EPSC Abstracts
Vol. 13, EPSC-DPS2019-1808-2, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

ExoMars/CaSSIS: Targeted Planning on Mars

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Abstract

We show the planning process and tools needed for targeting specific locations on the Martian Surface with the CaSSIS colour imager on board ExoMars/TGO.

1. Introduction

CaSSIS is the Colour and Stereo Surface Imaging System onboard the ESA ExoMars Trace Gas Orbiter, which launched in the 14th of March 2016, with the prime mission phase at Mars starting in April 2018.

CaSSIS images are ~40 km x 8 km, on the surface of Mars, what makes it better suited to target specific locations and make use of its high pixel scale (~4 m/pixel) and multi colour capability.

To that effect, a set of tools and processes was put in place, in order to allow the science team to propose and choose scientific relevant targets. And the CaSSIS target specialists can quickly and precisely turn them around into instrument commands to be executed on the spacecraft.

2. Planning Process

Given the precision necessary for a target experiment like CaSSIS, the level of complexity of the operations and the amount of people involved, there is the need of a procedural approach to operations with well-defined interfaces and tools.

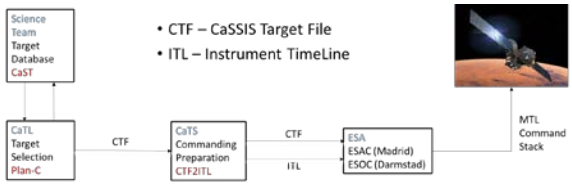

Figure 1 - CaSSIS Planing Overview

Targets are put in the CaST database (see Section 3) by the Science Team, and are selected to be imaged on a monthly basis by the CaSSIS Target Leads (CaTL) in Plan-C (see Section 4). The Selected target list is then converted by the CaSSIS Target Specialists (CaTS), with the tool CTF2ITL (see Section 4), into commands, to be put on the Spacecraft by ESA.

3. CaST

CaST is the CaSSIS target proposal tool. There are currently around 20000 targets in the database. The example below shows targeting around the expected InSight landing site. As with HiWish (https://www.uahirise.org/hiwish/, targets can be entered and specific requests made to the planners including stereo, colour, and minimum swath width.

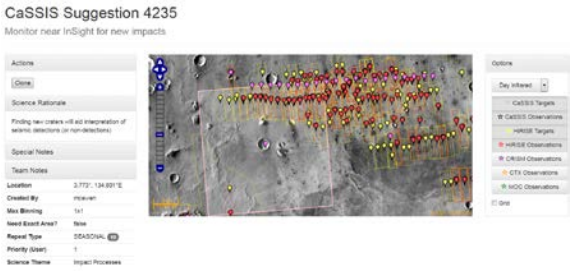

Figure 2 - CaST tool

4. PLAN-C, CTFs and ITLs

The Planning tool for Target selection is called Plan-C and is used as a layer in the GIS tool, JMARS [2]. CaST targets can be imported and checked against the TGO orbit files.

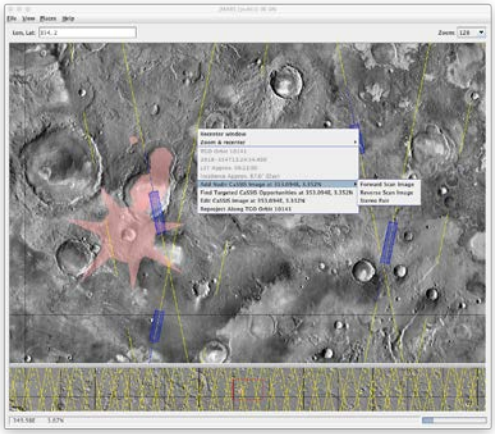

Figure 3 - Plan-C map layer with CaST targets (pink) and planned images (blue)

Proposed images are then stored in a CaSSIS Target File (CTF). The image set-up (colour etc.) is also defined here. The CTF is also the pointing interface with ESA.

Once the CTF is finalized (including accounting for exclusion zones), the file is automatically converted to the ITL format, which is the instrument command interface with ESA. The c_ctf2itl code, written in IDL, also outputs re-boot timings for CaSSIS, spacecraft data file names for verification, and SPICE kernel information.

5. Operations Monitoring

Figure 4 - CaSSIS monitoring tool

The instrument execution is monitored using a tool called Grafana (https://grafana.com). Housekeeping data are downloaded from the ExoMars Data Dissemination System (EDDS) every 15 minutes and loaded into a set of files which can then be read by the Grafana tool. Panels (see above) have been constructed for key parameters indicating instrument functionality. The example shows currents (top panel) which indicate when an image has been acquired and is compressing. The centre panel shows telescope rotation. The lower panel shows internal memory consumption.

6. Summary and Conclusions

CaSSIS has now, for over a year, been producing Mars Colour Images of specific targets, as chosen by the Science Team at a constant pace. The robust planning process has also helped when dealing with instrument hiccups that require extra intervention, while the nominal plan continues in parallel.

Future operations will continue to follow the same procedure while the different tools are further refined with the goal of giving the CaTL the best information when choosing targets and more analysis time to choose only the very best.

Acknowledgments

The authors wish to thank the spacecraft and instrument engineering teams for the successful completion of the instrument. CaSSIS is a project of the University of Bern and funded through the Swiss Space Office via ESA's PRODEX program. The instrument hardware development was also supported by the Italian Space Agency (ASI) (ASI-INAF agreement no. I/018/12/0), Leonardo-Selex ES, INAF/Astronomical Observatory of Padova, and the Space Research Center (CBK) in Warsaw. Support from NASA is grateful acknowledged.

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