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SMART-1 was travelling to the Moon, 10 years ago

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Abstract

Ten years ago, the ESA SMART-1 spacecraft was still on its way to the Moon with lunar orbital capture achieved on 13 November 2004. We review the legacy of SMART-1 for lunar science and exploration, applications and for preparing future orbital and lander missions.

1. Introduction

SMART-1 demonstrated the use of Solar Electric Propulsion for deep space, tested new technologies for spacecraft and instruments miniaturisation, and provided an opportunity for science [1-12] until impact on 3 September 2006. To date, 75 refereed papers and more than 325 conference or technical papers have been published based on SMART-1 (see ADS on SMART-1 scitech website). The SMART-1 data are accessible on the ESA Planetary Science Archive PSA [13]

2. Recent SMART-1 archive results

Some results were combined from combined data analysis using SMART-1 archive with other recent lunar missions. We discuss in particular impact craters, volcanic, photometry and studies of specific sites Recent results using these SMART-1 archives combined with other data include: multi-angular photometry of Mare and specific regions to diagnose the regolith roughness and to constrain models of light reflection and scattering [14, 26] and compared to laboratory granular photometric studies [15, 25]; the lunar North and South polar illumination was mapped and monitored over the entire year, permitting to identify “SMART-1 peaks of quasi-eternal light” and to study their topography [16, 17]; SMART-1 was also used for radio occultation experiments [18], and positioning reduction of SMART-1, Change’E1 and 2 VLBI tracking data were performed [19]; the X-Ray Solar Monitor studied the Sun as a flare star in conjunction with GOES and RHESSI [20,21]; SMART-1 SIR data were combined with HySI data from Chandrayaan-1 to study the composition of the central peak of craters [22]; the SMART-1 impact observed from Earth was modelled using laboratory experiments predicting the size of asymmetric crater and ejecta [23] in comparison with Kaguya and LCROSS impacts. The South Pole Aitken Basin was mapped and studied combining data from Clementine, SMART-1, and other missions [24]. The SMART-1 archive observations have been used to support Kaguya, Chandrayaan-1, Chang'E 1, the US LRO and to characterise potential sites relevant for lunar science and exploration.

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SMART-1 Scitech websites: sci.esa.int/smart-1

SMART-1 public websites: www.esa.int/smart-1