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ATV GNC FOR RENDEZ-VOUS AND DOCKING: PRINCIPLES, TECHNOLOGY AND EXPERIENCE

Abstract

Europe's most challenging spacecraft is about to start its third voyage to the International Space Station (ISS). Following the path of its predecessors, ATV-3, named Edoardo Amaldi after the Italian physicist and spaceflight pioneer, will fulfil its duty of resupplying the crew with food, water, oxygen and research or maintenance equipment. It will serve as a cargo carrier, storage facility and propulsion support vehicle for nearly half a year. ATV is the only resupply spacecraft, besides the Russian Progress spacecraft, that can provide refuelling, attitude control and regular orbital reboosts. It can also enable occasional manoeuvres to avoid collisions with space debris.

The 20-tonne vehicle is able to navigate on its own and dock automatically with the Station with a precision of better than six centimetres while ensuring at all times the safety of the crew on-board. The rendezvous phase is specifically designed to ensure the safety of trajectories with respect to ISS, to accommodate the characteristics of the different sensors that are used to perform relative navigation and to provide hold-points for operations coordination among partners and dedicated verifications.

This paper will provide an overview of the principles of the design of ATV GNC during rendezvous and docking as well as provide gathered flight experience from the previous missions post flight analysis ATV-1 Jules Vernes and ATV-2 Johannes Kepler, in particular achieved performances will be compared. For follow-on ATVs, including ATV3, new ISS Solar Arrays configuration during rendez-vous will be introduced and the potential impacts (GPS multipath and optical sensors dazzling) on GNC behaviour will be reported. The results of Edoardo Amaldi post-flight analysis will be presented and compared to previous flights.