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SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Technologies (5)

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RESULTS AND ROADMAP FOR ON-GROUND BREAD-BOARDING AND TESTING OF KEY GNC TECHNOLOGIES FOR ACTIVE DEBRIS REMOVAL

Abstract

Active Debris Removal missions are being proposed in the last years as a mean to control the growth of the space debris population and hence guarantee the exploitation of space in the years to come. Performing active debris removal, which is, capturing and manipulating a non-cooperative target, is a completely new application for which several technologies need to be developed. GMV has been involved and supported also at national levels in several ADR system and technology studies since 2010 both under ESA and national agencies (CNES, ROSA) contracts. Several internal activities focusing on GNC technologies have been also carried out taking advantage of the in-house knowledge and testing facilities. All the studies carried out have identified two main areas of development critical to accomplish the severe ADR mission requirements, 1) the Guidance Navigation and Control system (including both the sensors and the associated algorithms) and 2) the capture techniques (robotic arm or net). The performed projects have revealed a strong link in between the two areas, especially for capture techniques requiring rigid capture of the debris object. However it is also known that a large part of the GNC algorithms required can be reused in all the proposed mission concepts, at least for the far rendezvous and proximity operations. Navigation will be common while guidance and control will have to be developed on purpose for the capture and stabilisation phase depending on the capture technique in use. The paper will describe a feasible roadmap for the development of GNC systems for active debris removal mission. The proposed roadmap intends to maximise the use of ground testing facilities, hence limiting the need for in orbit demonstration to the bare minimum. Nonetheless, a small demonstration mission is proposed as the final step for the validation of the GNC system, among others, before full fledge mission is flown, either as an institutional mission or as a commercial service. The paper will be complemented with a discussion on the results of the ground tests already carried out at GMV premises in the platform-art© dynamic test bench. Tests have been already carried out for the three of the most critical phases of the mission, 1. The spin synchronisation with the target 2. The capture phase with a robotic arm 3. The deployment of a scaled net