IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – missions current and future (3A)

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EXOMARS PANCAM 3D VISION AND VISUALIZATION

Abstract

The ExoMars Rosalind Franklin Rover mission had undergone a re-planning and is now due for launch in 2028 and landing on Mars in 2030. It is equipped with a 2-m drill and a novel suite of instruments — the Pasteur payload — to perform geology and astrobiology investigations. Its PanCam instrument consists of two wide angle multi-spectral cameras for stereoscopic imaging (WAC), and a high resolution colour camera (HRC). 3D vision for PanCam is provided by PRoViP, a 3D vision processing suite, PRo3D (Planetary Robotics 3D Viewer), a real-time 3D seamless visualization, annotation and analysis tool, and PRoPano, a 2D panoramic viewer. The tools provide a virtual 3D environment for scientific and technical situational awareness, tactical and strategic planning, target definition,and short- and long-term geological analysis.

Processing capabilities include stereoscopic 3D reconstruction, data fusion and co-registration between 3D data products taken on different rover positions and with satellite image products, data fusion of WAC and HRC imagery, in-flight geometric calibration, and 3D data products optimized for large- and multi-scale visualization.

PRo3D is an interactive viewer for the virtual exploration and analysis of planetary surface reconstructions in the frame of geologic, aeolian, soil and crust-related as well as morphologic investigations. It allows fluent navigation through large-scale 3D reconstructions (DTM, DOM) in km to mm scale. Priority rendering allows to fuse huge low-resolution (based on orbiter imagery) with high-resolution (based on rover imagery) reconstructions in real-time. PRo3D offers a variety of annotation and measurement tools to carry out an extensive geologic analysis, hierarchically structuring measurements and annotations according to their spatial arrangements and geological significance and use them as navigation aid (fly to a selected item). Scale bars in the 3D scene gives a sense of scale also from larger distances. Sequenced bookmarks allow to create a guided tour through the scene and locations of annotations. Rover trajectories and their waypoints can be used for navigation or for planning views of rover instruments, showing

the instrument footprint on the surface and its simulated view.

We report on the current embedding of PanCam processing and visualization in regular ExoMars operations simulations, recent field testing using mission-representative PanCam imagery in planetary analogue terrestrial environments, and lessons learned from the processing and visualization assets in their operational use in Mars 2020 Mastcam-Z science exploitation.