**MAPPING MERCURY: GLOBAL IMAGING STRATEGY AND PRODUCTS FROM THE MESSENGER MISSION.**
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**Introduction:** Prior to the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) mission, only ~45% of Mercury's surface had been imaged by spacecraft. Thus, a major MESSENGER goal was to create the first global map of the planet, to gain insight into Mercury's geologic evolution and processes. Originally planned for only one Earth-year, MESSENGER's orbital mission ultimately was extended to just over four years in total, before the spacecraft's fuel was depleted. Here we outline the strategy used by the Mercury Dual Imaging System (MDIS) [1] team to undertake the first global imaging mapping campaigns of Mercury, and we present the resulting final imaging map products.

**Primary Mission Imaging Priorities:** For the first year in orbit, obtaining global imaging coverage was the main priority, given the limited coverage previously by Mariner 10 and MESSENGER's three Mercury flybys. Consequently, the majority of MDIS's data volume allocation was devoted to imaging the surface completely for the first time, at moderate incidence angles to provide both morphology and reflectance information, obtaining stereo imaging to enable the creation of a global digital elevation model (DEM), and acquiring a global multispectral map through 8 of MDIS's 11 narrow-band filters.

**Extended Mission Imaging Priorities:** Mapping campaigns were undertaken in MESSENGER's extended mission to complement and advance the primary mission products. A 3-color map was acquired that maximized the spatial resolution, and hence was focused largely on the northern hemisphere because of the spacecraft's highly eccentric orbit. A 5-color map was obtained for the north-polar region that minimized the phase angle, and hence shadows, in the images at these highest latitudes. The surface was also imaged at high incidence angles, at which shadows accentuate geologic features, with illumination from both the east and the west. In contrast, imaging that minimized the incidence angle enabled the creation of a map optimized for surface reflectance features. Additional imaging was also devoted to increasing stereo coverage.


**Figure 1.** MDIS multispectral mosaic products (1000-nm, 750-nm, 430-nm bands in red, green, blue, respectively). **A.** Global 8-color map. **B.** South pole from the 8-color map, extending to 65°S with 180°E at the bottom. **C.** Higher-resolution 3-color map, extending to ~50°S. **D.** North-polar 5-color map, extending to 60°N with 180°E at the top. (A, C in simple cylindrical projection centered on 0° longitude; B, D in polar stereographic projection.)

**Final MESSENGER Imaging Map Products:** Though during the orbital mission images were acquired to support specific campaigns, for the final map products all of the images acquired during the entire orbital mission were considered for inclusion in each product. For the final imaging map products, the MDIS calibration procedure [1], photometric correction [2], multispectral calibration [3], and the DEM with associated smithed kernels [4] were all crucial to the quality of the final products. Three multispectral maps were produced (**Fig. 1**):

- Global 8-color map. 665 m/pixel. Filter centers in nm: 430, 480, 560, 630, 750, 830, 900, 1000.
- High-resolution 3-color map. 332 m/pixel. Filter centers in nm: 430, 750, 1000.
- North-polar 5-color map. 332 m/pixel. Filter centers in nm: 430, 560, 750, 830, 1000. Acquired to minimize phase angles.

Four monochrome maps were created (**Fig. 2**), all at 166 m/pixel:

- Morphology base map. Favoring moderate incidence angles near 68°.
- Low-incidence-angle base map. Optimized to view surface reflectance variations.
- East illumination map. Favoring high incidence angles near 80°.
- West illumination map. Favoring high incidence angles near 80°.

Together, these seven products form a complementary set of maps that enable Mercury's surface to be robustly investigated from a diverse set of viewing, imaging, and multispectral conditions. These map products also facilitate comparisons with surface measurements from other MESSENGER instruments. The MDIS team is in the process of finalizing these map products, for release by NASA's Planetary Data System in May 2016.

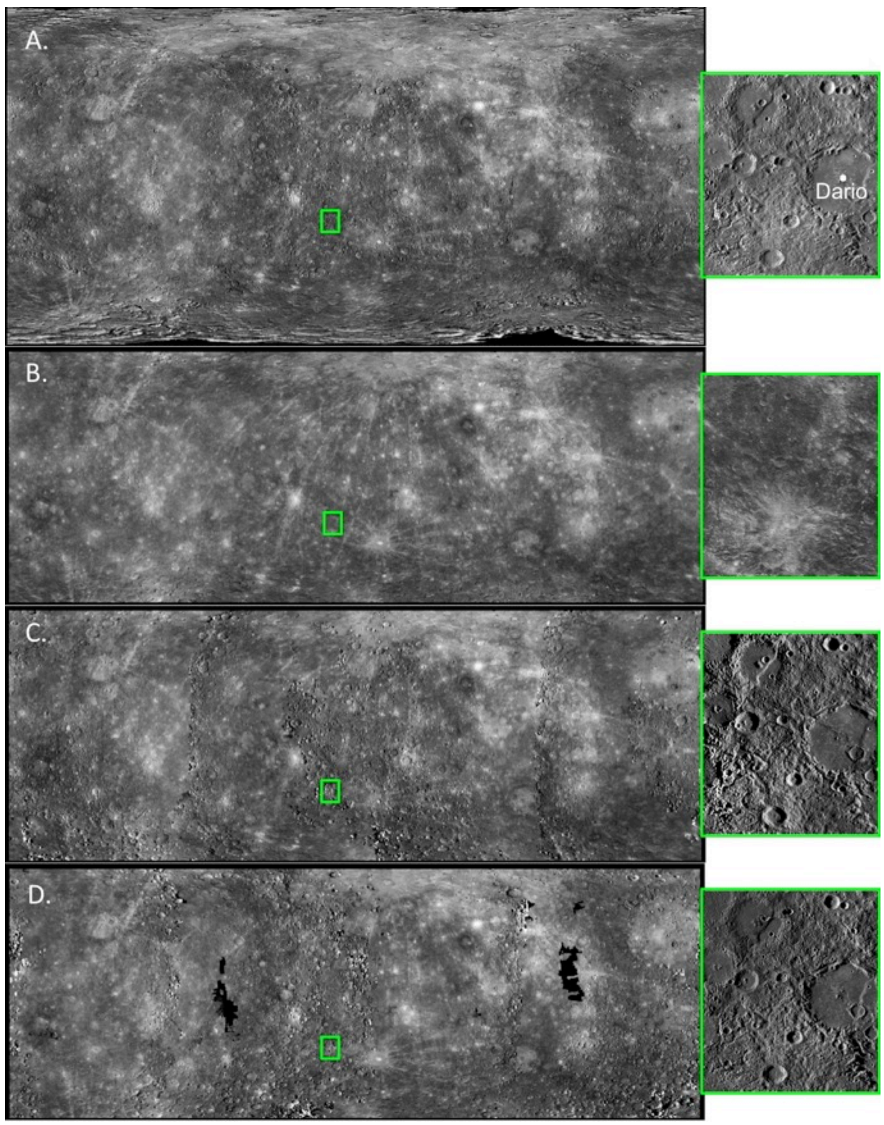


**Figure 2.** MDIS monochrome mosaic products (in simple cylindrical projection centered on 0° longitude), with a detailed view of the region near Darío crater (152-km diameter, 26.3°S, 350.7°E) to illustrate the complementary nature of the maps. **A.** Global base map, favoring moderate incidence angles. **B.** Low-incidence-angle map, optimized for viewing surface reflectance variations. **C.** Map favoring high incidence angles, illuminated from the east. **D.** Map favoring high incidence angles, illuminated from the west. (Maps in B-D extend from 65°N to 65°S; the final maps will include the polar regions and cover 90°N to 90°S, as shown in A.)

**References:** [1] Hawkins S.E., III et al. (2007) *Space Sci. Rev., 131*, 247-338. [2] Domingue D.L. et al. (2016) *Icarus,* doi: 10.1016/j.icarus.2015.11.040. [3] Denevi B.W. et al. (2016) *LPS*, this meeting. [4] Becker K.J. et al. (2016) *LPS*, this meeting.