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The ESMO Mission: Education, Outreach and Science

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The European Student Moon Orbiter (ESMO) is planned to be the first European student mission to the Moon. ESMO represents a unique and inspirational opportunity for university students, providing them with valuable and challenging hands-on space project experience in order to fully prepare a well qualified workforce for future ESA missions, particularly those planned by the Exploration and Science programmes in the next decades. In addition, ESMO has a powerful education outreach aspect and strong attraction for younger students studying in high schools across Europe, by lowering the entry-level for lunar exploration to attainable university project activities. ESMO also represents an opportunity for students to contribute to the scientific knowledge and future exploration of the Moon by returning new data and testing new technologies.

The primary objectives of the ESMO mission are (1) to launch the first lunar spacecraft to be designed, built and operated by students across ESA Member & Cooperating States; (2) to place the spacecraft in a lunar orbit; (3) to acquire images of the Moon from a stable lunar orbit and transmit them back to Earth for education outreach purposes; (4) to transfer to a science orbit, and deploy a small sub-satellite for conducting global, precision lunar gravity field mapping.

A miniaturised payload would perform measurements in order to achieve these objectives over a period of 6 months in lunar orbit. The core payload is a Narrow Angle Camera for optical imaging of specific locations on the lunar surface upon request from schools, and a nanosat subsatellite for global gravity field mapping to 10-20 mGal precision via accurate ranging of the subsatellite from the main spacecraft. Such a nanosat, called Lunette, would be deployed in a low altitude near-circular polar orbit

at 100 km altitude. Additional scientific payload under consideration includes a Biological Experiment (BioLE_x) characterizing lunar environment effects on living cells, and a passive microwave radiometer measuring the temperature of the lunar regolith at a few metres below the surface.

The 230 kg ESMO mini-spacecraft is designed to be launched into Geostationary Transfer Orbit (GTO) as a secondary payload in the 2011/2012 timeframe. The exact launch opportunity has yet to be established, although design work to date has assumed the use of the ASAP adaptor on the Ariane 5 or Soyuz launchers from Kourou. However, the design is adaptable to other launch vehicles. An on-board liquid bipropellant propulsion system will be used to transfer the spacecraft from its initial GTO to the operational lunar orbit via the Sun-Earth L1 Lagrange point over a period of 3 months.

ESMO is the third mission within ESA's Education Satellite Programme and builds upon the experience gained with SSETI Express (launched into LEO in 2005) and ESEO (the European Student Earth Orbiter planned for launch into GTO in late 2010). Some 300 students from 29 Universities in 12 countries are participating in the project, which has successfully completed a Phase A Feasibility Study and is proceeding into preliminary design activities in Phase B.

The paper will present the programmatic and technical details of the ESMO project, provide a description of the payload and its measurements, and discuss the final results and conclusions of the Phase A Feasibility Study.