-over maneuvers for returning to the launch site. The performance needed for these operations suits well to the aforementioned components developed for VEGA RACS. In addition, thanks to the safer nature of H2O2, the technology facilitates easier ground operations before, during and after flights. The system developed for VEGA RACS is an expendable system that will be dispatched after every flight. The focus of this presentation is therefore to address the key reusability needs and changes for adopting such a system into multiple repeating flights. Key subjects to be covered are applying aeronautics principles to the maintainability of the system; re-use implications to its components as well as the needs and complexity of the ground operations at CSG in Kourou. There will as well be a short update on the current development status, and how close Nammo is with key technologies that would demonstrate the next coming steps in RCS reusability on board Callisto.

References

[1] Michel Illig, Shinji Ishimoto, Etienne Dumont (2022), Callisto, a demonstrator for reusable launchers, 9th European Conference for aeronautics and space sciences (EUCASS)