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IAF SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (9)

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DESIGN OF HOVERING SOUNDING ROCKET USING GEL PROPULSION TECHNOLOGY

Abstract

Sounding rockets have been the go-to platform for performing accurate experiments at high altitudes primarily due to their reliability, relative ease of manufacture and cost. The low air density and ambient pressure conditions at high altitudes make it increasingly difficult for other flying vehicles like drones and high-altitude UAVs to be utilized, making sounding rockets an indispensable addition to high altitude experimentation. However, conventional sounding rockets have an ephemeral apogee duration, giving very minimal time for experiments to be performed. In order to circumvent this shortcoming, this paper expedites a novel method of providing prolonged experimentation times by means of a sounding rocket that will hover at apogee for a given period of time.

This would require an appropriate propulsion system that can provide the required thrust for hover, and an attitude control system that would hold the rocket in the required orientation. The adaption of a Gelled rocket motor (GRM) enables us to control the thrust of the rocket which is necessary while hovering. A powered/pressurized piston is used to move the gel propellant towards the Combustion Chamber through valves. These valves can be augmented to control the flow rate of Gelled Propellent, in turn controlling the combustion and thrust. GRM technology allows the manufacturing of lightweight rocket motors with enhanced safety of operation. Attitude control while hovering is achieved by incorporating Cold Gas Thrusters as the system is simple, feasible, and gives the advantage of using it at full storage tank pressure.

This paper investigates the development of a sounding rocket capable of hovering at apogee by focusing on Gel Propulsion Technology. It also provides an insight into the development of a cold gas attitude correction system which works in conjunction with GRM to achieve hovering.