Mars Exploration Programmme and Sample Return Missions
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Mars Aerobot Micromission

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Overview: The *Mars Aerobot Micromission* is almost a factor of 10 smaller than earlier concepts for a Mars balloon. A key goal is to achieve high payload mass fraction in a small total systems mass and to maximize the scientific potential of that payload. Scientific objectives include studies of the surface with a high resolution stereo imaging magnetometer and investigations of the structure and dynamics of the atmosphere with an *in situ meteorology payload.*

Mission Description: The balloon system is planned for delivery to Mars as a small piggy back mission from a French Ariane 5 launch vehicle to geosynchronous transfer orbit (GTO). The balloon will be deployed by parachute from the aeroshell at an altitude of about 7 km on Mars and inflated over the course of a few minutes as the parachute descends. During the ensuing mission, which may range in duration from one week to several weeks, the balloon and its payload will circumnavigate the planet at least once. Data will be transmitted to a Mars orbiter and relayed to Earth.

Technologies: The mission will use capabilities developed in a number of ongoing technology development programs and ground based aerobot technology validation activities.

- Technologies for Ultra Long Duration Balloons (ULDB) for Earth's stratosphere developed with NASA Code S support by the NASA GSFC Wallops Flight Facility will be incorporated through an ongoing JPL/GSFC collaborative activity
- Ground based validation of deployment and inflation and superpressure balloon technologies for a Mars Aerobot Technology Experiment conducted in the Mars Aerobot Validation program (MABVAP) program. This program, the subject of a companion paper, validates those key technologies that can be tested in the Earth's environment.
- Technologies for miniaturized sensors, space computers and low temperature survivable power systems that have been developed in the Mars Exploration Program, in New Millennium DS-2 and in MUSES C.
- Technologies for autonomous position determination and path prediction and modeling and simulation developed at JPL.

Science Observations: From its vantage in the atmosphere and by traversing several tens of thousands of kilometers over the surface of Mars, the *Mars Aerobot Micromission* will acquire surface observations and meteorological observations.

Surface Observations: The surface observations from the *Mars Aerobot Micromission* will include:

- unique observations of remnant magnetic in the Martian surface using a microminiaturized magnetometer. Remnant magnetism was discovered on Mars in late 1997 by the Mars Surveyor orbiter. The Mars aerobot measurements will be at much higher resolution and exploit the low altitude(<5km) and the long ground-track profile (>10,000km) of the aerobot and cannot be replicated by either orbital or surface platforms.
- high resolution stereo imaging observations of features beneath the ground track with 10 times higher resolution than is feasible from orbit. These measurements will be used to identify potential habitats where evidence of past life can be found and to characterize hazards on the surface that would be encountered for future lander and sample return missions.
- electromagnetic sounding of the subsurface at low frequencies to characterize the stratigraphy and search for evidence of water in the subsurface layers.

Atmospheric Observations: The *Mars Aerobot Micromission* will measure pressure, temperature and cloud properties. These measurements will be used to characterize:

- fluctuations in air mass properties such as temperature, water vapor concentration, vertical velocity, cloud and dust particle properties) and radiation field properties on meter length scales and 10-to-100 second time scales.
- temporal correlations among measured fields which are diagnostic of atmospheric waves, convection, and other small-scale phenomena.
- diurnal changes in the atmosphere containing key information about how local energy transport mechanisms change with time-of-day
- Balloon trajectory will provide *in situ* data on general circulation of the atmosphere
- Potential flight opportunities for the Mars Aerobot Micromission will occur in the 2003, 2005 and 2007 Mars opporunities.

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