SMART-1 Mission Goals and Science

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SMART-1 is the first in the programme of ESA's Small Missions for Advanced Research and Technology'. Its primary objective is to flight test Solar Electric Primary Propulsion as the key technology for future Cornerstones (such as Bepi-Colombo). Another objective is to test new technologies for spacecraft and instruments.

The SMART-1 mission is to orbit the Moon for a nominal period of six months, with possible extension. It is the first time that Europe sends a spacecraft to the Moon. The project aims to have the spacecraft ready in October 2002 for launch as an Ariane-5 auxiliary payload. In addition to the use of solar electric primary propulsion to reach Earth's natural satellite, the spacecraft will carry out a complete programme of scientific observations in lunar orbit.

SMART-1's science payload, with a total mass of some 15 kg, features many innovative instruments and advanced technologies. A miniaturised high-resolution camera (AMIE) for lunar surface imaging, a near-infrared point-spectrometer (SIR) for lunar mineralogy investigation, and a very compact X-ray spectrometer (D-CIXS) with a new type of detector and micro-collimator which will provide fluorescence spectroscopy and imagery of the Moon's surface elemental composition. During the cruise phase to reach the Moon, several of these instruments will be making observations of other celestial targets as opportunities arise, such as - for D-CIXS - X-ray sources or comets.

The payload also includes an experiment (KaTE) aimed at demonstrating deep-space telemetry and telecommand communications in the X and Ka-bands. A radio-science experiment (RSIS) relying on KaTE will monitor the electric propulsion by means of tracking techniques. In lunar orbit it will, with AMIE, also study the Moon's libration. This experiment is also a test of what will be a crucial investigation of Bepi-Colombo, aimed at the investigation of the planet's internal structure.

In addition to supporting RSIS, the AMIE micro-imager will help validate a deep space optical link (Laser-Link Experiment), using the ESA Optical Ground station in Tenerife, and validate a system of autonomous navigation (OBAN) based on image processing.

In synergy with its technology objectives, SMART-1 provides an opportunity for lunar science investigations. This includes studies of the chemical composition and evolution of the Moon, of geophysical processes (volcanism, tectonics, cratering, erosion, deposition of ices and volatiles) for comparative planetology, and high resolution studies in preparation for future steps of lunar exploration. The mission could address several topics such as the accretional processes that led to the formation of planets, and the origin of the Earth-Moon system.