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# SYSTEM DESIGN OF MISSION SHAKTHISAT INVOLVING A SEMI-HARD MOON IMPACTOR

**Abstract**

Mission ShakthiSAT is an unmanned lunar orbiter and lander mission scheduled for launch in September 2026 aboard the Indian Space Research Organization's (ISRO) PSLV rocket. Led by Space Kidz India (SKI) in collaboration with Meridian Space Command (UK), the mission aims to demonstrate the feasibility of CubeSat-based lunar exploration, providing a cost-effective entry point for emerging space nations and organizations looking to develop lunar capabilities. The Economical Transfer Vehicle (ETV), developed by Meridian Space Command, is central to this effort, designed as the first step on the ladder to cislunar exploration for underprivileged customers, offering an accessible and scalable platform before transitioning to advanced scientific programs.

Following launch, the ETV will remain in LEO until the appropriate timing to conduct a trans-lunar injection (TLI) burn, optimizing transfer efficiency. The trajectory includes two orbit correction maneuvers (OCM-1 at T+1.5 days and OCM-2 at T+4.5 days) before executing lunar orbit insertion (LOI) at T+5 days and a lunar correction maneuver (LCM-1) at T+5.5 days, establishing a highly elliptical polar lunar orbit with a perilune of 15km over the Lunar South Pole. Over a two-month period, the onboard payloads will conduct laser-based mapping, imaging, and sensing of the Moon's south pole, investigating potential water ice deposits across a heavily cratered surface.

At the mission's final phase, the ETV will initiate a controlled deorbit burn, targeting Atlas Crater. Shortly before impact, the micro lunar lander (¡6U) will separate and conduct a semi-hard landing, where survival upon impact is the primary objective. The ETV will intentionally impact within Atlas Crater, demonstrating a commitment to cislunar sustainability by removing debris from orbit and containing the impact within a crater with existing debris, thereby contributing to future lunar surface resource recycling

efforts.

This paper presents the system architecture, propulsion strategy, and operational design of ShakthiSAT, detailing the technical rationale behind the ETV's modular and economical design and scientific payloads. The partnership between Space Kidz India and Meridian Space Command exemplifies the fusion of educational outreach and industry innovation, building a sustainable and inclusive pathway for developing nations to participate in deep-space exploration.