

SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

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A SPACE DEBRIS "CLEANER KIT" BASED ON POLYURETANIC FOAMS

Abstract

Space debris is an increasing problem. The safety and even feasibility of future space missions strictly depend on the developments in the field of active debris removal. In last years the group of Space Robotics of the University of Bologna, in cooperation with the Space system Laboratory of the University of Rome, has been carrying out several studies concerning the use of poliurethanic foam for space application. Thanks to the different experiments and tests performed, it has been possible to define the multiple physical properties of this material in different chemical compositions. After the analysis of different possibilities, two suitable materials have been selected to be integrated in a small "cleaner kit" (10x10x10 centimeters) for debris removal. The idea is to make available a solution that can face the problem of space debris from 2 different points of view: on one side the possibility to reduce the space debris population growth preventing the formation of new debris using a deorbiting system and on the other side the possibility to perform an active removal of existing debris creating a rigid and affordable link between the debris and the satellite. The first system consists in a deorbiting drag sail based on a specific foam formulation that can guarantee a compact storage volume and a passive deploying system, without complex mechanism or boom that could be origins of failures. The reliability of the system is due also to the unlocking sail device that consists in a standalone passive actuator. The design of the sail is optimized to fulfill with a deorbiting time in LEO orbit that respects IADC guidelines (25 years maximum mechanical life). The second subsystem consists in a device that allows generating the foam and using it to glue the "cleaner kit" to the debris. Through several thermal, vacuum and adhesion tests has been possible to define a specific chemical formulation that permits to have the correct reaction time and the suitable mechanical properties to create a rigid link with the cleaner satellite in space like environment. Once the link has been accomplished it is possible to deploy the deorbiting sail included in the kit. The kit has been designed in order to leave the maximum flexibility depending on the kind of mission.