подтверждают предположение о перспективности использования ЖФПП для внутреннего охлаждения стенок ЖРДМТ [1] при эффективной организации их внутрикамерного рабочего процесса.

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CRITERIA OF CHOICE FOR AN ENGINE CAPABLE OF PERFORMING A TRANSFER ORBIT AND A DE-ORBITING OF A LAUNCHER'S ORBITAL STAGE AND GASIFICATION OF THE UNSPENT PROPELLANT OF THE STAGE

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In this paper it will discussed the criteria of choice of a secondary engine for a launcher's orbital stage capable of performing a transfer orbit and subsequently a de-orbiting on the occasion of a space debris removal mission. It will be analyzed also the hypothesis of using the unspent fuel of the stage with and without a gasification process.

The system that it's going to be considered, it's composed initially by the orbital stage of the launcher after the release of the payload. According to the purpose of the mission, after the payload's injection in orbit, the orbital stage could be simply de-orbited or it could be used as autonomous satellite and after a proper transfer orbit, using a tethered space micro tug that grabs the space debris, the whole system would be de-orbited into the atmosphere. To accomplish this mission, the orbital stage is designed to carry an Autonomous De-Orbiting System (ADS). The choice of the proper kind of ADS is the paper's core.

Initially it will be defined the criteria that will lead the analysis among the different type of engines (liquid, solid, hybrid, gas). The engines, according to the data provided by the astrodynamic of the mission, were sized to let a well aware and criticized choice.

It will be demonstrated in the paper that the standard engines, even if they can accomplish to the mission's request, they occupy a large amount of space and weight on the launder. In order to reduce the mass for the de-orbiting mission, it was studied a method to use the unspent liquid propellant of the rocket stages with a gas engine. Because of at the end of the launcher's mission, it remains usually in the tanks about the 3% of the initial propellant mass, the study was focused in exploiting this remaining resource using the residual propellant's evaporation to accomplish the maneuvers requested and in obtaining a sufficient thrust that permit a faster re-entry. This process, called gasification, can be used for different launchers, different rocket's stages of rockets and different maneuvers such as:

- Orbital transfer maneuver.
- De-orbiting.
- Safe re-entry of the 1st stage.

The gasification is performed by a system that introduces in tanks the warm gases, with temperature in a range of 800K - 1400K. The evaporation of the residual propellant is obtained by the heat exchange between the hot gases injected in the tanks and the liquid propellant. A pressure relief valve is installed in the tank to let the gas go out when the pressure reach the maximum level. It will be shown a method to find out the energy needed in the gasification and the time spent for completing the process.