MEDA, THE ENVIRONMENTAL DYNAMICS ANALYZER FOR MARS 2020. J.A. Rodriguez-Manfredi[1], M. de la Torre[2], J.S. Boland[2], N.T. Bridges[3], P. Conrad[4], F. Ferri[5], M. Genzer[6], F. Gómez-Gómez[1], J. Gómez-Elvira[1], A-M. Harri[6], O. Kemppinnen[6], M. Lemmon[7], G. Martínez[8], S. Navarro[1], C. Newman[9], S. Pérez-Hoyos[10], O. Prieto[1], M. Ramos[11], A. Saiz-López[12], A. Sánchez-Lavega[10], J.T. Schofield[2], E. Sebastian[1], M. Smith[4], L.K. Tamppari[2], and the MEDA team. [1]Centro de Astrobiología (INTA-CSIC), Madrid, Spain; [2]Jet Propulsion Laboratory/California Institute of Technology, Pasadena, CA 91109; [3]Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD 20723; [4]NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD 20771; [5]Università degli Studi di Padova, Centro Di Ateneo Di Studi E Attivita' Spaziali "Giuseppe Colombo" (CISAS), Padova Italy; [6]Finnish Meteorological Institute, Erik Palménin aukio 1, 00560 Helsinki, Finland; [7]Texas A&M University, College Station, TX 77843; [8]University of Michigan, 500 S State St, Ann Arbor, MI 48109; [9]Ashima Research, 600 S. Lake Ave, Suite 104, Pasadena, CA 91106; [10]University of Basque Country, Bilbao, Spain; [11]University of Alcalá, Plaza de San Diego, 28801, Alcalá de Henares, Spain; [12]Institute Physical-Chemistry Rocasolano, CSIC, Serrano 119, 28016, Madrid, Spain.

Introduction: The *Mars Environmental Dynamics Analyzer* (MEDA) is a suite of environmental sensors that compose one of seven instruments being developed for science investigations aboard the NASA Mars 2020 rover [1].

MEDA is an international collaboration to combine a mostly contributed set of sensors that can address two M-2020 investigation goals: “characterization of dust size and morphology”, and “surface weather measurements”. MEDA also responds to Mars Program objectives and Mars Strategic Knowledge Gap investigations for Human Exploration identified by the MEPAG [2].

The MEDA payload carries high heritage from the currently-in-use Remote Environmental Monitoring Station (REMS) [3] and PanCam/HazCam [4] instruments aboard the Mars Science Laboratory (MSL) mission. MEDA can monitor dust and surface meteorology autonomously and will be capable of sampling environmental conditions in parallel to other Mars 2020 investigations [such as e.g. the *Mars Oxygen ISRU Experiment* (MOXIE), designed to produce oxygen from Martian atmospheric carbon dioxide].

MEDA investigations: MEDA’s sensors will characterize the climate near the Martian surface. Those sensors are a dust and optical radiation sensor (RDS) that includes a camera (SkyCam), pressure sensor (PS), relative humidity sensor (HS), wind sensor (WS), 5 air temperature sensors (ATS), and a thermal infrared sensor (TIRS) for net flux and ground temperature.

The solar radiation sensor is designed to track direct and diffuse radiation in a geometry that characterizes both the prevailing environmental dust properties [5,6] and the behavior of solar radiation on subdiurnal time scales. This helps constrain and model the impact of solar radiation on local photochemistry, thus supporting assessments of the preservation potential for organics on a cache sample. The other sensors will enable comparisons to the environments found at other locations explored by environmental packages aboard previous landers and rovers on Mars. The MSL REMS heritage additionally permits easy comparisons to the meteorological station currently operating on Gale Crater.

MEDA’s investigations are to measure:

a. The physical and optical properties of the local atmospheric aerosols. Particle abundance, size distribution, shape, phase function, and how these optical properties relate to the meteorological cycles (diurnal, seasonal, interannual).

b. The conditions leading to dust lifting and how the aerosol diurnal cycle responds to the local atmospheric wind regimes.

c. How 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, Pathfinder, and Curiosity locations.

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

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

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

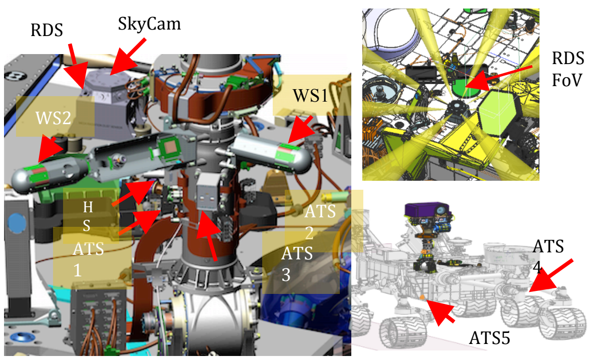
g. The environmental context for weathering and preservation potential of a possible cache sample.

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

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

MEDA Operations approach: To ensure these objectives, MEDA will be able to measure with 1Hz frequency for at least 5 minutes each 30 minutes. This occurs autonomously even if the rover is asleep. Over this basic operarions scenario, the M-2020 Science teams will be able to add as many 5 minute blocks as desired to fill up to 24 hours/sol anytime that rover power and data volume enables for it.

Development status: To ensure the investigation goals, the MEDA sensor locations have been selected searching to minimize the influence of the rover geometry on the sensors. This required for some sensors to be upwind of the rover. As a consequence there are several ATS and WS all distributed such that there is always one upwind of the rover. Two MEDA air temperature sensors will be accommodated on the sides of the rover providing local lapse rate information, the RDS will be on the rover deck, the pressure sensor and the MEDA CPU will be inside the rover and the rest of sensors, HS, TIRS, and 3 ATS will be on the rover Remote Sensing Mast.



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