SSI/RAC: IMAGERS FOR MARS POLAR LANDER. M.T. Lemmon, R.A. Yingst, R.J. Reid, P. Smith and the MVACS team, Lunar and Planetary Laboratory, Univ. Arizona, Tucson, AZ 85721; yingst@lpl.arizona.edu.

Introduction: The Mars Volatiles and Climate Surveyor (MVACS) instrument payload on the Mars Polar Lander includes two imagers designed and constructed at the Lunar and Planetary Laboratory at the University of Arizona and the Max Planck Institute for Aeronomy. These are the Surface Stereo Imager (SSI) and the Robotic Arm Camera (RAC). These instruments will create a multispectral and visual record of the geology and environmental changes of the landing site and will document the progress of the mission.

Instrument description: The SSI[1] is a stereoscopic, multispectral camera with Imager for Mars Pathfinder (IMP[2]) heritage. It has two eyes separated by 15.0 cm, each with a field of view (FOV) of 14.4° x 14.0°. It has 15 geology and 8 solar filters between 440 and 1000 nm, with stereo in blue, red, and IR filters. The resolution is 0.975 mrad/pixel, similar to IMP. SSI will acquire stereo, color, and multispectral panoramas of the landing site and Robotic Arm (RA) workspace to study local mineralogy, images of the sky and sun to study atmospheric dust and water vapor, and images of the TEGA and magnetic targets. RAC[3] is a lightweight monoscopic camera attached to the RA. It has variable focus from 10.5 mm to infinity, with a maximum resolution of 25 µm/pixel at close focus and 1.7 mrad/pixel at far focus (with a 50° x 25° field of view). RAC will be used with red, green and blue lamps to obtain color images of objects in the RA scoop. RAC will acquire stereo images of the RA workspace in support of RA operations and for study of surface and subsurface physical, geologic and mineralogic properties of the local terrain. RAC will also acquire limited stereo panoramas of the landing site.

Planned imaging sequences: Although it is expected that there will be some changes in the order and/or type of images collected during actual mission operations, we present here the currently planned imaging sequence for the SSI/RAC instruments.

SSI. SSI will obtain a data set similar to that obtained by IMP[4]. Unlike IMP, which took full landing-site panoramas in both its stowed and deployed positions, SSI can only take a single 14° (horizontal) by 60° (vertical) panorama before deploying to its full height of about 1.5 m above the surface. In the first two sols on Mars, SSI will obtain a horizon panorama, images from the lander to the horizon at four compass points, and a color/stereo panorama of the RA workspace. Within the first week, a color/stereo panorama of the entire landing site will be obtained and downlinked. This panorama will initially be the primary data set for three-dimensional geologic mapping and analysis of local and regional features at the site.

During the following weeks of the mission, the ongoing responsibilities of SSI will be to a) document the progress of the RA during digging operations; b) produce multispectral images of the sky for atmospheric analysis; c) monitor changes in the local environment, including weather variations; and d) indicate motion of the lander due to movements of the RA. In its optimal placement, the trench produced by the RA will be dug such that the SSI will be positioned to image directly inside and down its long axis. The tailings from the trench interior will also be imaged. Finally, the SSI will produce a "super" panorama of the landing site, using all fifteen geology filters and low compression. This panorama will provide the compositional context required to fully map and analyze the geologic units of the landing site.

RAC. In addition to imaging soil samples within the scoop, RAC will provide high-resolution, close-range images of the immediate landing environment, including the region underneath the lander disturbed by the retrorockets. Also, currently plans call for the RAC to provide some panoramas of the immediate landing site area early in the mission, as well as some stereo images of the horizon. A sample RAC panorama is shown in Fig. 1; a panorama during the mission would cover less than 180°, but would obtain stereo imaging with a 40-50 cm baseline (allowed by camera motion and the panoramic field of view) over much of that range. These images will complement the SSI data set and augment the collection of images in the immediate vicinity of the lander.

Finally, the RAC may potentially provide limited vertical stereo. Such images, in conjunction with SSI stereo, will provide important information on the size and depth of features at the landing site, necessary data for assessing the history of geologic processes.

Data reduction: SSI and RAC images will be calibrated to intensity units (W/m^2/ster/µm) by correcting raw images for bad pixels, dark current, the electronic shutter, flat fields, and absolute responsivity. SSI images will be further calibrated to reflectance units by measuring a Mars Pathfinder-heritage radiometric target on the lander deck.

References: 1) Smith *et al.*, *J. Geophys. Res.*, submitted (1999). 2) Smith *et al.*, *J. Geophys. Res.* **102**, 4003 (1997). 3) Keller *et al.*, *J. Geophys. Res.*, submitted (1999). 4) *E.g.*, Smith *et al.*, *Science* **278**, 1758 (1997).

Figure 1: Panorama taken near Baker, California, February 1999, with a prototype of the Robotic Arm Camera.