

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

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DEVELOPMENT AND TESTING OF PROPULSION SYSTEMS FOR REUSABLE SOUNDING
ROCKET

Abstract

From 2008, Japan Aerospace Exploration Agency (JAXA) conducted concept study and development of the Reusable Sounding Rocket. The concept of Reusable Sounding Rocket was made to reduce operation costs of the existing expendable sounding rockets and acquire key technologies on reusing a launch vehicle. To archive reusability, this vehicle must have ability for repetitive operation and to return whenever one engine (including propulsion module) fail to operate properly. The vehicle is configured with a single liquid oxygen/hydrogen stage, propelled by four newly developed expander bleed cycle engine. This vehicle takes off and lands vertically. Typical flight profile of the Reusable Sounding Rocket is the following; it blast off from the launch pad, cuts its four engines at predetermined altitude and takes a ballistic flight for science observation. It reaches to the altitude of 100km or more and then glides back down to near landing point. Before landing, it makes a turn over maneuver and it ignite four engines again. As previously described, the propulsion system of this vehicle needs various capabilities which traditional expendable launch vehicle doesn't have. Typical example are following; re-ignition after a drastic attitude change, maintaining tank pressure despite violent sloshing, propellant management and chilling down engine during ballistic flight, onboard health monitoring system. To achieve such capabilities, Mitsubishi Heavy Industries is conducting a system study and development on such critical technologies, under JAXA. This paper describes the recent results and future plan of development for the Reusable Sounding Rocket propulsion system, which includes some result on experiments for propellant tank pressurization system and propellant management device.