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A LUNAR MICROSATELLITE MISSION PROPELLED BY AN ELECTRIC PROPULSION SYSTEM

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ABSTRACT

It is described the electric configuration of the *Hevelius – Lunar Microsatellite Mission*, studied by a team of students during the course *Space System Design* at *Politecnico di Milano* (Italy) in 2004.
The mission aim is to perform scientific experiments thanks to a net-lander placed on the *Moon Far Side*. To carry on these experiments two microsatellites have been designed: an Orbiter and a Carrier.
Two innovative concepts have driven the mission analysis: low thrust trajectories and multi-body dynamics. The result is a very low propellant consumption, 11 kg against 51 kg needed by the chemical configuration, but a longer flight time, 410 d against 32 d.
Instead of using a conventional spherical tank, a toroidal one it was designed to storage the propellant (Xenon) and its estimated volume was calculated using the *Redlich-Kwong Equation of State*.
The choice of an electric propulsion system (here *QinetiQ T5*, an ion gridded thruster), though, generates a series of constraints on the other subsystems, in particular there is a negative aspect: the Orbiter requires a higher electrical power, 550 W more then for a chemical configuration.
Finally, new generation attitude control thrusters are suggested, Hollow Cathode Thrusters, which also use Xenon (another positive aspect).

INTRODUCTION

In this paper is shown a *pre-phase A* study of the mission *Hevelius - Lunar Microsatellite Mission* which has been developed at the *Politecnico di Milano*, in particular its shown the Orbiter of the mission.
The overall goal of the mission is to place a net-lander on the *Moon Far Side* to perform scientific experiments with the intent to fill the gap of knowledge related to the Moon and to test new key enabling technologies. The propulsion system chosen is an electric engine, following new technological trends. The mission analysis and design process has been driven by a low cost and low mass objective according to the new tendencies to invest in low cost and low risk missions. A great effort has been required in order to integrate the payloads in the confines of small buses and in order to reduce the mission ΔVs at their minimum.