CONTEXT FOR THE MASCOT LANDER ON HAYABUSA-2 – THE MASCOT-CAM.

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Introduction: A small lander, MASCOT (Mobile Asteroid Surface Scout) [1, 2], is being developed at DLR (German Aerospace Center), with contributions from CNES (France), for JAXA's HAYABUSA-2 mission to asteroid 1999JU3.

Main objective is to map the C-class asteroid's geomorphology, the minute structure, texture and composition of rocks, and the thermal and mechanical properties in order to provide context information for the returned samples, ground truth for the orbiter remote measurements and to support the selection of sampling sites. In order to determine the structural, textural and compositional characteristics of the surface layer, on scale lengths ranging from tens of meters to a fraction of a millimeter, MASCOT will carry a wide-angle multispectral imager (MASCOT-Cam), provided by DLR's Institute of Planetary Research.

The instrument: The MASCOT-Cam is a highly-miniaturized CMOS camera, based on the Rosetta ROLIS camera (optomechanics) [3] and the ExoMars PanCam's High Resolution Channel (focal plane and electronics) [4].

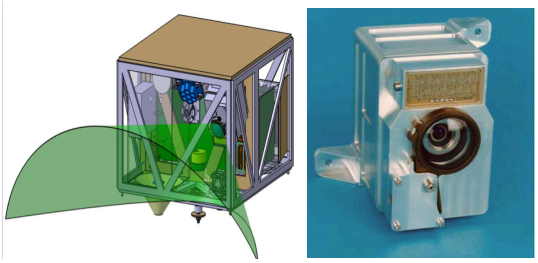

Figure 1: Left: Engineering drawing of the MASCOT-Cam inside the MASCOT lander. The green cone depicts the camera's field of view on the surface. Right: MASCOT-CAM applies heritage from the Rosetta-ROLIS camera [3] and the ExoMars PanCam/HRC [4].

During descent, the MASCOT-Cam will operate as a descent imager. After touchdown, the camera will acquire wide angle images of the asteroid's surface, providing context for all further measurements by the MASCOT in-situ instrument suite. Multispectral imaging is achieved through an illumination device consisting of four arrays of monochromatic light emitting diodes working in 4 spectral bands. The resulting images in 4 spectral channels will enable to complement the 2D visual information with spectral data. The spectral range and the spectral resolution will allow to classify and map the compositional heterogeneity of the asteroid's surface. Image series at different sun angles over the course of a day will also contribute to the physical characterization of the asteroid surface properties (photometric analysis). The images will also ideally guide the selection of sampling spot(s) of the Hayabusa-2 S/C (along with other results from the MASCOT in-situ measurements).

Single wide-angle images will also be acquired during the post-landing relocation phases of the lander (hopping phases).

Instrument Characteristics:

MASCOT-Cam will be located inside the MASCOT lander oriented in a surface-looking direction (figure 1), so as to cover a large part of the surface from the area directly in front of the lander up to the local horizon. The focal plane consists of a 1024 x 1024 pixel CMOS sensor (15 µm pixel pitch) with a 12 bit ADC. The camera is equipped with bi-modal optics, yielding a field of view of 50 degrees during descent and a wider angle field of view of 75 degrees (with an aperture of f/5) after landing. The camera has four color channels: centered at about 470, 530, 640 and 870 nm, respectively, provided by four independent arrays of light emitting diodes (LEDs). The current camera design yields a mass of about 0.7 kg, with a peak power consumption during multispectral imaging of < 10W.

References:

[1] Lange, C. et al. (2010) Proceedings of IPPW-7, Barcelona. [2] S. Ulamec et al. (2011), IAA Low Cost Planetary Missions Conference. (submitted to Acta Astronautica). [3] Mottola, S. et al. (2007) Space Science Reviews, Vol. 128, pp. 241–255 DOI: 10.1007/s11214-006-9004-2. [4] Griffiths et al. (2006) International Journal of Astrobiology, 5 (3) , pages 269-275.