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Hitchhiking to the Moon (8)

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## JULES VERNE: AN ACADEMY DEVELOPED NANOSPACECRAFT LUNAR ORBITER

**Abstract**

The paper presents a nanosat sized spacecraft capable of journeying to Lunar orbit once launched into GTO. The mission is being studied as a successor to the successful SwissCube project realized by a Western Switzerland academic network. A mission normally requiring large resources and infrastructures but not otherwise critical in terms of pure technical feasibility (it was indeed done many times) is targeted toward a miniaturized, streamlined solution. The mission is directly inspired by the current ESMO (European Student Moon Orbiter) initiative by ESA, planned for launch in the 2013/2014 timeframe. While our proposal shares the same general objective, it nonetheless differs notably from ESMO in the overall technical and programmatic approach: suffice to consider that ESMO is designed with a mass of 265 kg, while the proposed project is only 10 to 15 kg. Its key elements, which are also the main challenges of the project, are:

- Propulsion stage capable of interplanetary travel, based on a small apogee motor.
- 3-axis stabilization, spin stabilization during the propulsion phases
- Long range (up to 1 million km !) communication system.

The mission will start by hitching a ride to GTO. As the GTO orbit will not generally be suitable to a direct transfer, and it is expected that the first leg of the interplanetary journey is a very elongated orbit to an apogee about twice as distant as the Moon. To achieve it a perigee tangential burn is set, leading to an orbit with apogee at the order of 800'000 km where a relatively low energy burn will be able in any case to incline the orbit sufficiently, also increasing the ellipse minor axis so that the spacecraft obtains a Moon encounter. Several scientific or technology demonstration payloads are being considered. The proposed development pattern of this project follows what economists nowadays call frugal or constraint-based innovation. Of course frugal does not mean second rate, on the contrary it incorporates the latest technologies, particularly regarding miniaturization, here taking full advantage of the rich industrial and R&D background in microtechnology of the Western Switzerland region.