POLAR OBSERVATIONS OF MARCI / CTX CAMERAS ON MRO. Malin, M.C.\textsuperscript{1}, J.F. Bell\textsuperscript{2}, W. Calvin\textsuperscript{3}, B.A. Cantor\textsuperscript{4}, M.A. Caplinger\textsuperscript{5}, R.T. Clancy\textsuperscript{6}, A.S. Hale\textsuperscript{7}, R.M. Haberle\textsuperscript{8}, P.B. James\textsuperscript{9}, S.W. Lee\textsuperscript{7}, P.C. Thomas\textsuperscript{6}, and M.J. Wolff\textsuperscript{4}. \textsuperscript{1}Malin Space Science Systems, San Diego, CA, \textsuperscript{2}Cornell University, Ithaca, NY, \textsuperscript{3}U. Nevada, Reno NV, \textsuperscript{4}Space Science Institute, Boulder, CO, \textsuperscript{5}Jet Propulsion Laboratory, Pasadena, CA, \textsuperscript{6}NASA Ames Research Center, Moffett Field, CA, \textsuperscript{7}Denver Museum of Nature and Science, Denver, CO.

Introduction: The original MARCI experiment on Mars Climate Orbiter had two cameras-- a wide angle system to provide daily global views of the planet, and a medium angle system to provide 40 meters per pixel views of selected areas to be examined for landing site studies \cite{1}. For the 2005 MRO mission, NASA decided only to re-fly the MARCI wide angle system; the medium angle camera was replaced with the 6 meters per pixel, monochromatic Context Imager (CTX) \cite{2}.

MARCI: The Mars Color Imager (MARCI) on Mars Reconnaissance Orbiter (MRO) is designed to acquire daily global images of Mars for at least 1 martian year in 5 visible wavelengths and 2 ultraviolet wavelengths. MARCI images will document the weather on Mars by observing dust storms, polar frost, and clouds. MARCI's ultraviolet observations will map the distribution of ozone in the atmosphere and be useful in determining the opacities of dust and water ice clouds and hazes.

MARCI uses a pushbroom technique with a framing CCD as opposed to MOC and CTX which pushbroom a one dimensional array. Two dimensional images are simultaneously acquired at various wavelengths; these are followed by a y translation of the spacecraft nadir and another contiguous set of images. The field of view of MARCI is 180 degrees to give limb to limb images even during the frequent MRO rolls. The camera filters are applied directly to the CCD so there is no need for a mechanical filter wheel. MARCI acquires images in five visible passbands (450 nm, 550 nm, 600 nm, 650 nm, and 720 nm); a separate optical path is used to image in the two UV channels at 260 and 320 nm. The UV images will routinely be summed 8X8 because of the lower fluxes at the short wavelengths. The maximum resolution of the visible images will be about 1 km/pixel at 300 km altitude.

MARCI will acquire multiple images of the illuminated portions of the Polar Regions every day as it passes over the poles. It will therefore permit study of the diurnal development of clouds and frost near the poles as well as document seasonal variations. These data will be used to study the distribution and evolution of circumpolar dust storms and condensate clouds and correlate these with models for the polar circulations. The seasonal cycles will be compared with the four Mars year record of MGS to study interannual variability in the polar cap seasonal cycles. Particular features in the Polar Regions will be viewed at a variety of emission angles, enabling study of the phase function of the cap surface \cite{2}. The ultraviolet images will be used to study the correlation of polar ozone with the seasonal cap cycles. Figure 1 shows the first Mars image acquired by MARCI before the start of aerobraking.

![Figure 1. MARCI acquired the images used to make this color composited of Argyre Basin and the surrounding region on March 24, 2006, after Mars orbit insertion. Inasmuch as MRO was about 15 times farther from Mars than it will be during mapping, the resolution of this image is correspondingly much less than that anticipated for the mapping images.](8022.pdf)

CTX: The design of CTX is similar to the MOC Narrow Angle Camera in that both rely on pushbrooming linear CCDs and both have broad, minus blue filters. The optics are of a catadioptic design similar to that of the previous MARCI medium angle camera. The resolution is larger than that of MARCI MA, however, 6 meters/pixel at an altitude of 300 km. The FOV of the camera is 5.7 degrees corresponding to 30 km swaths at an altitude of 300 km.

Although CTX is a facility instrument and has as a principal goal the acquisition of context images for HIRISE and CRISM, the MARCI/CTX Science Team can use CTX in support of their own science goals. These include several projects that are focused on the polar regions. CTX can map the entirety of both resid-
ual polar caps at a resolution of ~6 km/pixel at nadir, slightly less when MRO rolls to view the interiors of the caps. The advantage of the CTX maps is the complete coverage that is possible; only a fraction of the total area of the residual caps has been mapped at the higher MOC resolution. These maps will be relevant to major scientific questions such as the stratigraphy and continuity of polar layered deposits and the distribution of craters in the polar regions. CTX will also monitor the time dependence of particular features within the seasonal polar caps. Examples include the spiders and dark spots in the south seasonal cap, the Mountains of Mitchel, defrosting of circumpolar dunes in the north, and behavior of frost in outliers such as large craters in the northern hemisphere. Even near the spacecraft periapsis, the CTX resolution is marginal for monitoring the erosion in a single Martian year of the pits, troughs, and mesas [4] in the residual south cap; however, it will be possible to accurately map these features in the entire residual cap and detect major changes over multiple years and in the topographic forms or the albedo.

Figure 2 shows the first full resolution Mars image acquired by CTX before the start of aerobraking.

Figure 2: The first CTX image of Mars shows a region south of Valles Marineris roughly 450 meters square. As in the first MARCI image, this is about 15 times lower resolution than will be obtained in the mapping orbit.