

SPACE DEBRIS SYMPOSIUM (A6)  
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SOME DESIGN APPROACHES TO PREVENT AND LIMIT THE NEAR-EARTH SPACE DEBRIS  
GENERATION**Abstract**

There is a great number of ideas on how to prevent and limit the generation of new near-Earth space debris. However, due to technological or economical reasons, they still cannot be realized. This paper gives a more detailed examination of some concepts that in Yuzhnoye State Design Office's opinion are most feasible. It is: • removal of space debris objects with Inflatable Drag System (IDS); and • removal of launch vehicle liquid-propellant upper stages with reactive forces that originate from the outflowing propellant tank pressurant after propulsion system's shutdown. Inflatable Drag System deorbits space debris objects by considerably increasing their cross-section area. This system consists of a shell made of light strong thin materials, pressurization system, pressurization control system, and a system of fastening to removed objects. To increase survivability of IDS, the shell takes its shape due to inflatable frame or segmental structures, which saves the system's drag capabilities even after colliding with space debris fragments. Inflatable Drag System can be attached to a space debris object that has to be removed in the course of an appropriate mission. It can also be mounted on a removed object in advance and activated after its mission's over. Removal of launch vehicle liquid-propellant upper stages with reactive forces that originate from the outflowing propellant tank pressurant after propulsion system's shutdown is carried out by mounted on propellant tanks reverse thrust nozzles with membranes. The nozzles are mounted in such a way that the outflowing pressurant creates forces parallel to the stage's longitudinal axis and opposite to its velocity vector, and also a torque around its longitudinal axis. As a result, the stage decelerates and twists around its longitudinal axis to ensure an oriented travel.