SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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THE INFINITE STAGING ROCKET – A PROGRESS TO REALIZATION

Abstract

A concept of an infinite staging rocket, a very small autophage launch vehicle of pico satellites consuming its own structure as fuel, has been discussed at IAC 2013 in Beijing. As it was emphasised the core problem of the concept realization was the development of a gasification chamber to turn the rocket solid structure into gas to feed it into the rocket combustion chamber. The first step of the project was testing a direct-feed gasification chamber consumed a propellant rod of polyethylene pipe filled with solid oxidizer inside (potassium nitrate, potassium perchlorate or ammonium perchlorate). The testing proved the workability of a coaxial fuel-oxidizer propellant charge gasification chamber as well as brought to light insufficient heating of the chamber in a self-sustaining burning mode when auxiliary propellant was cut-off.

At the next step of the project which is carried-out at Dnipropetrovs'k National University supporting with the Ukrainian Government grant the direct-fed gasification chamber is improved with groves and a coat to get a reverse-feed mode. The improved structure has been successfully tested using a polypropylene-ammonium nitrate coaxial propellant charge. The firing shows the new gasification chamber ensures the proper heating itself at a self-sustaining burning mode while a pneumatic pusher still forces the feed of the charge into the chamber.

The project is now continued by means of the installation a propellant valve on the reverse-feed gasification chamber and a dual-throat nozzle on the combustion chamber to achieve a pulse mode. Being successful, the pulse mode is a way to increase the combustion pressure over the feed pressure and change the pneumatic pusher for self-feeding structure in our laboratory-scale experimental propulsion.

The pulse mode can also overcome a 6-metres limit for the length of an infinite rocket and allow making autophage launch vehicles smaller, up to 1-1.5 m in length, to supplement a pico satellite with a really pico launcher. It would open prospects of mass production of them and putting personal satellites into orbits.