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SELF-CONTAINED ONBOARD LV STAGE DISPOSAL SYSTEM BASED ON ENERGY RESOURCES UNEXPENDED AFTER SC ORBITAL INSERTION

Abstract

The purpose of the self-contained onboard launch vehicle stage disposal system (SODS) is a major improvement of launch vehicle environmental footprint due to: - upper stages deorbiting from critical regions of near-earth space (with controllable orbit exit and safe descent to the Earth's surface or transfer to graveyard orbits); - controllable delivery of lower stages to impact areas that have a significantly smaller size compared to those used for existing LVs; - complete elimination of remaining propellant components in LV stages delivered to impact areas. The aim of SODS is to a provide a directional velocity impulse to a LV stage after its separation from the upper stage or to a SC by means of using energy resources remaining in LV stages. SODS operation concept is the gasification of residual components of propellant fuels and their use in combination with pressurizing gas as a working medium for special gas rocket engines designed to stabilize the stage and generate a velocity impulse. SODS key conceptual requirements: - minimal changes in the design of LV stages caused by SODS installation; - acceptable weight loss of the payload deployable in orbit; - design flexibility of SODS and its parts with respect to different class LVs stages. SODS composition: - gasification system designed to produce a heat-transfer medium with desired properties and parameters; - four chambers of gas rocket engines; - gas rocket engines fuel feed system; - LV stage propellant tanks; - guidance, navigation and control system; - self-contained electrical power supply. SODS design process:

- development and experimental testing of parts; - SODS installation on the first and second stages of light-class LVs such as Souyz-2-1v and its testing as a concurrent task during planned LV operations; - equipping of other class LVs with tested SODS units. SODS state of the art: - the justification of the need for SODS to achieve the desired purpose has been completed ; - tentative characteristics and composition of SODS required to solve the design problem have been formulated ; - a theoretical and experimental researches for the selection of main design characteristics of parts and requirements applicable to SODS as a whole has been carried out. The proponents of SODS development project will readily consider proposals from any interested parties regarding their possible involvement in the project.