MARS METEOROLOGICAL NETWORK. H. L. Justh[1] and J. F. Spann[2], [1]NASA Marshall Space Flight Center (Mail Code: EV44, Marshall Space Flight Center, AL, 35812, Hilary.L.Justh@nasa.gov), [2]NASA Marshall Space Flight Center (Mail Code: ZP10, Marshall Space Flight Center, AL, 35812, Jim.Spann@nasa.gov)

Introduction: Exploring and ultimately establishing a permanent presence on the surface of Mars will necessitate an understanding the weather conditions and the ability to forecast its dynamic behavior. The meteorology of Mars will need to be developed. This abstract puts forth a concept for a Mars Meteorological Network that will be used to investigate the Mars atmosphere behavior, explore the surface environment, and prepare for operational activities. It is proposed that the long term and the dynamic nature of the lower atmosphere and surface of Mars be observed with a distributed global array of simple automated surface nodes. The data would be ingested into the Mars Global Reference Atmospheric Model (Mars-GRAM) and other research tools for analyses to gain a better understanding of the atmospheric conditions on Mars.

Mars Weather Network: The Mars Weather Network is conceived as a distributed array of small and simple automated nodes located across the surface. The array would be modular to enable the evolution of the array, in number of nodes and layout.

Surface measurements of the lower atmosphere of Mars including the boundary layer would provide information that is unable to be determined through the use of orbiters. The majority of the information about the atmosphere of Mars that has been used to improve Mars-GRAM in recent years has been generated from the use of nadir and limb data from TES onboard Mars Global Surveyor. The addition of detailed, long-term meteorological data from the surface of Mars would fill a void in the overall understanding of the atmosphere of Mars.

Of particular interest on the surface of Mars would be the measurement of temperature, pressure, winds and dust over an extended period of time. This longer duration coverage is necessary to determine the diurnal as well as seasonal variations of the atmosphere of Mars. Ultimately expanding to a network of surface stations would provide a greater understanding of the local, regional, and global atmospheric variations on Mars.

The measurements from a Mars meteorological network could then be used through model-versus-data comparisons to improve existing Mars atmospheric models including Mars-GRAM. As appropriate, Mars atmospheric data could also be used to build auxiliary profiles, which can be utilized as a Mars-GRAM model input option. These improved simulations will be vital when designing and planning systems for aerocapture, aerobraking or landed missions to Mars.

Mars Global Reference Atmospheric Model (Mars-GRAM): Mars-GRAM is an engineering-level atmospheric model widely used for diverse mission applications. Applications include systems design, performance analysis, and operations planning for aerobraking, entry descent and landing, and aerocapture. Mars-GRAM has been utilized during the aerobraking operations of Mars Global Surveyor [1], Mars Odyssey and Mars Reconnaissance Orbiter. Mars-GRAM has also been used in the prediction and validation of Mars Pathfinder hypersonic aerodynamics [2], the aerothermodynamic and entry dynamics studies for Mars Polar Lander [3], the Mars Aerocapture System Study (MASS) as well as the Aerocapture Technology Assessment Group (TAG).

Mars-GRAM's perturbation modeling capability is commonly used, in a Monte-Carlo mode, to perform high fidelity engineering end-to-end simulations for entry, descent, and landing (EDL) [4]. Mars-GRAM 2005 has been validated [5] against Radio Science data, and both nadir and limb data from Thermal Emission Spectrometer (TES) [6].

From the surface to 80 km altitude, Mars-GRAM is based on the NASA Ames Mars General Circulation Model (MGCM) [7, 8]. Above 80 km, Mars-GRAM is based on the University of Michigan Mars Thermospheric General Circulation Model (MTGCM) [9, 10]. Mars-GRAM and MGCM use surface topography from Mars Global Surveyor Mars Orbiting Laser Altimeter (MOLA), with altitudes referenced to the MOLA constant potential surface (areoid).

References: [1] Lyons, D. T. et al. (1999) *JSR*, Vol. 36, No. 3, 307-313. [2] Gnoffo, P. A. et al. (1999) *JSR*, Vol. 36, No. 3, 367-373. [3] Queen, E. M. et al. (1999) *JSR*, Vol. 36, No. 3, 421-428. [4] Striepe S. A. at al. (2002) *AIAA Atmospheric Flight Mechanics Conference and Exhibit*, Abstract # 2002-4412. [5] Justus C. G. et al. (2005) *53rd JANNAF Propulsion Meeting*. [6] Smith M. D. (2004) *Icarus*, 167, 148-165. [7] Haberle, R. M. et al. (1993) *JGR*, 98, 3093-3123. [8] Barnes, J. R. et al. (1993) *JGR*, 98, 3125-3148. [9] Bougher, S. W. et al. (1990) *JGR*, 95, 14,811-14,827. [10] Bougher, S. W. et al. (1999) *JGR*, 104, 16,591-16,611.