

Mars Image Products: Science Goes Operational

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The exploration of Mars by NASA has recently become more focused on in-situ missions such as Mars Pathfinder (MPF) and the Mars Exploration Rovers (MER). These landers and rovers typically have onboard stereo cameras that take pictures of the surface. These pictures have always been used for science investigations. However, they are becoming increasingly important for operations, for tasks such as driving the rover and deploying instrument arms.

The Multimission Image Processing Lab (MIPL) at JPL is tasked with the creation of image products derived from these images, including the current MER mission. These products include mosaics, stereo correlation, terrain generation, pointing correction, arm reachability maps, and rover position determination. To support this, MIPL has written a reusable software suite consisting of a set of applications and a supporting library. The applications are truly multimission, containing no mission-specific references whatsoever. All mission-specific code is encapsulated in the library, called PIG (Planetary Image Geometry). It consists of an object-oriented, multimission framework which abstracts out elements common to all surface-based missions, with subclasses handling the mission-specific details.

While originally developed for science tasks, this software suite is now in the critical path for MER operations. A processing pipeline provides automated, systematic generation of products previously created on an ad-hoc basis. These products are used by the science planning team as well as the rover "drivers" to visualize the terrain, find science targets, plan traverses and arm deployments, and ensure rover safety.

In addition to MER, the suite works with Mars Pathfinder, Mars Polar Lander, the Mars '01 Athena Testbed, and the FIDO testbed rover. Mission adaptation time has ranged from a few days to two months, compared with years to write the original code. This results in large cost savings to new missions, freeing up resources to add functionality rather than rewriting old capabilities each time.

The kinds of products created by this library will be presented, along with an overview of the library and pipeline designs and how they are being used in MER operations. Experiences with the MER mission so far will also be described, as well as challenges to reuse that must be overcome.