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THE PRISMA FORMATION FLYING MISSION: GNC CAPABILITIES AND FUTURE OPPORTUNITIES

Abstract

PRISMA was launched on June 15, 2010 to demonstrate strategies and technologies for formation flying and rendezvous. OHB Sweden is the prime contractor for the project which is funded by the Swedish National Space Board with additional support from DLR, CNES, and DTU. By mid 2012, PRISMA has completed its nominal mission and extended missions.

PRISMA consists of two spacecraft: Mango and Tango. The Mango spacecraft is 3-axis stabilized and has a propulsion system providing full 3D orbit control. Tango is 3-axis stabilized with a solar magnetic control system and does not have orbit control capability. The two spacecraft were launched clamped together into a 700 km SSO and Tango was successfully separated from Mango on August 11, 2010.

PRISMA includes the flight qualification of several sensor and actuator systems and the in-flight execution of a range of GNC experiments using this equipment. The spacecraft are equipped with Vision Based, GPS, RF-sensor navigation systems and have three different propulsion systems. As a result of this variety of interests in the mission, the operational timeline has been packed with different experiments and the short mission time has required a high degree of flexibility from mission control as well as the experimenters themselves. Apart from OHB Sweden's GNC experiments, the propulsion manufacturers (ECAPS, NanoSpace) and the participating organizations DLR, CNES, DTU act as experimenters. DLR and CNES both have GNC-experiments for which software has been integrated into the over-all PRISMA on-board software.

By the end of its extended mission, it is expected that PRISMA will have a considerable amount of remaining delta-V. This opens for several possible further mission extensions. Areas such as virtual structures, distributed scientific instruments, Space Situation Awareness, or Space Surveillance include Formation Flying and Rendezvous as a key enabling technology and this paper will show how PRISMA is able to demonstrate relevant aspects of these areas.

The paper will provide an overview of the capabilities of PRISMA in its current implementation and will discuss how these can be elaborated in order to implement demonstration activities within areas such as:

- Distributed instruments with associated alignment, tracking and sensor data collection
- Rendezvous with unknown orbital objects and the characterization and visualisation of these objects

- Visual mapping and cataloguing of space objects

For each identified area, an experimental concept will be presented in order to emulate the application such that relevant aspects are demonstrated.