MarsDrop: Getting Miniature Instruments to the Surface of Mars as Secondary Payloads.

Robert L. Staehle[1], Matthew A. Eby[2], Jared J. Lang[2], Jeffrey A. Lang[2], Rebecca M. E. Williams[3], Justin S. Boland[1], Rebecca Castano[1], Marc S. Lane[1], Chris A. Lindensmith[1], Sara Spangelo[1]. [1]Jet Propulsion Laboratory, California Institute of Technology (4800 Oak Grove Drive, Pasadena, California 91109, robert.l.staehle@jpl.nasa.gov), [2]The Aerospace Corporation (2310 El Segundo Blvd., El Segundo, CA 90245, matthew.eby@aero.org), [3]Planetary Science Institute (1700 East Fort Lowell, Suite 106, Tucson, AZ 85719, williams@psi.edu)

Small (~1 kg) instrument payloads could be carried to Mars' surface utilizing the MarsDrop delivery system, based on an architecture that takes advantage of the extra cruise stage mass capability available on most Mars missions[1].

From canyons to glaciers, from geology to astrobiology, the amount of exciting surface science awaiting us at Mars greatly outstrips the available mission opportunities. Whether from the destination risks or just from the significant expense of a traditional Mars lander, the majority of proposed scientific surface missions are eliminated from consideration. By utilizing The Aerospace Corporation's Reentry Breakup Recorder (REBR) entry system already proven at Earth with entry velocities greater than for Mars missions, and adding a parawing for descent and landing that has been tested above the Earth's stratosphere at Mars dynamic pressure and density, a 3 kg entry vehicle can deliver small instruments to targeted locations. Such a vehicle could be accommodated on direct-entry Mars missions for <10 - 20 kg total mass allocation per MarsDrop secondary lander, including the attachment/jettison equipment on the primary cruise stage or launch vehicle upper stage. Depending on orbital parameters, similar mass allocations could accommodate such secondary landers on missions where an orbiter is the primary spacecraft.

CubeSat and SmallSat-class componentry, such as that utilized for JPL's Interplanetary NanoSpacecraft Pathfinder In a Relevant Environment (INSPIRE)[2], Mars CubeSat One (MarCO)[3], and other sources, would provide the needed electrical power, computing, and telecommunications resources to enable surface operations for 90 sols, and potentially much longer.

MarsDrop's small size could enable sterilization of its components, sterile assembly, and encapsulation in a sterile plastic shrink-wrap bag for ground handling. This bio-barrier bag would later burn off during hypersonic Mars entry. As a result, "special regions" on Mars, where the presence of part-time liquid water is possible, could be feasible targets within NASA planetary protection guidelines.

Information about the MarsDrop concept is pre-decisional and is presented for planning and discussion purposes only.

References:

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