GEORGE MASON UNIVERSITY | Mars Geodesy & Cartography Working Group

A Report to the
Mars Exploration Program Analysis Group (MEPAG)

by

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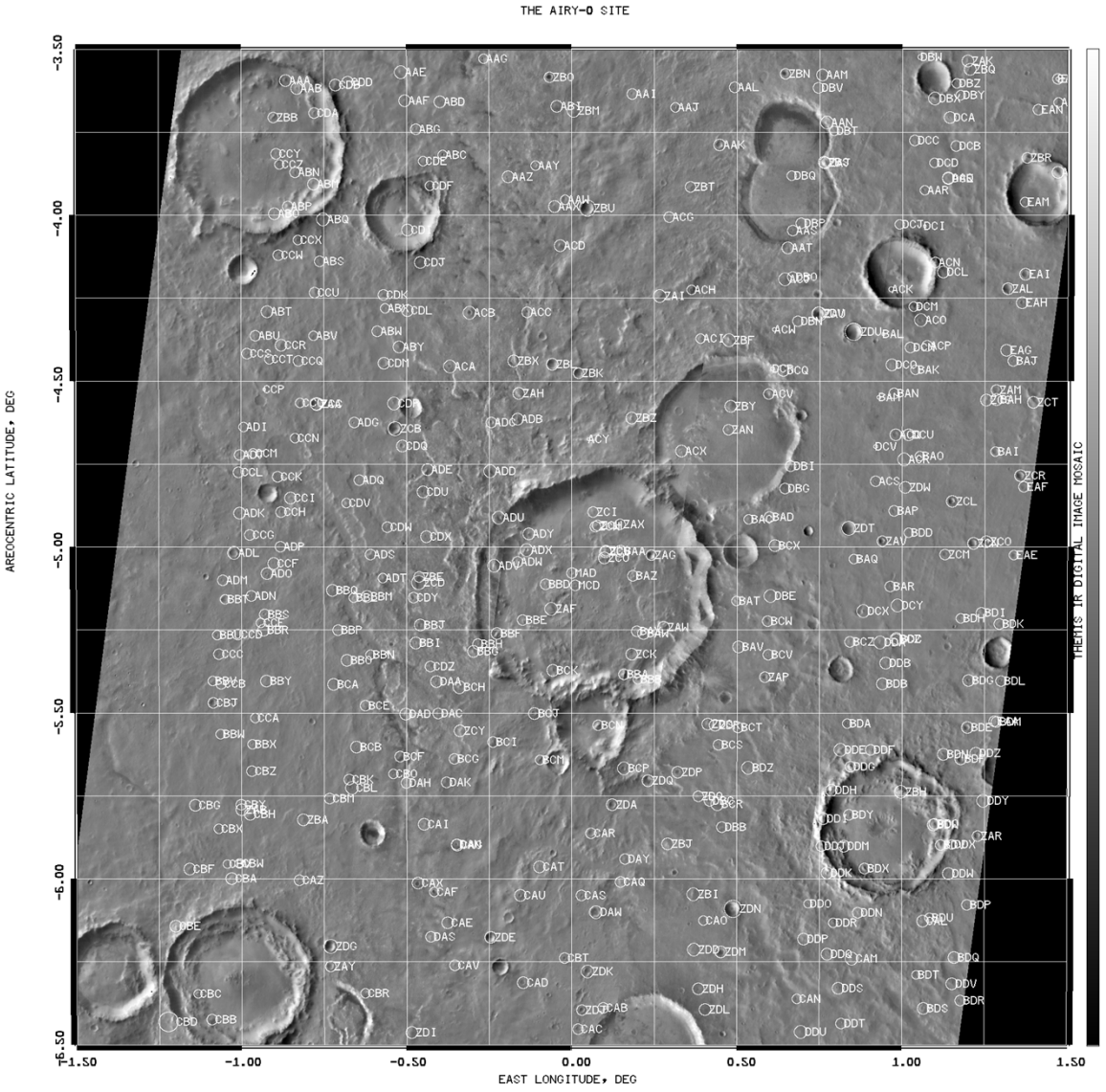
Mars Geodesy & Cartography Working Group

- Reports to the Mars Exploration Program Scientist
  - Dr. Richard Zurek, JPL
  - Participating Members (Volunteers) Funded Independently
    - NASA, ESA, Roscosmos, . . .
- Provides IAU with Improved Mars Geodetic / Cartographic Constants, Conventions
  - Spin Pole Direction, Spin Rate, Prime Meridian
- Recommend to NASA and International Mars Projects and Geodesy / Cartography Research Groups "Best" Data Sets to Use
  - Planetary Ephemerides, Phobos / Deimos Ephemerides, Digital Terrain Models,
  - Reconstructed Orbits, Spin Pole / Rate and Prime Meridian, NAIF SPICE Kernels,
- Provides an Independent Review / Validation of Precision Cartographic Landing Site Map Products used for Mission Operations
  - MPF, MPL, Beagle 2, MER, Phoenix, MSL, PhSRM (GRUNT)
- Makes Observation Recommendations to Individual Projects that Support MGCWG Objectives
  - Observe Geodetic / Cartographic Targets
    - VL-1, VL-2, MPF, MER-A/B, Phoenix, Airy 0, . . . MSL
  - Track Landers for Spin Property Improvements
- Provides Mechanism to Discuss Instruments / Datasets Across Projects

MARS PRIME MERIDIAN – AIRY 0



Mars Exploration Program Analysis Group (MEPAG)
chartered by NASA HQ to assist in planning the scientific exploration of Mars

TCD: LOLA / LROC

MARS POLE / SPIN RATE

- Current Model of the Form:

$$\alpha = 317.25268883 - 0.108965725\,T$$
$$\delta = 54.4097083 - 0.057933172\,T$$
$$W = 176.07653755 + 350.89198249649 18\,d$$

- Does not Reflect Seasonal Mass Movements Between the Poles or Improved Spin Rate (Konopliv, et. al., Folkner, et. al.)
  - Periodic Variations Having Amplitudes of up to 15 meters (~100 HiRISE pixels)

NEW FORM OF MARS SPIN DIRECTION / RATE

- An Update to the Mars Spin Pole Direction and Spin Rate is Being Prepared to be Provided this summer to the IAU as the New Recommended Standard – Awaiting New Results from Konopliv, et. al.
- Example of new form derived from Konopliv, A., et. al., Folkner, W., et. al.

$$
\begin{aligned}
\alpha &= 317.25268883 - 0.108965725\,T \\
&\quad +0.00006767 \sin(198.944201 + 19139.4819985\,T) \\
&\quad +0.00023839 \sin(226.282688 + 38280.8511281\,T) \\
&\quad +0.00005222 \sin(249.644835 + 57420.7251593\,T) \\
&\quad +0.00000876 \sin(266.184339 + 76560.6367950\,T) \\
&\quad +0.44896527 \sin(73.035239 + 0.5042615\,T) \\
\delta &= 54.4097083 - 0.057933172\,T \\
&\quad +0.00005167 \cos(122.492467 + 19139.9407476\,T) \\
&\quad +0.00014139 \cos(43.055283 + 38280.8753272\,T) \\
&\quad +0.00003110 \cos(57.650369 + 57420.7517205\,T) \\
&\quad +0.00000532 \cos(79.487357 + 76560.6495004\,T) \\
&\quad +1.57456751 \cos(165.350003 + 0.5042615\,T) \\
W &= 176.07653755 + 350.8919824964918\,d \\
&\quad +0.00015111 \sin(36.608523 + 38281.0473591\,T) \\
&\quad +0.00012404 \sin(136.527087 + 19140.0328244\,T) \\
&\quad +0.00003378 \sin(75.822238 + 57420.9295360\,T) \\
&\quad +0.00000935 \sin(54.276892 + 76560.2552215\,T) \\
&\quad +0.00000110 \sin(104.723812 + 95700.4387578\,T) \\
&\quad +0.61643271 \sin(116.072965 + 0.5042615\,T)
\end{aligned}
$$

Will be provided to the US / International Community as NAIF SPICE Kernel. Each Project / Research Group will Evaluate for Adoption.