REMOVAL OF SEPARATING PARTS USING A LIQUID ROCKET ENGINE

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This journal relates on active debris removal and mitigation processes. Since human space activities began, debris generated by these activities has started to accumulate. During years, this situation has been ignored, leading to the current situation, with hundreds of thousands dangerous pieces orbiting around Earth. At present, agencies and societies have concerned about looking for means to reduce the amount of debris in the LEO and GEO orbits, and finding means to avoid the generation of new debris from future launches.

This journal will present the solution under study by the Space Ecology center at Omsk State Technical University, leaded by Professor Valery I. Trushlyakov, to deorbit separating parts in an autonomous way. After a Space Launching Vehicle places the load, the remaining propellant in the tanks will be gasified by feeding tanks with hot gases. These hot gases will be provided by a small solid or liquid engine. Gasified propellants will be used in a gas engine to develop the thrust needed to deorbit the upper stage in a safe way back to Earth.

This method will be compared with the solutions that other agencies have already proved in a successful way: the reentry experiment of the Delta IV (2006, carried by NASA), the H-IIB (2011, JAXA and Mithsubishi Heavy Industries), and the Arianne V ECA (2008, ESA and Astrium). This work will focus in the phase transition processes (the evaporation of the propellant) and the models used to study it. The main problem we face is the gasification of high-boiling kerosene (for example in the case of Soyuz) residual.

In the end, this study is pretended to provide a methodology to study the gas engine, taking the main liquid engine as a basis. The work is currently under development.