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TGO/CaSSIS – First in-orbit observations

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Abstract

CaSSIS (Colour and Stereo Surface Imaging System) is the main imaging system for the ExoMars Trace Gas Orbiter (TGO) mission. A scientifically compelling instrument was completed in October 2015 and launched in March 2016 [1]. This abstract describes the current status of CaSSIS and provides a first assessment of its in-flight observations.

Observations

The scientific objectives of CaSSIS are to (1) characterize sites which have been identified as potential sources of trace gases, (2) investigate dynamic surface processes (e.g. sublimation, erosional processes, volcanism) which may help to constrain the atmospheric gas inventory, and (3) certify potential future landing sites by characterizing local (down to ~10 m) slopes.

The technical aims foreseen were to (1) acquire imaging observations at a scale of <5 m/px, (2) produce images in 4 broad-band colours optimized for Mars photometry, (3) acquire a swath width >8 km, and (4) obtain quasi-simultaneous stereo pairs over the full swath width for high res. digital terrain models. These technical aims combined with programmatic constraints drove the design. The concept was discussed at EPSC in 2014 [1]. A full instrument description is in review [2]. Details on the on-ground calibration of the instrument are provided in [3]. The full payload is described in [4].

CaSSIS was first switched-on on 7 April 2016 just over 3 weeks after launch and the first images of Mars in the Mars Capture Orbit (MCO) were acquired on 22 November 2016. An example from the first Mars sequence is shown in Figure 1.

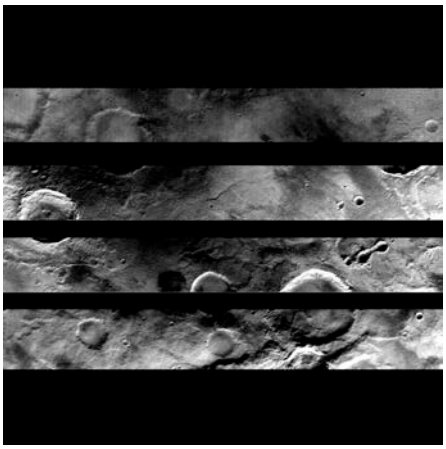

Figure 1 The first in-orbit observation of the surface of Mars with CaSSIS. This observation shows the image on the detector through the 4 filters. From the top, we see BLU, NIR, RED and PAN.

The timing of the push-frame images could be predicted well from the instrument geometry and the SPICE kernels generated by ESOC and ESAC. The test stereo pairs suggest that CaSSIS will perform stereo observations well [5,6]. Stereo reconstruction has already been performed [7]. Observations of Phobos [8] have been used to assess the photometric accuracy of the instrument and will be the subject of a publication. During the closest approach on 22 Nov. 2016, data at 2.7 m/px of Hebes Chasma was acquired with 700 µs exposure time with high signal to noise. Although the sites of the observations could not be targetted, scientifically interesting data could be acquired. The Hebes Chasma data show abundant slopes streaks and outcrops at high res (Figure 2).

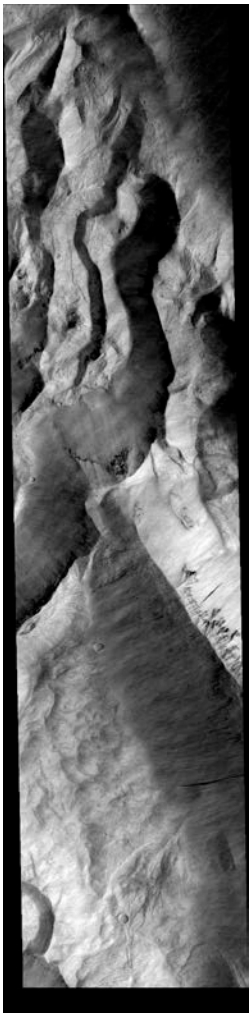

Figure 2 The reconstructed image of Hebes Chasma is 2237 x 9234 pixels in dimension at 2.7 m/px. Only one colour could be obtained in this case because of the very high ground-track velocity resulting from the close periapsis and the highly ellipitical orbit of TGO.

During the second test phase (March 2017), an invalid address in the memory caused the camera to re-boot shortly before the first periapsis pass. However, some data were acquired prior to this software error. An example is from Sisyphi Planum (Figure 3) which shows strong contrast.

The hardware appears to be working well. Future observations will test a new flight software version to be uploaded in August which incorporates compression algorithms in preparation for entry into the primary science phase in April 2018.

Figure 3 Sisyphi Planum (18W, 72S) showing dark surface material acquired at low resolution during the in-bound part of the periapsis pass on 5 March 2017.

Acknowledgements

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