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FLIGHT RESULTS FROM SSC'S GNC EXPERIMENTS WITHIN THE PRISMA FORMATION FLYING MISSION

Abstract

The PRISMA in-orbit test-bed was launched on June 15, 2010. The mission will demonstrate strategies and technologies for formation flying and rendezvous. The Swedish Space Corporation (SSC) is the prime contractor for the project which is funded by the Swedish National Space Board (SNSB) with additional support from the German Aerospace Center (DLR), the French National Space Center (CNES) and the Technical University of Denmark (DTU). The PRISMA mission consists of two spacecraft: Mango and Tango. The Mango spacecraft is 3-axis stabilized and is equipped with a propulsion system providing full 3D orbit control capability. Tango is also 3-axis stabilized but with a simplified solar magnetic control system. The Tango spacecraft does not have any orbit control capability. The two spacecraft were launched clamped together into a 700 km altitude sun synchronous dawn-dusk orbit. After an initial commissioning campaign, Tango was separated from Mango on August 11. The mission includes the flight qualification of a series of sensor and actuator systems as well as 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 has three different types of propulsion. The different GNC experiments are conducted by the participating organizations and this paper focuses on SSC's experiments. These consist of Autonomous Formation Flying, Proximity Operations with Final Approach/Recede Manoeuvres, and Autonomous Rendezvous. By the beginning of September 2010, all essential equipment on the two satellites has been fully commissioned and the initial parts of the Autonomous Formation Flying have been initiated. The Autonomous Formation Flying demonstrates aspects of flight in passive relative orbits and the transfer between different such orbits. The navigation is based on GPS and the control framework is linear Model Predictive Control (MPC) implemented for an arbitrary orbit, including eccentric orbits. This paper will focus on these earliest results from SSC's GNC experiments. The paper also contains a brief PRISMA system description and an overview of the GNC subsystem together with the SSC's GNC experiments.