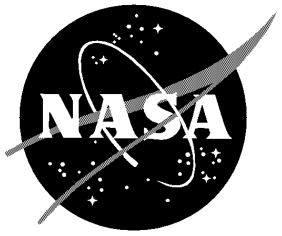

National Aeronautics and Space Administration

June 18, 1999
AO 99-HEDS-01

ANNOUNCEMENT OF OPPORTUNITY

MARS SURVEYOR PROGRAM 2003 LANDER MISSION & MARS 2005 DEFINITION STUDIES PREPARING FOR HUMAN EXPLORATION OF MARS

Office of Life and Microgravity Sciences and Applications and
Office of Space Flight
National Aeronautics and Space Administration
Washington, DC 20546-0001

Letters of Intent Due: **July 9, 1999**
Proposals Due: **August 17, 1999**

OMB Approval No. **2700-0042**

ANNOUNCEMENT OF OPPORTUNITY

Mars Surveyor Program 2003
Lander Mission and Mars 2005 Definition Studies:
Preparing for Human Exploration of Mars

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1.0 DESCRIPTION OF THE OPPORTUNITY

1.1 Introduction

The National Aeronautics and Space Administration (NASA) has established goals for human exploration of space which are documented in the NASA Strategic Plan. These goals, as part of the NASA Human Exploration and Development of Space Enterprise (HEDS) include:

- Prepare to conduct human missions of exploration to planetary and other bodies in the solar system
- Use the environment of space to expand scientific knowledge
- Provide safe and affordable human access to space, establish a human presence in space, and share the human experience of being in space
- Enable the commercial development of space and share HEDS knowledge, technologies, and assets that promise to enhance the quality of life on Earth

Furthermore, the HEDS Enterprise supports the following goals, which NASA has established as part of a roadmap for astrobiology:

- Understand how life evolves on the molecular, organism, and ecosystem levels
- Determine what makes a planet habitable and how common these worlds are in the universe
- Determine how to recognize the signature of life on other worlds
- Understand the response of terrestrial life to conditions in space and other planets

The HEDS Enterprise and the Space Science Enterprise (SSE) within NASA have agreed to collaborate in a long-term systematic program of robotic exploration to Mars in support of their respective strategic goals.

This program, the Mars Surveyor Program (MSP) is a sustained series of missions to Mars, each of which will provide important, focused scientific return. Up to two launches will take place approximately every 26 months (every launch window opportunity). In addition, a series of micromissions are planned which will provide opportunities for low-cost, focused research. These missions will play a critical role in acquiring knowledge through the conduct of science investigations and the demonstration of critical technologies necessary to make a decision early in the next century to initiate the human exploration of Mars.

It is expected that during the 2003 opportunity, a mission will be launched to the surface of Mars whose goals will be to:

- Perform *in situ* investigations on a fixed lander
- Perform science investigations on a mobile rover
- Collect a cache of soil, rock, and atmospheric samples
- Launch sample cache into Mars orbit for retrieval by a subsequent mission

In 2005, several potential mission opportunities exist. The first is a mission to the surface of Mars, which will have the same integrated HEDS/SSE goals as the 2003 mission. The second is a mission to the surface of Mars, which will be dedicated to HEDS goals. Micromissions, which address HEDS objectives, are a third type of mission opportunity.

This Announcement of Opportunity (AO) solicits proposed investigations for the MSP 2003 Lander Mission and definition studies for the 2005 mission opportunities. The theme for the these investigations is "Preparing for Human Exploration of Mars".

1.2 Announcement Objectives

NASA announces an opportunity to propose investigations to be carried to the surface of Mars by the MSP 2003 Lander Mission. These investigations will require instrumentation to be placed on a fixed lander platform in order to address scientific investigations of the radiation environment, physical properties of bulk soil and dust (atmospheric and surface), and fundamental biology. Instruments will also be solicited to demonstrate *in-situ* resource utilization technologies. These investigations will be carried out in addition to the primary Space Science Enterprise mission objectives for Mars sample return.

NASA announces an opportunity to propose definition studies for the mission opportunities in 2005. These opportunities include lander investigations similar to the 2003 opportunity, micromissions, and a dedicated HEDS lander mission. These definition studies should address potential flight experiments for HEDS specific Mars exploration goals.

1.3 Availability of AO Documentation

This Announcement is available electronically via the World-Wide-Web at:

http://peer1.idi.usra.edu/peer_review/ao/99_HEDS_01.html

Paper copies of this AO are available to those who do not have access to the Internet by calling (202) 358-4180 and leaving a voice mail message. Please request AO 99-HEDS-01 and leave your full name and address, including zip code and telephone number with area code.

Questions regarding this Announcement may be directed to:

Peter Ahlf
Code UL
NASA Headquarters
Washington, DC 20546-0001
USA
Facsimile: 202/358-4168
e-mail: peter.ahlf@hq.nasa.gov

A Proposal Information Package (PIP) provides detailed background information on the Mars Surveyor Program 2003 Lander Mission that will be needed for the preparation of a formal proposals designated for the Mars 2003 mission. The PIP contains the Technical Descriptions and Instrument Interface Definitions for the MSP 2003 Lander Mission PIP is available electronically through:

http://peer1.idi.usra.edu/peer_review/ao/99_HEDS_01.html

Paper copies of the PIP and further information on access procedures may be obtained from:

Mr. Robert Manning
Mail Stop 264-426
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099
USA
Facsimile: 818/393-6800
e-mail: robert.m.manning@jpl.nasa.gov

No detailed information regarding the 2005 lander opportunities is available at this time. However, proposers may assume that a 2005 lander (including a 2005 lander dedicated to the HEDS enterprise) will conform to the same specifications as the 2003 lander.

Questions regarding clarification of items in the PIP should be submitted in writing or electronically to Mr. Robert Manning at the above address. Responses to inquiries received will be available electronically at the ftp site shown above.

1.4 Availability of Reports Referenced In This AO

The following reports and web sites are relevant to this AO and are available electronically at:

http://peer1.idi.usra.edu/peer_review/ao/99_HEDS_01.html

or through the Internet addresses provided below:

- NASA Mars Web Site **http://www.hq.nasa.gov/office/oss/mars.htm**
- Astrobiology Roadmap **http://astrobiology.arc.nasa.gov/home.html**
- Human Exploration of Mars: The Reference Mission of the NASA Mars Exploration Studies Team **http://www-sn.jsc.nasa.gov/marsref/contents.html**
- NASA Document NPG 8020.12B, titled "*Planetary Protection Provisions for Robotic Extraterrestrial Missions*" **http://nodis.gsfc.nasa.gov/Library/Directives/NASA-WIDE/Procedures/Program_Management/N_PG_8020_12B/contents.html**
- MSP 2001 Mars Environmental Compatibility Assessment (MECA) Project Web Site **http://mars.jpl.nasa.gov/2001/lander/meca/pubsplash-3.htm**
- Feasibility and Concept Design Studies for Mars Microspacecraft Bus **http://peer1.idi.usra.edu/peer_review/ao/99_HEDS_01.html**
- Deep Drill System (DEEDRI) for Mars Surveyor Program 2003 (Subsystem Proposal Information Package) **http://ars.rm.asi.it/~webars/bandi/ao3.html**

1.5 Letter of Intent and Proposal Submission Information

Letters of Intent To facilitate proposal processing, potential Principal Investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a ***letter of intent (LOI) to propose by July 9, 1999 by 4:30 PM Eastern Time.*** The letter of intent, which should be no more than two pages, should contain:

- The name, address, and telephone number of a single principal investigator and the names and affiliations of all co-investigators

- Identification of the research emphasis described in this Announcement that is most closely aligned with your proposal
- A descriptive title of the research or technical proposal
- A brief yet thorough summary describing the proposed research
- The major participating institutions
- Up to six (6) key words that best describe the research area of the pending proposal

LOIs should be submitted via the WWW at:

http://peer1.idi.usra.edu/expro/loi/AO99_HEDS_01_loi.cfn

If you do not have access to the WWW, you may submit an LOI via email to:

loi@hq.nasa.gov

The subject heading of the e-mail message should read "LOI AO 99-HEDS-01." If you do not have access to e-mail, you may submit an LOI by U.S. Postal Service or commercial delivery to the same address listed for proposals.

Proposals An original signed proposal, plus twenty-five (25) complete copies of that proposal and a 3.5-inch computer disk (containing an electronic copy of the Principal Investigator's name, address, telephone and fax numbers, e-mail address and the complete project title and abstract, as provided on Form B) in either Macintosh or PC format ***must be received by August 17, 1999 by 4:30 PM Eastern Time*.**

Proposals and Letters of Intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA
c/o Information Dynamics, Inc.
SUBJECT: MSP 2003/2005
300 D Street, SW
Suite 801
Washington, DC 20024
USA

Proposals and Letters of Intent hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between the hours of 8:00 AM and 4:30 PM Eastern Time. The telephone number, (202) 479-2609, may be used when required for reference by delivery services.

Note that Information Dynamics, Inc. (IDI) cannot receive deliveries on Saturdays, Sundays, or federal holidays.

1.6 Schedule for Proposal Submission and Selection

Announcement of Opportunity Release	June 18, 1999
Letter of Intent to propose due	July 9, 1999
Proposal submittal due by 4:30 p.m. Eastern Time	August 17, 1999
Announcement of Selections (target)	November 1999
Award of funding (target)	November 1999

2.0 MISSION OVERVIEW

2.1 MSP 2003 Lander Mission Overview

The Mars Lander, attached to a Cruise Stage, will be launched on a Delta-class launch vehicle in May 2003 and is expected to arrive at Mars in December 2003. The Lander descent to the surface will be slowed initially by an aeroshell and then by parachute. Final descent will be controlled by an active terminal descent system that uses propulsion similar to the Mars 2001 Lander. It is expected that the nominal landing accuracy will be approximately 10 km, three-sigma.

The primary engineering considerations for selection of the landing site for the Lander is site elevation and solar illumination (which determines power availability and thermal control needs) and thus determines the possible range of landing site latitudes. Based on these considerations, the landing site will tentatively be limited to sites less than approximately 2.5 km above the mean Martian datum, and within a 20 degree band of latitude to be selected between the latitudes of approximately 15 degrees South and 15 degrees North.

The specific landing site will be tentatively selected prior to launch. This selection will be based primarily upon the requirements of the selected Mars Sample Return science investigations and within the engineering constraints outlined above. Investigators selected as a result of this Announcement may participate in the site selection process through the Project Science Group. In addition, it is expected that prior to the launch of the MSP 2003 Lander, present knowledge of Mars will have been improved considerably by analyses of scientific data to be returned by the Mars Pathfinder, Mars Global Surveyor, Mars 1998, and Mars 2001 Missions. Thus, the final selection by NASA of the landing site for the 2003 Lander Mission will also be based on the most current knowledge of Mars that exists at that time.

The 2003 Lander Mission will provide high resolution imaging of the selected landing site and the immediate vicinity during its descent to the Martian surface. In addition the Lander Mission will provide a platform for surface environmental measurements in radiation, soil and dust, and biology as well as serving as a platform for demonstration of several key components of an *in situ* propellant production facility. The Lander will communicate directly with Earth via X-Band to Earth and possibly by a 2003 orbiter UHF relay. The 2003 Lander is expected to survive on the Martian surface for approximately 90 Martian sols (approximately equal to 90 Earth days).

At that point, the Mars Ascent Vehicle (MAV) which contains the collected Martian samples will ascend from the lander and the resulting launch energy may end the lander mission. There is a possibility, but not a guarantee, that the lander may survive the MAV launch and that the lander mission will continue beyond 90 Martian sols.

2.2 Mars 2005 Mission Overview

Another launch window for missions to Mars will open in 2005, which will present additional opportunities for HEDS investigations. While the specific opportunities which HEDS will target have not been finalized, options include experiments on Lander missions similar to the 2003 Lander Mission, experiments on a lander dedicated to the HEDS enterprise, and “micromissions”.

Micromissions are small “piggyback” spacecraft, which are placed into geosynchronous transfer orbit by a launch vehicle such as the Ariane 5. These payloads may be delivered into Mars orbit or into the atmosphere. NASA plans to develop a common micromission spacecraft bus, including its own propulsion system, which will allow a variety of payloads to be delivered independently to Mars. Each spacecraft will be capable of delivering up to a 40kg payload directly into the Mars atmosphere or a 10kg payload into orbit around Mars.

Additional information on micromissions can be accessed at

http://peer1.idi.usra.edu/peer_review/ao/99_HEDS_01.html

Examples of potential Mars micromissions include:

- Penetrator studies of surface and subsurface chemistry
- Networks of sensors for geological and climatological studies
- Soft landers for local imaging and mineralogy
- Deployment of aerial platforms ("Mars airplanes")
- Small orbiters for magnetic field studies, telecom relay, etc.

The NASA Space Science Enterprise is planning a MSP 2005 Lander Mission. This mission will be identical in capability and will have the same general SSE/HEDS objectives as the MSP 2003 Lander Mission. In addition, NASA's HEDS Enterprise is considering the possibility of an additional 2005 Lander Mission, utilizing the same lander design as the MSP 2003 Lander Mission, but dedicated to HEDS objectives. The 350 kg payload capability of a lander could be used for a dedicated HEDS payload.

The HEDS enterprise views the 2005 missions as an opportunity to pursue science and technology demonstrations which require additional development time or greater resources that those available for the 2003 Lander mission.

3.0 TYPES OF PROPOSALS

3.1 General

This Announcement invites Principal Investigator/Instrument/Research Team Proposals for the MSP 2003 Lander Mission and for Definition Study Proposals for Mars 2005 Mission Opportunities. All proposals submitted in response to this AO are to be prepared and submitted in accordance with the policies and provisions of Appendices A, B, and C of this AO.

Proposers must explicitly state whether the proposal is for a MSP 2003 Lander Mission Principal Investigator/Instrument/Research Team or a Mars 2005 Definition Study on Form B (See Appendix C).

3.2 MSP 2003 PI/Instrument/Research Team Proposals

The principal objectives of the Lander Mission and its payload are to:

- Deliver the Rover and its scientific payload safely to the Martian surface
- Provide high spatial resolution descent imaging of the selected landing site and its immediate vicinity for use in site analyses
- Provide for transfer of samples from the Rover to a Mars Ascent Vehicle
- Launch the collected Mars samples to Mars orbit using the Mars Ascent Vehicle

and, by virtue of investigations and studies selected through this Announcement, to:

- Conduct *in situ* investigations aimed at identifying possible evidence of past or present life on Mars
- Conduct technology demonstrations to characterize the performance of processors and hardware that are important to *In situ* Resource Utilization (ISRU) processes and to demonstrate the use of ISRU products
- Measure the neutron spectra on the surface of Mars
- Define and determine the relationships between the aeolian transport of surface materials, atmospheric instability, atmospheric electrical phenomena, geoelectrical factors such as Paschen discharge and ionization, and surface mineralogy of soil and dust and their effects on humans and machines

Manipulation systems are planned for the Lander that will provide samples for return to Earth in addition to samples collected by the Rover. Proposers requiring soil samples may assume that these devices will be able to provide samples to their payload, or they may include sampling mechanisms within their proposed instrument package. If the manipulation system on the Lander is to be used as the means of acquiring samples for a Lander investigation, a description of the manipulator-instrument interaction must be provided. A description of an Italian Space Agency provided drill system can be found at:

http://ars.rm.asi.it/~webars/bandi/ao3.html

In the event that unique sample characteristics, deployment devices, sampling mechanisms, or other devices necessary for the proposed instruments to accomplish their measurements are required, they must be identified as part of the proposed payload instrument. Because such devices significantly affect the basic design and function of the Lander, the MSP 2003 Project expects to provide guidance in their development and integration.

The Proposal Information Package (PIP) provides a detailed description of the basic Lander vehicle that will provide the platform for these investigations.

3.2.1 Fundamental Biology Investigation Objectives

Proposals are being solicited for *in situ* studies aimed at identifying possible evidence of past or present life on Mars. Appropriate proposals will use sensors or analytical tools to detect signatures of life, such classes of complex organic compounds or their degratory products. Only studies using existing technologies or instrumentation that require limited modification to be accommodated on the lander or that can be developed and deployed within the financial constraints described in this announcement will be considered.

3.2.2 *In situ* Resource Utilization Investigation Objectives

Two elements of *In situ* resource utilization (ISRU) include *In situ* propellant production (ISPP) and *In situ* consumables production (ISCP).

ISPP, the ability to manufacture propellant on the Martian surface utilizing the Martian atmosphere, provides a significant benefit in terms of reduced launch mass. Prior to conducting a mission that relies on the *in situ* production of propellant, it is important to demonstrate that the key technologies can operate effectively on the Martian surface for the appropriate periods of time. In addition to propellant production, ISCP for life support processes, is important in terms of both

cost and risk reduction for initial human missions. For life support, the collection of gases and water are the most critical processes to be advanced.

ISRU technology demonstrations will allow us to answer critical questions and develop confidence in the use of these processes to support human missions. They will allow us to characterize processes and the performance of hardware which are important to ISPP and ISCP concepts and which interact with the Mars environment during operation.

ISPP technology (CO_2 acquisition and O_2 generation) will first be tested on the Mars 2001 lander. Proposals are solicited which build upon the component level technology demonstrations of the 2001 ISPP experiment, and involve "end-to-end" system-level demonstrations of ISPP and ISCP processes, including acquisition of resources, chemical processing, storage of products, and demonstration level use of the products. Proposals for end-to-end demonstrations, which can meet the constraints for the 2003 Lander Mission, are encouraged. However, recognizing the challenge of such a demonstration within the resources available on the lander, proposals for scaleable demonstration of the components of an ISPP plant are also encouraged.

Many concepts for ISPP involve elements, which are common or synergistic to those for ISCP, such as CO_2 acquisition and O_2 production. Proposals for ISPP, which highlight such synergistic concepts, are strongly encouraged. Furthermore, proposals for ISCP specific demonstrations, such as buffer gas (nitrogen and argon) or water extraction are solicited. Such proposals may be independent or may be part of an integrated ISRU proposal. In cases where such ISCP demonstrations are included with an ISPP proposal, the proposal should be structured in a way that allows NASA to evaluate the merits of the ISPP and ISCP elements independently. In particular, costs associated with the ISPP and ISCP elements of an integrated ISRU proposal must be clearly distinguishable and must meet the budget constraints identified in Section 6.1 of this AO.

3.2.3 Radiation Environment Investigation Objectives

At present, one of the major components of the radiation environment at the surface of Mars is predicted to be the presence of significant numbers of neutrons, both directly incident from nuclear interactions of space radiation in the Martian atmosphere and back-scattered from Martian soil. The contribution of the back-scattered neutrons is predicted to peak in the energy range of a few MeV to tens of MeV. An instrument to measure charged particle spectra and obtain dose information for the Mars surface, MARIE, is part of the Mars 2001 mission, and methods to relate the information obtained in different Mars Precursor Missions to the results of these measurements (and to each other) are required.

Accordingly, proposals for instrument packages to measure neutron spectra are encouraged. The instruments should have the capability to distinguish neutrons from charged particles (or other confounding sources of background signals). Discrimination against charged particles is likely to require some degree of identification (whether they are protons or heavier nuclei). Hence, proposals are encouraged to provide particle identification data that can be correlated with MARIE data expected from the Mars 2001 mission. The ability of instrument packages to profit from NASA experience with MARIE will be considered favorably.

Instrumentation packages should be able to measure neutron energy in the range of several MeV to several tens of MeV. Proposals demonstrating a capability to cover a broader energy range are encouraged. Proposals should provide information demonstrating that appropriate energy resolution can be attained. The detection efficiency of the instruments needs to be well characterized, both by calculation and by ground-based measurements, to ensure that numbers of neutrons in each energy interval are known with appropriate statistical significance. The ability to obtain information on the source of the neutrons (depth in soil, atmosphere) is a strongly desirable

feature and therefore provisions for assessing direction of incidence of the neutrons are encouraged.

Proposals are required to provide convincing evidence that the neutron dose, dose rate, dose equivalent, and dose equivalent rate is likely to be obtained, either by direct measurement or by verifiable calculations. The results should be easily comparable with data expected from MARIE.

A degree of autonomy in the instrument packages, that would enable data acquisition during the cruise phase of the mission, will be considered favorably, to the extent that surface measurements and cost and resource constraints are not compromised.

All proposals should contain sufficient design data (i.e., charge and energy resolution, detection efficiency, angle of incidence, etc.) to provide a clearly understandable assessment of the statistical significance of the expected experimental results.

3.2.4 Soil, Dust, and Environmental Interaction Investigation Objectives

The objectives for this AO emphasize the relationship between the aeolian transport of surface materials, atmospheric instability, atmospheric electrical phenomena, and geoelectrical factors such as Paschen discharge and ionization and their effects on human and machines.

With regard to both hazards to humans and geological processes, the surface of our own planet is dominated by an integrated hydrological-meteorological system. Water and wind control most hazardous events on Earth, and the ability to predict the timing and ferocity of these events is important to the preservation of human lives, property, and culture.

Mars, however, has a completely different system from Earth. From what we know of the planet, there are also potential threats from atmospheric activity such as high winds, dust-laden winds (dust storms), and possibly strong local atmospheric vorticity. There is no hydrological system on Mars to interact with the meteorology, but Mars has its own equivalent atmospheric partners: dust and electrical effects. Dust loading in intense storms may be extremely hazardous to humans and machines. So too will be the potential electrical phenomena associated with weather features such as electrical discharges, which may make up in ubiquity what they lack in voltage.

It is clear that the surface of Mars should be regarded as having a meteorological-aeolian-geoelectrical system, constituted by an integrated dynamic interdependence of a large suite of physical, electrical, and chemical phenomena. As a result, emphasis is placed on approaches that attempt to understand relationships between phenomena, rather than isolated individual measurements.

Specific Objectives include:

Meteorological Hazard Detection

- Detect distant approaching dust storm systems; characterize the processes active in these storms in terms of the associated wind speeds, pressure changes, atmospheric dust loading and electrical discharging; determine how these characteristics can be used to betray their approach
- Detect local atmospheric vorticity and associated electrical activity in terms of frequency of local “dust devil” development, quantity of dust lofted, associated wind speeds, and whether they carry significant electrical charge levels

- Detect atmospheric charging (with or without dust load) under quiescent conditions, related to charge separation from settling dust, where different sizes have different charges, that could ultimately lead to electrical discharges
- Develop a basic meteorological package to measure temperature, pressure, wind speed and direction and electrometry

Geoelectrical Phenomena

- Mechanics of Dust Electrification
  - Determine the extent of the dust electrification in the Martian environment resulting from triboelectrification, ionization and charging due to Stokes separation, leading to an understanding of the mechanics and consequences of dust electrification such as dust adhesion to surfaces and dust cohesion into aggregates
  - Determine the atmospheric electrification due to turbulent motion in dust clouds and dust storms; determine the population of atmospheric ions and whether there is a diurnal variation; determine what types of discharges occur on Mars
  - Determine the electrostatic charge state (magnitude, sign, and longevity of charges) for both aerosols and soil particles up to 100 microns
  - Determine Paschen curves (electrical breakdown in gases) for Mars as a function of temperature, pressure, wind, dust load in atmosphere, and season for meteorological use and as a tool for designing and safeguarding equipment for Mars exploration
- Bulk Subsurface and Particulate Electrical Phenomena
  - For the bulk subsurface to a minimum 10 meters, determine the electrical grounding properties and stability for mechanical loading by measuring the conductivity, resistivity, dielectric constant, and piezoelectric properties

3.3 Mars 2005 Definition Study Proposals

Mars 2005 definition study proposals may address any of the following:

- Development of innovative instrument concepts
- Mission and systems analysis
- Advanced development of instrumentation technologies
- Ground-based research involving simulations of the Mars environment

Mars 2005 Definition Studies will be funded for a two year period and shall not exceed $150K per year for each funded study. Specific HEDS objectives for missions to Mars in the 2005 timeframe are described in Sections 3.3.1 - 3.3.4.

3.3.1 Fundamental Biology Study Objectives

Ground-based definition studies are being solicited to provide a scientific and technical foundation for possible flight experiments on the Mars 2005 mission. Of particular interest are studies in the following areas:

- Examination of the response of terrestrial organisms (e.g. microbes, simple multi-cellular organisms), to a simulated Martian environment to determine 1) if exposure to the Martian environment results in changes that could have deleterious effects on crew health and/or the spacecraft environment 2) if exposure to the Martian environment results in fundamental changes to biological processes
- Examination of the response of terrestrial organisms or biomolecules to a simulated Martian environment in order to identify organic signatures that could be used to guide the search for evidence of past or present life on Mars.

· Technologies to support flight studies in these areas

3.3.2 *In situ* Resource Utilization Study Objectives

Definition study proposals for a water production technology demonstration are solicited. An integrated analysis of data (available and planned environmental water measurements on atmospheric humidity, subsurface water and adsorbed water in the soil) with concept development for a water extraction or production demonstration package is strongly encouraged.

Study proposals are also solicited for advanced innovative *In situ* Propellant Production (ISPP) and *In situ* Consumables Production (ISCP) processes which may include the use of any of the Mars resources, new methods of acquiring these resources, innovative chemical processes, product storage technologies, and methods to measure and demonstrate the quality of the ISPP/ISCP products.

3.3.3 Radiation Environment Study Objectives

Mars 2005 mission opportunities will allow the extension of measurements of the type performed in 2001 and 2003. Coverage of a wider energy range for neutrons, improved statistics and higher accuracy are desirable features of such measurements, but the major objective is an assessment of the variation of the radiation environment over the solar cycle. For this reason, studies are encouraged that would lead to long-duration measurements (e.g., by means of autonomous instrument packages that could be deployed independently on the Martian surface and that would be capable of operating for 2-3 years). Such studies would be aimed primarily at a better understanding of Solar Particle Events. Proposals would be expected to demonstrate a capability to interface with existing solar observation platforms and to contribute to the results obtainable with them. For this reason, instrument designs need to include charged particle and solar plasma characterization.

3.3.4 Soil, Dust, and Environmental Interaction Study Objectives

Definition studies for additional characterization of the soil/dust are solicited. Surface state (not bulk) mineralogy such as the surface energy, electrostatic charge, reactivity, ionic populations and absorbed chemical species as well as grain size analyses are of interest. The relationships between these physical characteristics and the effect they have on machinery and the human body is of primary importance.

4.0 FUTURE SOLICITATIONS

Following the selection of investigations solicited by this AO, NASA may solicit for Interdisciplinary Scientist proposals and for Participating Scientist proposals for the MSP 2003 Lander Mission. Both Interdisciplinary and Participating Scientists would be expected to use data acquired by the MSP 2003 Lander Mission to assess the readiness for a decision by NASA to initiate the human exploration of Mars, and identify the additional knowledge from Mars robotic missions that is needed for planning human missions to Mars.

NASA also expects to solicit proposals through one or more future Announcements for Mars 2005 mission opportunities. These Announcements may be for micromissions or for Lander mission opportunities. All HEDS sponsored investigations for Mars 2005 PI/instrument/research teams will be selected through these future Announcements; the award of a Mars 2005 Mission Definition Study to an investigator **will not** guarantee selection for these opportunities.

5.0 FORMATION OF PROJECT SCIENCE GROUP

After selection of investigations by NASA, a MSP 2003 Project Science Group (PSG) will be established. All 2003 Principal Investigators selected through this AO as well as PIs for the SSE rover science will automatically become members of the PSG. The PSG will be co-chaired by the MSP 2003 Project Scientist at the Jet Propulsion Laboratory and the NASA Headquarters Program Scientist.

The PSG will meet regularly through the lifetime of the MSP 2003 Lander Mission, and will work with the Mars Surveyor 2003 Project Office.

6.0 CONSTRAINTS AND REQUIREMENTS

Certain constraints are mandated by NASA's commitment to cost efficiency in the MSP 2003 Missions. The cost constrained nature of the missions required that the integrated lander payload will be limited by available resources of funding, mass, total energy consumption, volume, data rate, duty cycle, and other key resources as specified in the PIP.

The PIP contains descriptions of the MSP 2003 Lander, and also contains information on the environments in which the instruments are expected to survive and operate, Principal Investigator (PI) responsibilities and deliverables, and a description of the capabilities of the MSP ground system and mission operations. In case of a conflict between this AO and the PIP, the AO takes precedence.

Costs of meeting planetary protection for the Lander payloads, with requirements given in the PIP, must be included by proposers in the instrument payload costs. Briefly, planetary protection requirements depend on the specific mission. The Lander payload will be required to achieve and maintain a reduced level of microbial contamination. Information on planetary protection and its requirements are available from NASA Document NPG 8020.12B (for information on accessing this Document, see Section 1.4).

6.1 Constraints on Cost and Mass

(MSP 2003 PI/Instrument/Research Team Proposals Only)
The total mass available for experiments selected through this Announcement is approximately 40 kg. The total mass available for the ISRU payload is 20 kg. The total mass available to the remaining payloads (fundamental biology; radiation environment; and soil, dust and environmental interactions) is 20 kg. Specific allocations to these areas are not being given, however, proposals for experiments with a mass less than 7 kg are strongly encouraged.

Experiments that can be accommodated within the smallest experiment volume and mass will provide the greatest flexibility to NASA for selection through this solicitation. Experiments that require minimal power and do not require continuous power provide similar flexibility to NASA.

Maximum funding available for the MSP 2003 Lander Mission objectives solicited by this AO is shown in the table below. These values do not include funding for the experiment operations phase.

	FY 00	FY 01	FY 02	FY 03	Total
Fundamental Biology	$0.4M	$0.8M	$0.7M	$0.3M	$2.2M
ISRU	$5.2M	$7.9M	$5.6M	$1.7M	$20.4M
ISPP	$4.7M	$6.6M	$4.3M	$0.8M	$16.4M
ISCP	$0.5M	$1.3M	$1.3M	$0.9M	$4.0M
Radiation Environment	$0.5M	$1.5M	$1.5M	$0.5M	$4.0M
Soil, Dust, and Environmental Interaction	$2.0M	$2.5M	$2.5M	$1.5M	$8.5M

6.2 Experiment Operations Phase

(MSP 2003 PI/Instrument/Research Team Proposals Only)
MSP 2003 PI/Instrument/Research Team proposals should include budgets for Phase E and describe expected activities in the following areas: 1) science operations; 2) generation, validation, and archiving of Data Products; and 3) data analysis activities leading to publication of the initial results of their investigations. Phase E of the Lander Mission extends from May 2003 through May 2005. Selection of an investigation does not imply a commitment for Phase E funding at the budget level submitted by the selected investigator. Phase E budgets for Principal Investigators selected for the MSP 2003 Missions will be negotiated with the Mars Surveyor Operations Project (MSOP).

6.3 Science Operations Site Requirements

(MSP 2003 PI/Instrument/Research Team Proposals Only)
It is expected that MSP 2003 Lander Mission PIs will develop and maintain a science operations facility that will provide instrument performance assessment and data records assimilation and archiving. In addition, Lander PI's will provide instrument command generation and transmission to the Project Database.

To enable these activities, the MSOP will provide to each PI a Science Operations and Planning Computer (SOPC) complete with operations compatible software, connectivity, and maintenance. In addition, Internet connections to each Co-I for data records transfer will be supplied. Implementation of science operations facilities in time to support spacecraft/instrument testing will be monitored by the MSOP Science Office by means of reviews, documentation, and configuration control.

6.4 Data Analysis, Archiving and Publication

(MSP 2003 PI/Instrument/Research Team Proposals Only)
The MSP 2003 Project requires that raw data, calibration records, and processed data be

maintained in an updated form throughout the period of investigation. Specifically, each selected PI must plan to:

- Maintain a continually updated record of the "best version" of the data until meaningful changes in data calibration no longer occur
- Make updated data records available to other investigators and project personnel during the mission for shared analysis
- Support the timely processing and [distribution of data]

Initial data analyses will be accomplished by the PIs and their Co-Is. Proposers are expected to include, as part of their proposed Mission Operations and Data Analysis activities, an appropriate data analysis period that is consistent with archiving activities. In summary, the investigation team will be responsible for initial analysis of the data, its subsequent delivery for archiving and reports, and the publication of initial scientific findings. The investigation team is expected to define a set of archival Data Products and provide timely delivery of the Data Products according to the Science Data Management Plan.

As part of this process, investigators selected as a result of this AO must provide NASA with two Reports:

- A “quick-look” report of preliminary results, due approximately 30 days following conclusion of Lander operations
- A final report containing all information on the investigation, due approximately one year following conclusion of Lander operations

Both reports must include a statement of hypothesis, how the hypothesis was addressed, results of the investigation and the application of that knowledge to future space missions or for Earth benefits in the forseeable future in layman’s English as well as a technical version of the report.

6.5 Approaches to Reducing Instrument and Instrument Operations Costs

(MSP 2003 PI/Instrument/Research Team Proposals Only)
Because of the firm overall limitation on the science costs and the total costs to NASA of Mars missions, prospective investigators are encouraged to seek innovative approaches to reducing both instrument and instrument operation costs, and also the resources required from the Lander.

Investigators are encouraged to reduce costs by proposing instrument suites that integrate a set of instruments, which address several, or all of the primary scientific specified in this announcement. Another approach to U.S. (NASA) cost savings, which proposers are also encouraged to investigate, may be to share payload development costs through collaboration with other government agencies or with private industry, or through international collaboration.

6.6 Technical Approach Requirements

(MSP 2003 PI/Instrument/Research Team Proposals Only)
The proposal must address all technical aspects of the investigation from the beginning of funding through delivery of the data for archiving and the publication of results in the peer-reviewed literature. Proposers are encouraged to propose innovative processes, techniques, and activities to accomplish these objectives and to demonstrate cost, schedule, and technical efficiencies.

The PI is responsible for the scientific success of his/her investigation, whether a single instrument or integrated payload. The proposal must describe the technical approach the PI plans to take for every element of his/her investigation to ensure that the investigation does not go out of the bounds

of the resources available including cost, that the payload will operate reliably, and that the data can be interpreted.

6.7 Education and Public Outreach

(MSP 2003 PI/Instrument/Research Team Proposals Only)
Mars robotic missions represent an opportunity for NASA to use knowledge gained from its exploration of Mars to increase the science, technology, and mathematics literacy of students and of the American public. Therefore, proposed investigations must include activities that will make significant and measurable contributions to enhance the level of understanding and awareness of Mars exploration. Such public outreach may be accomplished through:

- Education activities, which might include substantial participation in the investigation by teachers and students, and the development and utilization of programs that would involve educational institutions at any level in the investigation
- Public information programs that will inform the public by mass media or other means, or other innovative ideas for bringing planetary science to the public

This plan will be judged as part of the Evaluation criteria.

7.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

7.1 Evaluation Criteria

The fundamental aim of the NASA investigation acquisition process is to identify scientific ideas that are tested and verified by unique instrumental and/or analytical capabilities that best suit the overall scientific and cost objectives of the program as described in the AO. The following criteria, listed in order of importance, will be used in evaluating all proposals submitted in response to this AO:

1. **Scientific/Technical Merit, Relevance to Mission Objectives, Science Feasibility** The scientific and technological merit of the proposed investigation and its relevance to this specific opportunity and the established mission plans and objectives outlined in the AO will be evaluated. For proposals involving provision of an instrument or integrated instrument suite, the science feasibility will be evaluated. Science feasibility is defined as the appropriateness of the proposed measurement technique(s) and the degree to which the proposed instrument or integrated instrument suite accomplishes the objectives outlined in the AO.

2. **Engineering Feasibility and Probability of Success** For proposals involving provision of an instrument or integrated instrument suite, the engineering feasibility of the proposed instrument or integrated instrument suite will be evaluated. Engineering feasibility is defined as the ability to implement the proposed instrument or integrated instrument suite within mission constraints such as mass, volume, available energy, available data storage and transmission rates, and mission operations. The probability of success will be evaluated by assessing the degree of technical risk associated with the proposed instrument or integrated instrument suite and the degree to which the proposed data acquisition strategy is likely to succeed.

3. **Total Cost, Cost Realism, And Management Considerations** Total cost will be considered to include not only that proposed for the instrument development and for data validation, but also the impact on operations costs. The technical and cost risk (uncertainty) associated with the investigation will also be considered. Due to the

program's strict financial constraints, any proposed instrument options that would enhance scientific return but increase cost should be clearly identified and costed. Management aspects include demonstrated capability to adhere to sound business practices.

4. **Competence And Relevant Experience** The competence and relevant experience of the proposer and any proposed investigative team will be evaluated by assessing their ability to carry the investigation to a successful conclusion. The commitment of the proposer's institution, as measured by the willingness of the institution to provide the necessary support (logistics, facilities, etc.) to ensure that the investigation can be completed satisfactorily will also be evaluated.

5. **Education and Outreach** The proposed plan for education and public outreach activities will be evaluated.

NASA may desire to select only a portion of the proposer's investigation and may also desire the proposer's participation with other investigators in a joint investigation. In this case, the proposer will be given the opportunity to accept or decline such partial acceptance and/or participation with other investigators.

7.2 Evaluation and Selection Procedures

Proposals received in response to this AO will be evaluated in accordance with the provisions of NASA Federal Acquisition Regulations (FAR) Supplement Part 1872, "Acquisition of Investigations", that may be accessed through the World Wide Web at:

http://www.hq.nasa.gov/office/procurement/regs/1872.htm

7.2.1 Evaluation Process

All proposals will be subjected to a preliminary screening to determine their suitability and responsiveness to the AO. Proposals that are not responsive to the intent and provisions of this AO will be handled as technical correspondence and returned without further review.

Those proposals that are responsive to the AO will then be subjected to a scientific peer review and a technical, management, and cost assessment. The scientific and technical merit (criterion 1 above) of each proposal will be assessed, in terms of its strengths and weaknesses, by panels composed of reviewers who are scientific and technical peers of the proposers. Each proposal will be assigned a score of 0 (worst) to 100 (best). A proposal may also be scored as Not Recommended for Further Consideration (NRFC). The science panel will also comment on the competence and experience of the investigators and the suitability of the proposer's institution (criterion 4 above). An independent technical, management and cost evaluation (criteria 2 and 3 above) of the proposal will be performed by an engineering, management, and cost evaluation panel. This panel will also assess the cost impact of accommodating the instrument or integrated instrument suite in the mission payload. The engineering, management, and cost evaluation panel will also comment on the competence and experience of the investigators and the suitability of the proposer's institution (criterion 4 above). The educational/public outreach plan (criterion 5) will be appraised by a subpanel of personnel having professional qualifications in those fields.

7.2.2 Categorization Process

(MSP 2003 PI/ Instrument Research Proposals ONLY)
After all scientific, technical, management, cost and education evaluations are completed, an *ad hoc* Categorization Subcommittee of the HEDS Steering Committee (see section 7.2.3 below),

consisting of U.S. Civil Servants, will consider the totality of all evaluations in order to categorize the submitted proposals according to the following definitions:

Category I Well conceived, scientifically and technically sound investigations pertinent to the goals of the program and the AO's objectives. A competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that the data can be properly reduced, analyzed, interpreted, and published in a reasonable time.

Category II Well conceived, scientifically and technically sound investigations that are recommended for acceptance, but at a lower priority than Category I.

Category III Scientifically and technically sound investigations that require further development.

Category IV Investigations which are recommended for rejection for this particular opportunity, for scientific, technical, cost, or other reasons.

After the categorization of proposals, further discussions among representatives of the sponsoring NASA Program Offices, the MSP 2003 Project Offices, and the proposers may occur for those proposals rated Category I and II to assess cost realism and development risk and to further clarify the existing proposal(s). Any such discussions will not be an opportunity to revise a submitted proposal. Note that if this option is exercised, all proposers in the Category I and II range will be contacted, and all proposers not in these Categories will be so notified and offered a debriefing (see also Section 7.3).

7.2.3 Selection Process

Following the evaluations described above, the NASA Headquarters organizations sponsoring this AO will develop payload recommendations for their respective areas of solicitation. These recommendations and all peer review and categorization materials on all proposals will be submitted to a Steering Committee composed of NASA Headquarters personnel. The Steering Committee will review the completeness and adequacy of all materials regarding the review and categorization of proposals, and the soundness and justification for recommendations for selection resulting therefrom. Investigation selections will be made by the Associate Administrators for the Office of Space Flight and the Office of Life and Microgravity Sciences and Applications in their respective areas of solicitation.

7.3 Implementation Procedures

Immediately following selection, appropriate letters of selection or rejection along with the panel critiques, will be sent to all proposers. All selected proposers will be contacted immediately in order to establish a funding mechanism as quickly as possible. In particular, it is expected that all selected PIs will attend a first meeting of the PSG within approximately two weeks of selection notification.

8.0 CONCLUSION

The objectives of these Missions are wide ranging and represent significant steps forward in the systematic study of Mars to characterize aspects of the Martian environment and demonstrate technologies that are key to the decision of possible exploration of Mars by humans. We invite you to participate in these important and exciting opportunities.

Original signed by
Arnauld E. Nicogossian, M.D.
Associate Administrator for
Office of Life and Microgravity Sciences
and Applications

Original signed by
Joseph Rothenberg
Associate Administrator for
Office of Space Flight

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS

1.0 INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation, or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that subsequently becomes available, with or without modification, that will meet the investigative objectives.

2.0 TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment, and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

3.0 SELECTION WITHOUT DISCUSSION

The Government reserves the right to reject any or all proposals received in response to this Announcement when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion (other than discussions conducted for the purpose of minor clarification). It is, therefore, emphasized that all proposals should be submitted initially on the most favorable terms that the offeror can submit.

4.0 NON-U.S. PROPOSALS

Guidelines for non-U.S. responses to this Announcement of Opportunity are presented in Appendix B, Section 3.0. Requirements for PI/Instrument proposals involving U.S./non-U.S. collaboration are summarized below:

4.1 Non-U.S. Proposals with U.S. Co-Is

In cases where the participation of a U.S. individual is included in a PI/Instrument proposal submitted by a non-U.S. individual, and where it is anticipated that such participation will be supported by NASA, a Management and Cost Plan covering such participation must be submitted to NASA as part of the proposal. This Management and Cost Plan must be signed by the U.S.

individual and certified by the U.S. individual's institution. Such costs will be considered in the review and evaluation of proposals submitted by non-U.S. individuals.

4.2 U.S. Proposals with Non-U.S. Co-Is

Non-U.S. individuals who plan to participate as Co-Investigators on a U.S. PI/Instrument proposal must have such participation reviewed and endorsed by their appropriate governmental agency before such participation can be selected. Evidence of such review and endorsement should be provided at the time that the proposal is submitted or as soon as possible thereafter. Formal arrangements for such participation will be made by NASA's International Relations Division after selection of the investigation.

5.0 TREATMENT OF PROPOSAL DATA

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Restriction on Use and Disclosure of Proposal and Quotation Information (Data)

> The information (data) contained in (insert page numbers or other identification) of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding, that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information to the extent provided in the contract This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

6.0 STATUS OF COST PROPOSALS (PROPOSALS REQUESTING NASA SUPPORT)

Submission of Standard Form (SF) 1411 "Contract Pricing Proposal Cover Sheet" is required as part of the cost proposal (see Section 1.4, Part 3 of Appendix B). The investigator's institution agrees that the cost proposal submitted in response to this Announcement is for proposal evaluation and selection purposes, and that, following selection and during negotiations leading to a definitive contract, the institution will be required to resubmit or execute SF Form 1411 and all certifications and representations required by law and regulation.

7.0 LATE PROPOSALS

Proposals received after the deadline given in this Announcement will not be accepted for review and will be returned to the proposer.

8.0 SOURCE OF SPACE INVESTIGATIONS

Investigators are advised that candidate investigations for space missions can come from many sources. These sources include those selected through the Announcement of Opportunity, those generated by NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

9.0 DISCLOSURE OF PROPOSALS OUTSIDE GOVERNMENT

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal, the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

10.0 EQUAL OPPORTUNITY (U.S. PROPOSALS ONLY)

By submitting a proposal, the investigator and institution agree to accept the following clause in any resulting contract:

Equal Opportunity

During the performance of this contract, the Contractor agrees as follows:

The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to (a) employment; (b) upgrading; (c) demotion; (d) transfer; (e) recruitment or recruitment advertising; (f) layoff or termination; (g) rates of pay or other forms of compensation; and (h) selection for training, including apprenticeship.

The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, the notices to be provided by the Contracting Officer that explain this clause.

The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.

The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.
If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, the contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

The Contractor shall include the terms and conditions of subparagraph 1 through 9 of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontractor or vendor.

The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

11.0 PATENT RIGHTS

For any contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at NFS 18-52.227-70, "New Technology," shall apply. Such contractors may, in advance of contract, request waiver of rights as set forth in the provision at NFS 18-52.227-73, "Requests for Waiver of Rights to Inventions.

For any contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-1 1, "Patent Rights--Retention by the Contractor (Short Form)" (as modified by NFS 18-52.227-1 1) shall apply.

APPENDIX B

GUIDELINES FOR PROPOSAL PREPARATION AND SUBMISSION

1.0 PROPOSAL PREPARATION

The following guidelines apply to the preparation of proposals by potential investigators in response to this AO. The material presented is merely a guide for the prospective proposer and it is not intended to be all encompassing. The proposer should provide information relative to those items applicable or as otherwise required by this AO.

In order to provide a firm basis for the comparison of PI/Instrument/Research Team proposals received in response to this AO, the MSP 2003 Lander capabilities and constraints, the expected flight environments, ground system capabilities and constraints, and requirements for data archiving described in the Proposal Information Package (PIP) must be used for PI/Instrument/Research Team proposal preparation (for information on accessing the PIP, see Section 1.3 of this AO). (*MSP 2003 PI / Instrument / Research Team Proposals ONLY*)

A science investigation must be clearly defined including a statement of hypothesis and how that hypothesis will be addressed. The description of any proposed instrumentation must provide adequate technical information to permit evaluation. In addition, it must specifically address those Lander resources, configurations, or special requirements necessary for successful implementation of the proposed investigation. This information should be given in sufficient detail to permit an evaluation of both the concept and the practical feasibility of the investigation. If appropriate, the proposal should describe the heritage of any proposed instrumentation, how the investigation is related to other proposed investigations, and the specific approach being taken to coordinate measurement goals and/or to share instrument hardware. The proposal should describe any technology developments that are anticipated for development of the instrument or instrument suite, and also describe backup strategies in the event that the expected technologies are not available. The proposal should also describe any recognized need for supporting laboratory research or ground-based, airborne, or other activities required to support development of the instrument and its operation during the mission.

The proposal should also contain the best possible description of the proposer's plans for data processing, management, and archiving. If details of these procedures are not established at this time, the proposal should include as much information as possible concerning the investigator's plans, requirements, and costs, especially those for unique data management requirements (hardware and software).

A uniform proposal format will be required from all proposers in order to aid in proposal evaluation and to facilitate comparative analysis. Therefore, each proposal must have Form A, Form B and must be submitted in two separately bound volumes: Volume 1, Investigation and Technical Plan; and Volume 2, Management and Cost Plan. All documents must be typewritten in English and must be clearly legible. **At least one copy of each document should be clear black print on white paper and of a quality suitable for reproduction. Submission of proposal material by facsimile (Fax), electronic media, videotape, floppy disk, etc., is not acceptable.**

All proposals must be signed by an institutional official authorized to certify institutional support and sponsorship of the investigation, as well as concurrence in the management and financial parts of the proposal. This signature is required on Form A.

The format required and the required contents are summarized below.

1.1 Cover Page: Solicited Proposal Application (Form A)

All of the information requested on Form A must be provided, and one original signature version of this form should be submitted.

1.2 Proposal Executive Summary (Form B)

The information requested on this form is essential to ensure proper review of the proposal. It determines which mission opportunity (Mars Surveyor Program 2003 Lander Mission or Mars 2005 Definition Study) and which scientific/technical objective the proposal addresses. The Executive Summary is a brief description of the proposal stating the broad, long-term objectives and specific aims of the proposed work. Describe concisely the research design and methods for achieving these objectives and aims. This executive summary is meant to serve as a succinct and accurate description of the proposed work when separated from this application. Limit the Executive Summary to two pages or less.

1.3 Volume 1: Investigation and Technical Plan

Volume 1 should consist of the main body of the proposal and any optional appendices. The volume should provide a clear statement of the proposed investigation and how it will address the objectives of the Mars Surveyor 2003 Lander Mission and 2005 Definition studies. The proposal should contain enough background information to be meaningful to a reviewer who is generally familiar with the field, although not necessarily a specialist.

The title page of Volume 1 must clearly state if the proposal is for the MSP 2003 Lander Mission (described in Sections 3.2.1 - 3.2.4 of this Announcement) or for the MSP 2005 Definition Study (described in Sections 3.3.1 - 3.3.3 of this Announcement).

The title page of Volume 1 must state the title(s), names(s), addresses, affiliation(s), the telephone and Fax numbers, and e-mail addresses of a single Principal Investigator and Co-Investigators. The Title Page must also contain the authorizing signatures of appropriate officials of participating organizations. Such organizations may include industrial contractors who are part of the proposed team. In the Preface to Volume 1 the proposer must also include a separate table, one page or less in length, listing the major instrument parameters or specifications of the investigation. For Mars 2005 Definition Studies that include instrument concepts, estimates of parameters or specifications are acceptable.

The main body of Volume 1 will generally contain the following:

1. **Objectives and Significant Aspects** Volume 1 must include a brief definition of the proposed investigation objectives, their value, and their relationships to past, current, and future efforts. The history and basis for the proposal and a demonstration of the need for such an investigation is required. A statement of present development in the discipline field, and areas for insertion of new technology should also be included.

2. **Investigation Approach** Volume 1 must fully describe the concept of the investigation and the method and procedures for carrying out the investigation. This section must include a statement of hypothesis and how the hypothesis will be addressed**.** For technology demonstrations, this section must include success criteria for the demonstration and how they will be met.

3. **Instrumentation** (*MSP 2003 PI / Instrument / Research Team Proposals ONLY*) Volume 1 must also fully describe all information necessary to plan for experiment development, integration, ground operations, and flight operations. Proposers of integrated instrument suites for the Lander must provide a prioritization of their individual instruments. This section must be complete in itself without the need to request additional data. Failure to furnish complete data may preclude evaluation of the proposal.

    i. **Payload/Instrument Description** This section should fully describe the instrumentation (instruments and any associated deployment/mobility/ sampling devices) and indicate items which are proposed to be developed, as well as any existing instrumentation. Performance characteristics should be related to the experiment objectives as stated in the proposal.

    ii. **Payload/Instrument Integration** This section should describe all parameters of the instrument pertinent to the accommodation of the instrument in the spacecraft. These include, but are not limited to: volumetric envelope (including view angle requirements), weight, power, and energy requirements, thermal requirements, telemetry requirements, sensitivity to or generation of contamination (e.g., electromagnetic interference, gaseous effluent), data processing requirements. Energy requirements and a time profile of power requirements should be described.

    iii. **Prioritization of Individual Instruments of Integrated Lander Payloads** Proposers of integrated scientific instrument suites for the Lander must prioritize individual scientific instruments.

    iv. **Ground Operations** This section should identify requirements for pre-launch or post-launch ground operations support, science site implementation, and configuration control.

    v. **Flight Operations** This section should identify any requirements for flight operations support including instrument testing, calibration, and mission planning. Describe any special communications or near real-time ground support requirements and indicate any special equipment or skills required of ground personnel.

4. **Data Reduction and Validation** (*MSP 2003 PI / Instrument / Research Team Proposals ONLY*) Volume 1 must include a discussion of the data reduction and validation plan including a definition of archival Data Products and, insofar as possible, the method and format. The plan should include a schedule for the submission of validated archival Data Products, as specified in this AO, and the plan for submission of final interpretive papers to the peer-reviewed literature.

5. **Education/Public Outreach** *(MSP 2003 PI/Instrument/Research Team Proposals Only)* Volume 1 must also include provisions and plans for education and public outreach activities of the proposed investigation, arrangements for appropriate partners and alliances, implementation of the education/outreach program, and dissemination of education/outreach products and materials. This should include a statement of hypothesis, how the hypothesis will be addressed, the impact of the results on future space missions and how the research will provide benefits for the average person on the Earth, all in plain English. Visual aids including photographs demonstrating the hypothesis and how it will be and finally is tested, should be a part of the outreach plan.

6. **Roles and Responsibilities** *(MSP 2003 PI/Instrument/Research Team Proposals Only)* Volume 1 must describe the specific roles and responsibilities of the PI and of each Co-Investigator, along with a time-phasing of their activities. Because the number of

participants will be limited, each participant must have an identified specific function that makes a demonstrable contribution to the development and/or implementation of the investigation. A condensed description of all prospective participants' relevant background, experience, and selected publications (if appropriate) should be provided.

Volume 1 is limited to 25 pages for proposals for individual instruments and 50 pages for proposals for integrated suites of instruments; these limits do not include title page, preface pages, or Table of Contents. For either type of proposal, a maximum of 4 foldout pages is allowed. Appendices are limited to a total of 5 single-spaced, typewritten pages, without reduction for single instrument proposals, and 10 pages for instrument suite proposals. In complying with page limits, no page should contain more than 50 lines of text, and the type size should not be smaller than 10-point font, with a minimum margin of 2.5 cm on all sides. Each side of a sheet of paper containing text or figures is considered a page; each side of a foldout sheet of paper containing text or figures is considered as 2 pages.

1.4 Volume 2: Management and Cost Plan

The management plan sets forth the investigator's approach for managing the work, the recognition of essential management functions, and the overall integration of these functions in order to meet the established review and delivery dates. It provides insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators. This volume is limited to 25 pages for proposals for individual instruments and 50 pages for proposals for integrated instrument suites.

The following items must be supplied in Volume 2.

1. **Method of Instrument/Payload Acquisition** (*MSP 2003 PI / Instrument / Research Team Proposals ONLY*)
   Volume 2 must describe the proposed method of instrument acquisition. Specifically, it must include the following, as applicable:

   i. Rationale for the investigator to obtain the instrument/payload through or by the investigator's institution

   ii. Method and basis for the selection of the proposed instrument/payload fabricator

   iii. Unique or proprietary capabilities of the instrument/payload fabricator that are not available from any other source

   iv. Contributions or characteristics of the proposed fabricator's instrument/payload that make it an inseparable part of the investigation

   v. Availability of supporting personnel in the institution to successfully administer the instrument/payload contract and technically monitor the fabrication

   vi. Status of development of the instrument/payload, e.g., what additional development is needed. Areas that need further design or in which unknowns are present. Backup options for any function or hardware requiring technology development

   vii. Method by which the investigator proposes to:

      a. Prepare instrument/payload hardware and software specifications.
      b. Review development progress and maintain configuration control.

c. Review design and fabrication changes.
d. Participate in testing program.
e. Participate in final checkout and calibration.
f. Provide for integration of instrument/payload.
g. Support the flight operations.
h. Coordinate with Co-Investigators, other related investigations, and the payload integrator.
i. Assure safety, reliability, and quality.
j. Control cost.

viii. For proposals seeking NASA funding, planned participation by small and/or minority business in any subcontracting for instrument fabrication or investigative support functions.

All major facilities, laboratory equipment, and ground-support equipment (GSE) (including those of the investigator's proposed contractors and those of NASA and other U.S. Government agencies) essential to the experiment in terms of its system and subsystems are to be indicated, distinguishing insofar as possible between those already in existence and those that will be developed in order to execute the investigation. The outline of new facilities and equipment should also indicate the lead-time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

2. **Schedules and Responsibilities** Volume 2 must include schedules necessary for the logical and timely pursuit of the work, accompanied by a description of the investigator's work plan and deliverables to the Mars Surveyor 2003 Project or 2005 definition studies, and the responsibilities of the Co-Investigators. A discussion must be provided of the specific roles that each of the participants and their institutions intend to play in the investigation. This discussion should include a statement of the portion of time that each participant expects to devote to the investigation and of the institutional resources on which each can draw.

3. **Cost Plan For Proposals Requesting NASA Support** Volume 2 must also provide a detailed estimate of the total cost of the investigation and cost spread per Government Fiscal Year using SF1411 (Contract Pricing Proposal Cover Sheet),. Sufficient technical information on which to judge the reliability of the figures should also be provided. The assumptions on which the estimate is based should be stated, particularly with regard to Government-furnished equipment and services. Reserve should be shown explicitly. Details on Cost Proposal Certifications are provided in Appendix A (General Instructions and Provisions) to this AO.

In addition to submitting the SF 1411 the cost plan should summarize, in real-year dollars, and by Government Fiscal Year (October 1 to September 30), the total investigation cost by major categories of cost as well as by function.

The categories of cost should include the following:

i. **Direct Labor** List by labor category, with labor hours and rates for each. Provide actual salaries of all personnel, including civil service labor, and the percentage of time each individual will devote to the effort. NASA civil service labor and supporting NASA Center infrastructure must be costed on a full cost accounting basis. If NASA guidance for full cost accounting has not been fully developed by the closing date for proposal submission, NASA Centers may submit full cost proposals based on the instructions in the NASA Financial Management Manual, Section 9091-5, Cost Principles for Reimbursable Agreements. If any NASA costs are to be considered as

contributed costs, the contributed item(s) must be separately funded by an effort complimentary to the proposed investigation, and the funding sources must be identified. Other Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the Managerial Cost Accounting Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.

ii. **Overhead** Include indirect costs which, because of their incurrence for common or joint objectives, are not readily subject to treatment as a direct cost. Usually this is in the form of a percentage of the direct labor costs.

iii. **Materials** This should give the total cost of the bill of materials, including estimated cost of each major item. Include lead-time of critical items.

iv. **Subcontracts** List those over $5,000, specify the vendor and the basis for estimated costs. Include any baseline or supporting studies.

v. **Special Equipment** Include a list of special equipment with lead and/or development time. Include number of units and types.

vi. **Travel** List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.

vii. **Other Costs** Costs not covered elsewhere.

viii. **General and Administrative Expense** This includes the expenses of the institution's general and executive offices and other miscellaneous expenses related to the overall business.

ix. **Fee** (if applicable).

Cost summaries for MSP 2003 PI/Instrument/Research Team Proposals should be attached to show total cost allocable to the following by Government Fiscal Year. Mars 2005 Definition Study Proposals only need to show cost summaries by PI and Co-I Costs for Science Support (i).

i. **PI and Co-I Costs for Science Support** Includes all efforts associated with overall investigation management; support of the Mars Surveyor 2003 PSG; the development of calibration requirements (but not calibration itself); the planning for the mission operations/data analysis phase, including necessary pre-launch development of ground software required for post-launch activities; costs for education/public outreach. This category begins on November 1999, and ends on January 2004 (approximately Launch plus 30 days).

ii. **Hardware Costs** *(MSP 2003 PI/Instrument/Research Team Proposals Only)* Consists of all efforts, including field support at JPL, associated with the design, fabrication, test, calibration, operation and maintenance of the flight instrument(s), enabling devices and a suitable complement of spare components (and functional or nonfunctional models such as Engineering, Models and Temperature Control Models if proposed); the design, development, test, operation, and maintenance of instrument ground support equipment; the design, test, and maintenance of instrument and support equipment software; support to the Project regarding matters related to the integration of the flight instrument with the spacecraft; and the engineering management of the foregoing efforts. This category begins on November 1999, and ends on January 2004

iii. **Science Operations/Generation and Validation of Data Products/Data Analysis Costs** *(MSP 2003 PI/Instrument/Research Team Proposals Only)* Includes all costs associated with the investigation, beginning on November 1999**,** including support of the PSG, science operations, computer time, and data reduction, data generation, validation, and archiving of Data Products, and education/public outreach. As with science support, it also includes investigator support of the PSG working groups, but in the period from January 2004 until January 2006 for the Lander Mission.

1.3 Certification

All proposals must be signed by an institutional official authorized to certify institutional support and sponsorship of the investigation as well as of the management and financial parts of the proposal. By submitting and signing the proposal identified on Form A in response to AO 99-HEDS-01, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution): 1) certifies that the statements made in this proposal are true and complete to the best of his/her knowledge; 2) agrees to accept the obligations to comply with the sponsoring agency award terms and conditions if an award is made as a result of this proposal; and 3) if the applicant organization is an entity of the United States of America, confirms compliance with all provisions, rules, and stipulations set forth in the three Certifications contained in this AO [namely, i) Certification Regarding Debarment, Suspension, and Other Responsibility Matters Primary Cover Transactions, ii) Certification Regarding Lobbying, and iii) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs]. Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

2.0 PROPOSAL SUBMISSION

The requirements for the submission of proposals from both U.S. and non-U.S. institutions in response to this AO are given in Sections 1.5 and 1.6 of the Announcement.

3.0 FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION IN RESPONSE TO NASA ANNOUNCEMENTS OF OPPORTUNITY

(a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. participation must be endorsed by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations, Human Space Flight and Research Division, will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective

responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

1. A letter of notification by NASA, and
2. An exchange of letters between NASA and the sponsoring governmental agency; or
3. A formal Government to Government Memorandum of Understanding (MOU).

(c) As stated in Paragraph b. above, foreign proposals accepted under this AO will be implemented on the customary no-exchange-of-funds basis in which NASA and the sponsoring foreign agency will each bear the cost of discharging their respective responsibilities. Additionally, NASA funding may not be used to purchase a launch service from a non-U.S. source. However, the direct purchase of goods and/or services from non-U.S. sources by U.S. Principal Investigators or U.S. Co-Investigators is permitted. Proposers are advised that international purchases must meet NASA and Federal regulations and that these regulations may place an additional burden on the successful proposer that should be explicitly included in discussions of the proposed budget.

All proposals from non-U.S. institutions will compete on an equal basis with U.S.-originated proposals, and go through the same review, evaluation, and selection process. Proposals from institutions outside the United States must be typewritten in English and in the same format as U.S. proposals. Proposers from non-U.S. institutions operate on a no exchange of funds basis and therefore are not required to submit a Cost Plan; however, a Management Plan must be submitted.

In cases where the participation of a U.S. individual is included in a proposal submitted by a non-U.S. individual, and where it is requested that such participation be supported by NASA, a Management and Cost Plan covering such participation must be submitted to NASA as part of the proposal. This Management and Cost Plan must be signed by the U.S. individual and certified by the U.S. individual's institution. Such costs will be considered in the review and evaluation of proposals submitted by non-U.S. individuals.