SMART-1 / AMIE CAMERA SYSTEM. J.-L. Josset[1], S. Beauvivre[2], P. Cerroni[3], M. C. De Sanctis[3], P. Pinet[4], S. Chevrel[4], Y. Langevin[5], M. A.Barucci[6], P. Plancke[7], D. Koschny[7], M. Almeida[7], Z. Sodnik[7], S. Mancuso[7], B.A. Hofmann[8], K. Muinonen[9], V. Shevchenko[10], Yu. Shkuratov[11], P. Ehrenfreund[12] and B.H. Foing[7], [1]Space Exploration Institute (Case postale, CH-2002 Neuchâtel, Switzerland, jean-luc.josset@space-x.ch), [2]Micro-cameras & Space Exploration (Jaquet-Droz 1, CH-2000 Neuchâtel, Switzerland), [3]IASF (Area Ricerca Cnr, Via Fosso del Cavaliere, 00133 Roma, Italy), [4]UMR 5562 CNRS/GRGS Observatoire Midi-Pyrénées (14, avenue Edouard Belin 31400 Toulouse, France), [5]IAS (Bat. 121, 91405 Orsay, France), [6]Observatoire Paris Meudon (Meudon , France), [7]ESA/ESTEC (Keplerlaan 1, 2201 Noordwijk, The Netherlands), [8]Natural History Museum (Bern, Switzerland), [9]Helsinki Observatory (Kopernikuk sentie 1 P.O.Box 14, Finland), [10]Sternberg Astronomical Institute (Moscow, 119899, Russia), [11]Astronomical Institute of Kharkov National University (35 Sumskaya St. Kharkov. 61022. Ukraine), [12] Leiden Observatory & Austrian Academy of Sciences (P.O. Box 9513, 2300 RA Leiden, The Netherlands).

Introduction: The Advanced Moon micro-Imager Experiment (AMIE), on board ESA SMART-1, the first European mission to the Moon (launched on 27th September 2003), is an imaging system with scientific, technical and public outreach oriented objectives. The science objectives are to image the Lunar South Pole, permanent shadow areas (ice deposit), eternal light (crater rims), ancient Lunar Non-mare volcanism, local spectro-photometry and physical state of the lunar surface, and to map high latitudes regions (south) mainly at far side (South Pole Aitken basin). The technical objectives are to perform a laserlink experiment (detection of laser beam emitted by ESA/Tenerife ground station), flight demonstration of new technologies and on-board autonomy navigation. The public outreach and educational objectives are to promote planetary exploration.

AMIE instrument: The AMIE imaging system is constituted of two units, a camera unit and a dedicated electronics unit (Fig. 1). The camera includes a tele-objective with a 5.3° x 5.3° field of view and an imaging sensor of 1024x1024 pixels.

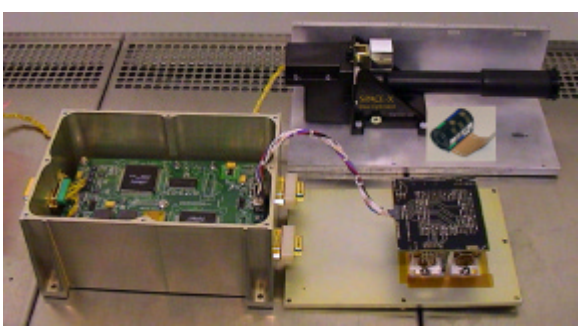

Fig. 1: AMIE Camera system

The AMIE camera acquires images in three spectral filters, at wavelengths of 750, 915 and 960 nm; the filters are directly in front of the CCD covering an area of 11/16 of the total CCD area, with one 1/16 used by the laser filter at 847 nm, while the remaining 512 x 512 pixels (i.e., 1/4 of the CCD area) are not covered by filters and thus devoted to total light imaging. The filters disposition allows a mapping of the lunar surface during the 2 orbit configurations around the Moon, i.e. it allows the same region on the lunar surface to be imaged in the three spectral filters during the two different orbital attitudes.

The dedicated electronic unit insures the following functions: i) data control and power management of the camera; ii) image data storage into a mass memory buffer; iii) data control and power management of a cube Micro-DPU (image processing, e.g. compression); iv) communication with the S/C through the S/C CAN Bus Interface; v) adaptation of the S/C supply voltage (S/C Power Bus Interface) to the levels required by its electronics and the camera.

AMIE performances: The instrument performances are :

- 5.3° x 5.3° FOV --> Images 45 km x 45 km at 500 km
- CCD 1024 x 1024 --> resolution 45 m / pixel at 500 km with 10 bits/pixel
- Powerful Image Compression Unit -> high data compression rate
- Power Supply I/F Board (PSIF)
- System Control Unit (SCU): µP Board, buffer memory...
- Specific radiation shielding
- Total Mass 2 Kg

The nominal operational lunar orbit of the spacecraft SMART-1 is polar, with the perilune lowest altitude at approximately 300 km and apolune at 3000 km. At a distance of 300 km, the field of view of AMIE (5.3° x 5.3°) corresponds to 27 km: the spatial resolution for the 1024 x 1024 CCD is therefore 27 m at perilune.