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SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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RTMSS - A NOVEL SYSTEM FOR SPACE LAUNCH COST-REDUCTION

Abstract

Launching payloads into low earth orbit requires a very large amount of energy; therefore it is vital to keep the mass of the launch vehicle to a minimum at all times during the ascent. The conventional practice is to build a launcher from several stages, positioned either stacked one on top of the other, or in parallel, and then to discard them individually as their propellant is depleted. This method results in very expensive launchers. It is evident that the best performance may be achieved by replacing staging by a continuous process of discarding empty portions of the propellant tanks as the propellant is depleted. This problem haunted the imagination of launcher designers since the early 1950's. This method of achieving continuous discarding of mass involves two fundamental tasks:

1. Moving the bottom of the tank, which is carrying the rocket motors (hereafter called "piston"), inside the tank towards the upper end of the tank, as the propellant is consumed.

1. Discarding the unneeded wall of the tank which extends below the moving piston.

The method which will be described here, named RTMSS (Redundant Tank Mass Shedding System) is different from previously proposed ideas in this field, and a patent has been applied for it. A novel method of propelling the piston at a controlled rate will be shown, as well as several methods of shedding the redundant skin below the moving piston. Preliminary calculations will be presented to show its validity, and we are confident that it can be successfully employed. The RTMSS improves launch performance to the extent that the first and second stages may be combined into one, thus saving the cost of a second stage structure, rocket motor, avionics, inter-stage structure and separation system, as well as reducing the tank's helium pressurization system to almost none. A major advantage over previous proposals is the utilization of existing propulsion systems instead of developing new special ones. The total cost of launch to LEO will be reduced. It may also be easier to retrieve the greatly reduced mass of the shortened stage, if so desired, and reuse the rocket motors, which are the most expensive part of a stage.