SMART-1 RESULTS AND LESSONS LEARNED FOR PREPARING FUTURE EXPLORATION

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Abstract: We shall report at LEAG/ ICEUM10 Lunar Conference 2008 on SMART-1 lunar highlights relevant for future lunar exploration. The SMART-1 spacecraft reached on 15 March 2005 a lunar orbit 400-3000 km for a nominal science period of six months, with 1 year extension until impact on 3 September 2006.

Overview of SMART-1 mission and payload: SMART-1 is the first in the programme of ESA's Small Missions for Advanced Research and Technology [1,2,3]. Its first objective has been achieved to demonstrate Solar Electric Primary Propulsion (SEP). SMART-1 science payload, with a total mass of some 19 kg, featured many innovative instruments and advanced technologies [1], with 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) [4-6] for fluorescence spectroscopy and imagery of the Moon's surface elemental composition. The payload also included plasma studies (SPEDE and EPDP), deep-space telemetry (KaTE), a radio-science (RSIS), a Laser-Link and autonomous navigation (OBAN) investigations.

SMART-1 lunar science and exploration results:
AMIE (Advanced-Moon micro-Imager Experiment). AMIE is a miniature high resolution (35 m pixel at 350 km perilune height) camera, equipped with a fixed panchromatic and 3-colour filter, for Moon topography and imaging support [7,10,11]. Lunar North polar maps (Fig. 1) and South pole repeated high resolution images have been obtained, giving a monitoring of illumination to map potential sites relevant for future exploration .
D-CIXS (Demonstration of a Compact Imaging X-ray Spectrometer). DCIXS is based on novel detector and filter/collimator technologies, and has performing the first lunar X-ray fluorescence global mapping in the 0.5–10 keV range [4,5,9]. D-CIXS has been improved for the C1XS instrument on ISRO Chandrayaan-1.
SIR (Smart-1 Infra-Red Spectrometer). SIR has been operating at 0.9-2.6 μm carrying out mineralogical survey of the lunar crust. SIR has been improved for the Chandrayaan-1 SIR2 instrument.

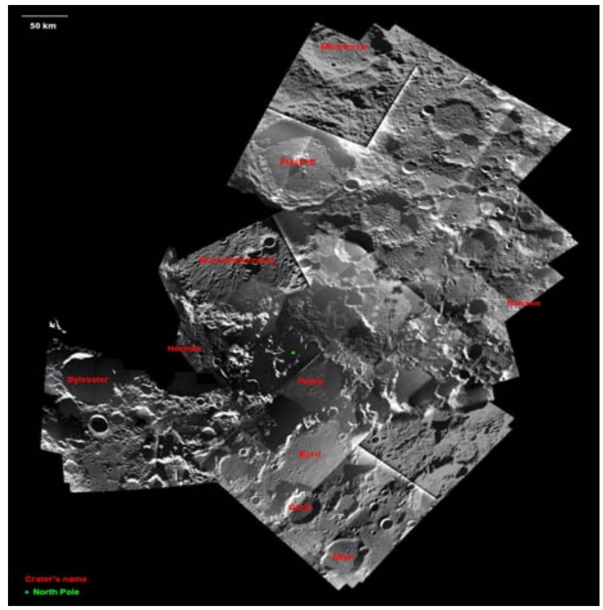

Fig. 1: SMART-1 /AMIE mosaic of the lunar North pole, covering an area of about 800 by 600 km, composed of about 30 images . These travel maps are used to prepare future polar lunar exploration.

The SMART-1 team collaborated with upcoming missions (Kaguya, Chandrayaan-1, Chang'E 1, LRO, LCROSS) and subsequent lunar landers (Moon-NEXT, International Lunar Network). SMART-1 is contributing to prepare the next steps: survey of resources, monitoring polar illumination, mapping of sites for potential landings, international robotic villages and for future human activities and lunar bases.

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