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The Biological Oxidant and Life Detection (BOLD) mission: A proposal for a low-cost mission to Mars

Dirk Schulze-Makuch (Washington State University, USA/Technical University Berlin, Germany), Dale Andersen (Carl Sagan Center, Mountain View, USA), Mike Daly (York University, Canada), Alfonso F. Davila (Carl Sagan Center, Mountain View, USA), David Deamer (University of California-Santa Cruz, USA), James Dohm (The University of Tokyo, Japan), Alberto G. Fairen (Center of Astrobiology, Madrid, Spain), Wolfgang Fink (University of Arizona/CalTech, USA), Roberto Furfaro (University of Arizona, USA), Aaron R. Hawkins (Brigham Young University, USA), James N. Head (Raytheon Missile Systems/Planetary Science Institute, USA), Joop M. Houtkooper (Technical University Berlin, Germany), Louis N. Irwin (University of Texas at El Paso, USA), Michael Knoblauch (Washington State University, USA), Darlene S.S. Lim (NASA Ames), Abel Mendez (University of Puerto Rico-Arecibo; USA), Holger Schmidt (University of California-Santa Cruz, USA), S. Kelly Sears (McGill University, Canada), Henry J. Sun (Desert Research Institute, Las Vegas, USA), Hojatollah Vali (McGill University, Canada)

The next step in the exploration of Mars should include a strong and comprehensive life detection component, which can be done in a NASA Discovery-class or ESA Medium-Class budget. We propose a mission called BOLD: Biological Oxidant and Life Detection mission. The scientific objectives of the BOLD mission are to characterize habitability of the Martian surface and to search for evidence of extinct or extant life. In contrast to the Viking mission, which was designed to detect heterotrophic life on Mars, the BOLD mission incorporates a more comprehensive search for autotrophic microorganisms, as well as detecting a variety of biomarkers and understanding their environment. Six penetrator-type miniature landers are envisioned for BOLD that might utilize either an orbital (e.g. Viking) or direct entry (e.g., MER, Phoenix) mission architecture. The number of landers will provide mission redundancy. Preliminary payload planning included a Mars Soil Analyzer, a Multispectral Microscopic Imager, a Nanopore-ARROW that detects biopolymers with single molecule resolution, an Atmospheric Structure and Surface Environment Instrument, a Fluorescent Stain experiment, and a Chirality experiment (Schulze-Makuch et al., 2012, *Planetary and Space Science* 67, 57–69). A terrain navigation system, coupled with robust propulsion, permits a landing accuracy on the order of meters if required to meet the science objectives. The probes will preferably use existing orbiters for communication relay to keep mission costs low.