

A.2 SOLAR SYSTEM EXPLORATION

A.2.1 Overview

Solar System Research and Analysis supports investigations of all classes of objects in the Solar System, except the Earth and Sun, consistent with the strategy for Solar System Exploration embodied in *Mission to the Solar System: Exploration and Discovery, A Mission and Technology Roadmap* (available at <http://sse.jpl.nasa.gov/roadmap/>). A proposal submitted to any of the following programs in this Section A.2 must present, within its *Scientific/Technical/Management* Section, a clear description of a specific scientific problem, a description of how the attack on this problem will be carried out, and a discussion of the relevance of the proposed research to NASA's current and/or future programs. Proposals whose intent or purpose is to extend or directly supplement investigations selected for approved space flight missions are not appropriate for this NRA, and investigators who are members of science teams of ongoing missions must delineate clearly between their mission responsibilities and any research efforts proposed through this NRA. Furthermore, proposals that include analysis of data from space flight missions must use publicly available data only (e.g. through the Planetary Data System); proposals that utilize data not yet released publicly will not be considered.

Solar System Research and Analysis is divided into four groups of related Program Elements. The first group, entitled "Origin and Evolution of Solar System Bodies," relates primarily to the Solar System Exploration theme, although one of its program elements also relates strongly to the Astronomical Search for Origins theme in the Astronomy and Physics Division (see Section A.1 in this NRA):

- Cosmochemistry (Appendix A.2.2) supports scientific investigations that are cosmochemical in nature and may involve laboratory studies of a variety of extraterrestrial materials (meteorites, cosmic dust, and lunar samples) or understanding of the geochemical nature of solar system bodies;
- Planetary Geology and Geophysics (Appendix A.2.3) supports scientific investigations of planetary surfaces and interiors, satellites (including the Moon), satellite and ring systems, and smaller solar system bodies such as asteroids and comets;
- Origins of Solar Systems (Appendix A.2.4) solicits basic research proposals to conduct scientific investigations related to understanding the formation and early evolution of planetary systems and to provide the fundamental research and analysis necessary to detect and characterize other planetary systems;
- The Mars Data Analysis Program (Appendix A.2.5) is intended to enhance the scientific return from the missions in the Mars Exploration Program: to date, Mars Pathfinder (MPF), Mars Global Surveyor (MGS), and Mars Odyssey; and
- The Sample Return Laboratory Instruments and Data Analysis Program (Appendix 2.6) solicits investigations that seek to maximize the scientific return from samples provided by NASA's missions to the planets and comets through the development of advanced laboratory instruments and analytical techniques.

- The Discovery Data Analysis (DDA) program (Appendix A.2.17) is intended to enhance the scientific return of completed Discovery missions by broadening the scientific participation in the analysis of data collected by those missions. While investigations proposed to this program must entail analysis of Discovery mission data, investigators may additionally propose tasks that involve modeling, basic theory, laboratory studies that are relevant to interpretation of mission data, correlative analyses of data from other missions and/or from ground-based observations, and/or research that seeks to place the Discovery mission results in a larger context. Investigators should determine that the required Discovery data are publicly available before submitting a proposal.

The program elements within the second group, entitled “Planetary Systems Science,” are:

- Planetary Astronomy (Appendix A.2.7) supports ground-based telescopic observations that contribute to understanding the general properties and evolution of planets, natural satellites, asteroids, and comets;
- Near Earth Object Observations (Appendix A.2.8) supports ground-based telescopic observations to inventory the population of the asteroids whose orbits bring them near the Earth and to characterize a representative sample of them; and
- Planetary Atmospheres (Appendix A.2.9) supports investigations directed at the understanding of planetary atmospheres, including their formation, evolution, and fundamental properties.

The third group, entitled “Astrobiology and Planetary Instrumentation,” includes Exobiology research, as well as the Planetary Instrument Definition and Development program and the Planetary Major Equipment program. The newest addition to this group, starting as an amendment to the ROSS-2002 NRA, is the Astrobiology Science and Technology for Exploration of Planets (ASTEP) program. This group relates to both OSS science themes of Astronomical Search for Origins and Solar System Exploration as follows:

- The Astrobiology program (Appendix A.2.10) seeks to understand the origin, evolution, and distribution of life in the universe. Research is centered around the origin of life and is focused on achieving this goal by tracing the pathways taken by the biogenic elements, leading from the origin of the universe through the major epochs in the evolution of living systems and their precursors. In addition, research in the area of planetary protection and exobiology instrument concepts may also be supported.
- The Planetary Instrument Definition and Development program (Appendix A.2.11) supports the advancement of spacecraft-based instrument technology that shows promise for use in scientific investigations on future planetary missions. The goal of the program is not to develop flight-qualified hardware, but rather to define and develop scientific instruments or components of such instruments to the point where the instruments may be proposed in response to future

announcements of flight opportunity without additional extensive technology development.

- The Planetary Major Equipment (Appendix A.2.12) program allows proposals for upgrading the analytical, computational, telescopic, and other instrumentation required by investigations sponsored by the Solar System Exploration programs, including Exobiology.
- The Astrobiology Science and Technology Instrument Development (ASTID) program (Appendix A.2.13) seeks to develop instrumentation capabilities that may help meet the science requirements of future space missions having astrobiology objectives, as well as to advance such objectives for Earth-based investigations. This program is meant to support the development of prototype instruments, primarily for future space flight, but also for terrestrial laboratory use; the ASTID program does not provide for the construction of flight-qualified hardware or operational laboratory or field equipment.
- The Astrobiology Science and Technology for Exploration of Planets (ASTEP) program (Appendix A.2.14) is a science-driven exploration program that is expected to result in new science and operational/technological capabilities that enable the next generation of planetary exploration. A unique feature that is central to the ASTEP program is the use of field campaigns to further science and technology.

The fourth group, entitled “Mars Science,” includes Mars Fundamental Research (MFR) and the Mars Instrument Development program (MIDP):

- The Mars Fundamental Research program (Appendix A.2.15) seeks innovative research related to atmospheric, climatological, and geologic processes on Mars. It offers opportunities to researchers who are interested in Mars, but who are not yet prepared to work exclusively with mission data. The MFR program includes: (i) investigations that study the basic physics of the coupled atmospheric/geologic systems on Mars; (2) terrestrial field investigations that further understanding of *in situ* measurements that have been made or will be made on Mars; and (iii) other research activities that are relevant to NASA’s programmatic goals for the scientific exploration of Mars.
- The Mars Instrument Development Program (Appendix A.2.16) solicits proposals to take instruments that are specifically suited for characterization of the Martian surface from the breadboard or laboratory-demonstration phase to a level of development at which they can be tested under realistic environmental conditions. These instruments must specifically target issues related to characterizing the Martian near-surface, surface, or near-subsurface environments from a lander or rover by conducting detailed *in situ* analytical studies of samples, or by collecting samples for analysis and/or for later return to Earth. Proposals that seek to combine existing instruments into architectures that lead to overall reductions in size, mass, or power consumption are especially encouraged.

