SPACE PROPULSION SYMPOSIUM (C4)
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# PROPULSION SYSTEM OF THE LUNAR LANDER BUILT FOR GOOGLE LUNAR X PRIZE

**Abstract**

Team Indus, the sole Indian participant for the Google Lunar X Prize (GLXP), is building a lunar lander which will land on the Moon to deliver a lunar rover. As per the rules of GLXP, the rover has to move 500m on the lunar surface and send back high quality video and imagery. GLXP guidelines, stipulates that the mission has to be accomplished with 90% private funding and without any government sponsorship and should be launched before December 2016.

The Team Indus's Lunar lander will be launched by Indian Space Research Organization (ISRO) using the Polar Satellite Launch Vehicle (PSLV) and will be inserted in an earth parking orbit (of 800kmx71000km) from where the lander's propulsion system will be responsible to propel it towards the Moon and execute the necessary decent maneuvers to land on the moon's surface.

The propulsion system has to meet the stringent requirements of mass, compactness, throttled thrust performance, efficiency, robustness and reliability. It should also be realizable within the tight time schedules of the competitive project. To meet these requirements, a propulsion system configuration design was evolved and implemented using off-the-shelf components with considerable heritage. The propulsion system is envisaged to be a Hydrazine and MON-3 bipropellant regulated pressure fed system. The propulsion system performs orbit raising maneuvers around earth, lunar orbit capture and orbit lowering maneuvers around the Moon and finally enables the descent of the lander on lunar surface.

The current development status of the propulsion system has reached finalization of the system architecture, completed various trade studies to optimally choose the thruster, propellant and pressurant tanks, flow control components and to consolidate and refine the system architecture. This paper will present the propulsion system's frozen configuration, and will report some early breadboard testing such as detailed hydraulic characterization of the propellant feed system's Liquid Modules and the Gas Module. The results of these tests will validate the numerical models that will be used in the system performance prediction software to be used for the mission during various orbital maneuvers and final lunar descent.