MEDA: AN ENVIRONMENTAL AND METEOROLOGICAL PACKAGE FOR MARS 2020. J.A. Rodriguez-Manfredi[1], M. de la Torre[2], L. Tamppari[2], P. Conrad[3], M. Lemmon[4], G. Martinez[5], C. Newman[6], M. Smith[3], T. Schofield[2], J. Gomez-Elvira[1], F. Gomez[1], A-M. Harri[7], S. Navarro[1], O. Prieto[1], M. Ramos[8], A. Saiz-Lopez[9], A. Sanchez-Lavega[10], E. Sebastian[1], M. Genzer[7], O. Kemppinnen[7], S. Perez-Hoyos[10], N.T. Bridges[11]. [1]Centro de Astrobiologia (INTA-CSIC), Madrid, Spain; [2]Jet Propulsion Laboratory, Pasadena, CA 91109; [3]NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD 20771; [4]Texas A&M University, College Station, TX 77843; [5]University of Michigan, 500 S State St, Ann Arbor, MI 48109; [6]Ashima Research, 600 S. Lake Ave, Suite 104, Pasadena, CA 91106; [7]Finnish Meteorological Institute, Erik Palménin aukio 1, 00560 Helsinki, Finland; [8]University of Alcala, Plaza de San Diego, 28801,Alcalá de Henares, Spain; [9]Institute Physical-Chemistry Rocasolano, CSIC, Serrano 119, 28016, Madrid, Spain; [10]University of Basque Country, Bilbao, Spain; [11]Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723.

The *Mars Environmental Dynamics Analyzer* (MEDA) is a contributed REMS follow-on suite of sensors designed to address the Mars 2020 AO investigation goals D.2 "characterization of dust size and morphology" and D.3 "surface weather measurements" while maximizing the REMS and PanCam/HazCam heritage. MEDA's design makes it more than a dust characterization and MET station package, as it offers synergies with the goals of other AO investigations, Mars Program objectives, and with Mars Strategic Knowledge Gap investigations.

MEDA will monitor dust properties and *in-situ* near-surface pressure, relative humidity, the air and surface thermal environment, wind, and the solar radiation cycle autonomously on Mars around the clock. The solar radiation sensors will track direct and diffuse radiation in a geometry that characterizes the prevailing environmental dust properties, the behavior of solar radiation on subdiurnal time scales, and the impact of solar radiation on local photochemistry, thus supporting assessments of the preservation potential for organics on a cache sample.

Resolving dust and environmental variables over many time scales is required to (a) the predictive capabilities of models of the near surface environment on Mars, and (b) assess how the environment affects operational and rover engineering cycles. Therefore, MEDA's operation concept is to work autonomously and continuously with a programmable continued temporal coverage and a variable sampling rate, including during rover sleep periods.

The MEPAG's P-SAG report (2012) recommends understanding the different Mars surface scenarios which requires sampling the near surface environment at geographically diverse locations on Mars. The suite of sensors chosen will enable comparisons to the environments measured at other surface locations previously explored on Mars, with the MSL REMS heritage enabling very robust comparisons to the meteorological station currently operating in Gale Crater

MEDA addresses the following investigations:

a. The physical and optical characteristics of the local atmospheric dust. Its particle abundance, size distribution, nonsphericity, and how do these optical properties relate to the meteorological cycles (diurnal, seasonal, interannual).

b. The conditions leading to dust lifting and how does the aerosol diurnal (daytime and night time) cycle respond to the atmospheric wind regimes.

c. How do the current environmental pressure, temperature, relative humidity, solar radiation, net infrared radiation, and winds at the landing site differ from those at the Viking, Phoenix, MPF, and Curiosity locations.

d. The relationship between the surface environment and the large-scale dynamics observed from orbiting instruments.

e. What are the energy and water fluxes between the surface and the lower atmosphere of Mars near the rover.

f. What are the annual cycles of the solar UV, visible and NIR radiation on the surface of Mars?

g. The environmental context for weathering and preservation potential of a possible cache sample.

h. How do pressure, humidity, temperature and winds influence the ISRU engineering efficiency?

i. How do the MEDA observations agree with models extrapolations to the Martian surface.

Fig. 1: MEDA fact sheet.

References

[1] Gómez-Elvira, J. et al. (2012), /SSR, 170,/ 583-640.

[2] Dubovik, O., and M. D. King (2000), A flexible inversion algorithm for retrieval of aerosol optical properties from Sun and sky radiance measurements, J. Geophys. Res., 105(D16), 20673–20696, doi:10.1029/2000JD900282 <http://dx.doi.org/10.1029/2000JD900282>.

[3] Lemmon, M. T., M. J. Wolff, M. D. Smith, R. T. Clancy, D. Banfield, G. A. Landis, A. Ghosh, P. H. Smith, N. Spanovich, B. Whitney, P. Whelley, R. Greeley, S. Thompson, J. F. Bell III, and S. W. Squyres. 2004. Atmospheric Imaging Results from the Mars Exploration Rovers: Spirit and Opportunity. /Science/ 306

[4] P-SAG (2012) Analysis of Strategic Knowledge Gaps Associated with Potential Human Missions to the Martian System: Final report of the Precursor Strategy Analysis Group (P-SAG), D.W. Beaty and M.H. Carr (co-chairs) + 25 co-authors, sponsored by MEPAG/SBAG, 72 pp., posted July 2012, by the Mars Exploration Program Analysis Group (MEPAG) at http://mepag.jpl.nasa.gov/reports/