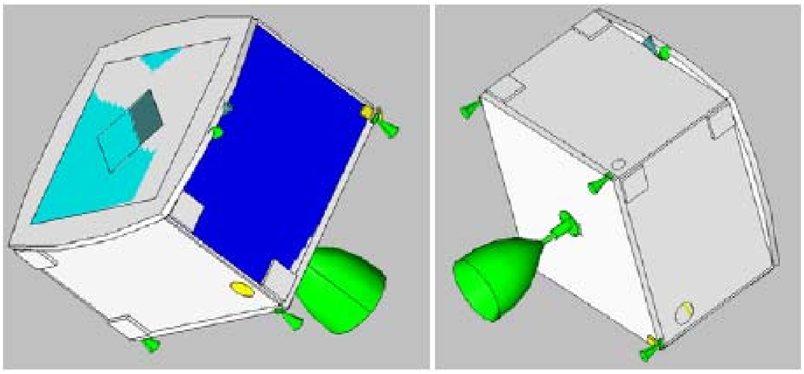
ESMO - The European Student Moon Orbiter

Education Projects Activities Unit, ESA Education Office, ESTEC



MISSION STATEMENT

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.

MISSION OBJECTIVES

- To launch the first lunar spacecraft to be designed, built and operated by students across ESA Member States and ESA Cooperating States.

- To place the spacecraft in a lunar orbit.
  An on-board chemical propulsion system will be used to transfer the spacecraft from its initial Earth orbit to a polar orbit around the Moon via the Sun-Earth L1 Lagrange point over a period of 3 months; this is done to reduce propellant consumption.

- To acquire images of the Moon from a stable lunar orbit and transmit them back to Earth for education outreach purposes.
  A 2.5 kg narrow angle camera will be used for providing medium-resolution images of the lunar surface at specific locations upon request from schools.

- To transfer to a science orbit, and deploy a small sub-satellite for conducting global, precision lunar gravity field mapping.
  A 9kg nano-satellite called "Lunette" will be deployed from ESMO into a 100 km altitude orbit for global gravity-mapping in support of sub-surface science and precision landing navigation of future missions. Other backup payloads being studied are a biological experiment (radiation effects on living cells) and a passive microwave radiometer (temperature of the regolith a few metres below the surface).

BRIEF DESCRIPTION OF ESMO

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 ESMO 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.

The ESA Education Office is managing the ESMO project and providing considerable system-level and specialist technical support to the university student teams during the execution of the project. The students obtain training and benefit from access to ESA in-house expertise, in addition to its facilities at ESTEC for spacecraft assembly, integration and testing.

The student teams are expected to provide most of the spacecraft subsystems, payload and ground support systems in coordination with their universities and European space industry in order to deliver their elements of the mission as part of their academic studies. Flight spare hardware is also donated by ESA where justified to lower project cost and risk.

TECHNICAL FACTS

Dimensions	854x854x622 mm
Mass	230 kg
Expected Lifetime	10 months
Attitude and Orbit Control System	3-axis stabilised: 2 star trackers, 4 sun sensors, 2 IMUs, 4 reaction wheels, 8 cold gas thrusters
On-board Data Handling	2 ESA LEON2 processors (1 OBC, 1 AOCS hot redundant), 16 MByte SDRAM for payload data storage, On-board command timeline and simple FDIR
Communications	Low Gain Antennas for omni-directional coverage; 8 kbps downlink / 4 kbps uplink between Moon and Earth stations with S-band transponder; Proximity-1 link for comms with other lunar vehicles
Electrical Power System	Body mounted 3J GaAs solar cells for 110W EOL power; 23-37 V unregulated bus; 400 Wh capacity Li-ion batteries
Propulsion	MON/MMH bipropellant R4D thruster; 490 N thrust; 315s impulse
Structure	CFRP/Al honeycomb construction box with load bearing central thrust tube
Thermal Control	MLI, surface coatings + active heaters
Ground segment	Ground stations: Malindi 10m S-band, Weilheim 15 or 30 m S-band dishes; + Perth and Kourou for LEOP.