



MISSION STATEMENT

The European Student Moon Orbiter (ESMO) shall be a mini-satellite, designed, built and tested by a network of European students as part of ESA's educational SSETI Program, which will orbit the Moon taking pictures for outreach purposes, conducting scientific experiments and preparing for possible future lunar landing missions.

MISSION OBJECTIVES

- To demonstrate the successful implementation of ESA's pan-European educational initiative, SSETI, and therefore encourage, motivate and challenge students to improve their education and literacy in the field of space research and exploration.
- To transfer the spacecraft from a geostationary transfer orbit (GTO) to a lunar orbit
- To take pictures in lunar orbit
- To search for potential landing sites for future lunar landing missions
- To perform scientific experiments and remote sensing during the spacecraft's lifetime.

BRIEF DESCRIPTION OF SSETI ESMO

SSETI ESMO is the **third ESA student satellite**, after SSETI Express and SSETI ESEO. ESMO will be the first SSETI exploration mission beyond Earth's orbit.

As with the previous satellites, all phases of the ESMO spacecraft will be carried out by student teams across Europe: from conception, design and development, to construction, launch and operation. Regular workshops and reviews ensure that the students receive valuable feedback and guidance from ESA and industry experts.

An initial analysis of **potential payloads** for ESMO is being carried out by the Payload team in Barcelona, Spain, with the aid of the Space Synthetic Aperture Radar (SSAR) team in Warsaw, Poland and the Light Detection and Ranging (LIDAR) team in Quebec, Canada. They are considering the following possibilities:

- Optical imaging of specific targets; such as the Apollo landing sites, the Sea of Tranquility and possible landing sites for future lunar landing missions
- Optical mapping of the lunar surface with a Charge-Coupled Device (CCD) camera
- 3D mapping of the lunar surface with radar, stereo CCDs, a version of the Mars Orbiter Laser Altimeter (MOLA), or a LIDAR instrument
- Using a thermal imaging camera for surface mineral mapping (with a micro-bolometer)
- Measuring magnetic properties, especially close to the Earth's magneto-tail, with a magnetometer
- Measuring variations of acceleration for gravitational mapping, using the accelerometers in the attitude and orbit control system
- Deploying an object to the lunar surface

The feasibility study of the **Mission Analysis** (MIAS) is being conducted by a team in Zaragoza, Spain. Their study includes areas such as low-thrust and weak-stability assisted transfers.

The study for the **Attitude Determination and Control System** (ADCS) and orbit control system is being conducted by students from Narvik and Trondheim, Norway. They are looking at mathematical modelling, control algorithms, momentum dumping, a Pulse-Width-Pulse-Frequency Modulation (PWPFM) scheme of reaction control thrusters, a four-wheel actuator configuration arranged in a tetrahedron, six reaction control thrusters and implementations on microcontrollers.

Two teams are busy in Porto, Portugal: the **On Board Data Handling** (OBDH) team are investigating architectures, redundancy, operating systems and programming standards, while the **Structure and Configuration** (SAC) team are studying materials, structure dimensions and structure stability.

The study for the spacecraft's **Communications** (COMM) system involves students in Munich, Germany; Wroclaw, Poland; and Barcelona, Spain. Their study includes areas such as: internal communication, external communication, ground stations, link budgets, power usage, frequencies, coverage and bit-rate.

Other studies in progress include those for the **Propulsion System** (PROP), **Electrical Power System** (EPS) and **Mechanisms** (MECH), which are underway in Stuttgart, Germany; Quebec, Canada; and Vienna, Austria, respectively.

The estimated size of the spacecraft is approximately 600 x 600 x 1500 mm and the expected total mass is 240 kg.

