

SCIENCE PROGRAM ELEMENTS SOLICITED BY THE ROSS-98 NRAA.1.1 Origins of Solar Systems Program (OSSP)1. Scope of Program

This NASA Research Announcement (NRA) 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. These investigations may involve analytical and numerical modeling, laboratory research, and observational studies in the following areas: star formation and the relationship to planetary system formation, solar nebula processes, accumulation and dynamical evolution, analysis of primitive materials, and the detection of other planetary systems. The investigations supported through this NRA should directly support the goals related to understanding planetary system formation.

For example, key questions addressed by the research activities supported by this program may include: What was the initial mass, structure, motions, and temperature of the solar nebula, and the time scales over which planets formed? What are the conditions of star formation that lead to a single star surrounded by a protoplanetary disk? How was angular momentum transported in the nebula? What determined the masses of the giant planets? By what mechanism did the most primitive bodies in the solar system accumulate? What factors influence the growth of planetary embryos into planets? What processes were responsible for the patterns of chemical fractionation observed in the primitive meteorites and the volatile abundances in the planets? What is the frequency of the occurrence of planetary systems?

This Origins program realizes the existing potential for complementary interdisciplinary efforts to solve key scientific questions. To achieve this goal, proposals are encouraged that involve joint research efforts by investigators from different scientific communities. Interdisciplinary investigations may include, for example, studies of nebular chemistry and dynamics to understand the composition of primitive volatile-rich solar system bodies, or collaborations between observational astronomers and modelers to study the initial collapse of a protostellar cloud to form a nebula.

Proposals for topical conferences, workshops, symposia, or other new initiatives related to the Origins program are also solicited through this NRA.

Ground-based Efforts towards Detection of Planetary Systems

The OSSP will also support the ground-based observational efforts to detect (indirect and direct) and characterize other planetary systems, particularly those key observations summarized in the *Exploration of Neighboring Planetary Systems (ExNPS) Mission and Technology Roadmap* available at <<http://techinfo.jpl.nasa.gov/WWW/ExNPS/homepage.html>>. NASA expects to capitalize on its investments in ground-based facilities, but detection projects will not be limited to these primary research assets (Keck Observatory, Infrared Telescope Facility (IRTF) with its new tip-tilt secondary, and the Palomar Testbed Interferometer (PTI)). Investigations may include detection projects to continue ongoing search programs, as well as to use innovative new techniques, new instruments, and/or telescopes to cover the maximum extrasolar planet search space.

2. Programmatic Information

It is estimated that the funding level for this program for fiscal year (FY) 1999 will be approximately \$5M and that this level of funding will support approximately 100 research investigations, including both new proposals and in-progress multiple year proposals. Awards under this NRA are subject to the availability of program funds.

Holders of existing OSSP multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report* by the same deadline as given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The five page limit does not include a *Cover Page*, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site should contact the Lunar Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance.

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Origins of Solar Systems Program (OSSP)

The Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone contact for commercial delivery: (281) 486-2166

Obtain additional information from the Discipline Scientist:

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A.1.2 Research in Exobiology

1. Scope of Program

The goal of NASA's Exobiology Program is to understand the origin, evolution, and distribution of life in the universe. Research 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. These epochs (and the approximate percentage of funding historically allocated to each) are: the cosmic evolution of the biogenic compounds (15%); prebiotic evolution (35%); the early evolution of life (35%); and the evolution of advanced life (15%).

The principal goal of research in the area of the cosmic evolution of the biogenic compounds is to determine the history of the biogenic elements (C, H, N, O, P, S) from their birth in stars to their incorporation into planetary bodies. Emphasis is placed on studies that constrain or extend concepts of possible chemical evolution relevant to the origin, evolution, and distribution of life.

- Research in the area of prebiotic evolution seeks to understand the pathways and processes leading from the origin of a planet to the origin of life. The strategy is to investigate the planetary and molecular processes that set the physical and chemical conditions within which living systems arose. Four major objectives are to: i) determine constraints on prebiotic evolution imposed by the physical and chemical histories of planets; ii) develop models of active boundary regions in which chemical evolution could have occurred; iii) determine what chemical systems could have served as precursors of metabolic and replicating systems both on Earth and elsewhere; and iv) determine in what forms prebiotic organic matter has been preserved in planetary materials.

The goal of research into the early evolution of life is to determine the nature of the most primitive organisms, the environment in which they evolved, and the way in which they influenced that environment. As an approach to understanding life in the universe, the opportunity is taken to investigate two natural repositories of evolutionary history available on Earth, in particular, the molecular record in living organisms and the geological record in rocks. These paired records are used to: i) determine when and in what setting life first appeared; ii) determine the characteristics of the first successful living organisms; iii) understand the phylogeny and physiology of microorganisms thought to be analogs of primitive environments; iv) determine the original nature of biotic energy transduction, membrane function, and information processing through study of extant microbes; and iv) elucidate the physical, chemical, and biotic forces operating on microbial evolution.

- The research associated with the study of the evolution of advanced life seeks to determine the extrinsic factors influencing the development of advanced life and its potential distribution. This research includes an evaluation of the influence of extraterrestrial and planetary processes on the appearance and evolution of multicellular life, conducted by: i) tracing the effects of major changes in the Earth's environment on the evolution of complex life, especially during mass extinction events, and ii) determining the effects of global events and of events originating in space on the production of environmental changes that affected the evolution of multicellular life. Also, studies will be considered that would seek approaches to investigations furthering our understanding of the distribution of life elsewhere in the universe.

The severe constraints of weight and volume on payloads and the unique nature of some potential exobiological investigations necessitates novel concepts for flight instrumentation to maximize the scientific return of future missions. Therefore, included in the scope of the Exobiology Program is the development of advanced instrument concepts and technologies that may enable exobiology research in space exploration, for which additional funding is available. Beyond advanced instrument concepts the Planetary Instrument Definition and Development Program (PIDDP; Section A.3.5 in Appendix A of this NRA) supports the development of exobiology instruments through the breadboard stage. Funds are available under the PIDDP to provide for upgrading of analytical instruments required by investigations sponsored by the Exobiology Program.

In addition, proposals for new, major analytical instrumentation that is necessary for the conduct of proposed exobiology research, or that would substantially improve its quality, may be submitted through the provisions of the Planetary Major Equipment Program; see Section A.3.6 of Appendix A of this ROSS NRA.

2. Programmatic Information

Proposals are sought for new projects within the scope of the Exobiology Program. Proposals submitted in response to this NRA should be for work that is not currently supported by the Exobiology Program, as well as tasks that are currently funded in the Exobiology Program but whose periods of performance are expiring in 1998 or in the first half of 1999. Periods of performance from one to five years (typically three years) may be proposed, as appropriate to the nature of the contemplated research. Proposers are reminded that programmatic balance (see historical percentages above) may limit the opportunities for funding in some areas.

The Exobiology Program usually competes one third of the program every year, and so it is anticipated that approximately \$3M will be available to support research proposed in response to this NRA.

Progress reports for the annual funding allotment to complete the second or subsequent years of previously approved multiple year awards will be considered separately and should be sent directly to the Exobiology Program Discipline Scientist (see below) at least 90 days before their funding anniversary date.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact the Lunar Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281)486-2156 or -2166 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
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A.2.1 High Energy Astrophysics Program

1. Scope of Program

This program element solicits basic research proposals to conduct investigations that are relevant to the NASA High Energy Astrophysics (HEA) Supporting Research and Technology (SR&T) Program. The primary goal of the HEA SR&T program is to obtain a better understanding of astrophysical objects (excluding the Sun) and phenomena as revealed through their high energy radiation characteristics. This HEA program comprises the fields of x-ray and gamma-ray astronomy, which correspond operationally to photon energies in the approximate range of 0.1 keV to 50 GeV.

The purpose of the HEA SR&T program is to provide support for the HEA flight program in the disciplines of x- and gamma-ray astronomy. In the context of this program, x-rays are defined as photons in the approximate energy range 0.1-30 keV, while gamma-rays are considered to lie in the energy range 30 keV - 50 GeV. The HEA SR&T program provides support for basic research relevant to the design and development of instrumental concepts for future NASA HEA missions and the conduct of scientific investigations via exposure of instrumentation carried on sounding rockets and high-altitude balloons. Proposed research may include experimental laboratory astrophysics investigations, as well as ground-based observations of phenomena defined primarily by their high-energy characteristics, provided that such studies pertain directly to NASA HEA space missions. Note that while the scientific and technical merit of the proposed research is the primary selection criterion, relevance to NASA's HEA flight program is of nearly equal weight and must be explicitly described in the proposal. A list of relevant past, present and future HEA missions is given in Tables 1 and 2 below in this Section, which are furnished only as a guide to assessing relevance of proposals for this program element.

NOTE: Theoretical investigations that are generally relevant to this science area are solicited separately under the Astrophysical Theory Program, and projects directed mainly toward the analysis of archival data are covered under the Astrophysics Data Program. Investigations that fall into either of these categories are not within the scope of the HEA SR&T program.

Table 1 - NASA X-ray Astronomy Missions Relevant to the HEA SR&T Program

<u>MISSION</u>	<u>PRIMARY EMPHASIS</u>
High Energy Astronomy Observatory-1 (HEAO-1)	All-sky x-ray survey and spectrophotometric observations of selected cosmic x-ray sources
High Energy Astronomy Observatory-2 (HEAO-2: "Einstein")	Imaging and spectroscopic observations of selected cosmic x-ray sources
Broad Band X-ray Telescope (Astro/BBXRT)	Nondispersive spectroscopic observations of selected cosmic x-ray sources
Diffuse X-ray Spectrometer (DXS)	Spectroscopic observations of the soft x-ray diffuse background
Roentgen Satellite* (ROSAT)	All-sky x-ray/EUV survey and imaging observations of selected cosmic x-ray sources
Asuka (ASCA, formerly ASTRO-D)*	Spatially-resolved spectroscopic observations of selected cosmic x-ray sources
X-ray Timing Explorer (XTE)	Spectrophotometric observations of selected cosmic x-ray sources
Advanced X-ray Astrophysics Facility (AXAF)	High-resolution imaging/spectroscopic observations of selected cosmic x-ray sources
Spectrum-X-Gamma*	High-throughput, moderate-resolution imaging spectroscopic and polarimetric observations of selected cosmic x-ray sources
X-ray Multi-Mirror Mission* (XMM)	High-throughput, moderate-resolution imaging/spectroscopic observations of selected cosmic x-ray sources
ASTRO-E*	Spatially-resolved high-resolution spectroscopic observations of selected cosmic x-ray sources
Constellation X	High throughput, high resolution spectroscopic observations of selected cosmic x-ray sources
* International Collaboration	

Table 2 - NASA Gamma-Ray Astronomy Missions Relevant to the HEA SR&T Program

<u>MISSION</u>	<u>PRIMARY EMPHASIS</u>
High Energy Astronomy Observatory-1 (HEAO-A4)	All-sky intermediate energy survey
High Energy Astronomy Observatory-3 (HEAO-C1)	All-sky high resolution spectroscopic survey
Solar Maximum Mission Astronomy (SMM)	Solar and cosmic x-ray and gamma-ray observations
International Sun-Earth Explorer/	Gamma-ray bursts
International Cometary Explorer (ISEE/ICE)	Gamma-ray bursts
Compton Gamma-Ray Observatory (GRO)	All-sky wide-band gamma-ray survey
Global Geospace Program (GGS [Wind/TGRS/Konus])	Gamma-ray burst spectroscopy
High-Energy Transient Experiment (HETE-II)	Gamma-ray burst position determination
INTEGRAL*	High-resolution gamma-ray spectroscopy
GLAST	High-throughput, high energy gamma-ray imaging/spectroscopic observations of selected cosmic gamma-ray sources
* International Collaboration	

2. Programmatic Considerations

The HEA SR&T program has traditionally been announced and proposals selected only every three years. The last such selection was in 1996. Therefore, the budget for this program is currently fully subscribed, and proposals for participation in the HEA SR&T Program are not solicited by this ROSS-98 NRA. It is anticipated that the next opportunity to propose to this program will be in spring 1999, and that roughly \$9M will be available in FY 2000 for the funding of about 30-40 new three year projects. Detailed information pertaining to the schedule (NOI/Proposal due dates, etc.) will be provided in the ROSS-99 NRA that will be issued approximately one year from now.

Additional information may be obtained from the Discipline Scientist:

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A.2.2 Long-Term Astrophysics Program (LTSA)

1. Scope of Program

The Long-Term Space Astrophysics (LTSA) Research Program is intended to enhance research in space astrophysics by providing a stable long term source of support, up to a maximum of five years, and to strengthen the U.S. long term research base in space astrophysics. Abstracts of currently funded LTSA projects can be found at <http://www.hq.nasa.gov/office/oss/codesr/LTSA_Abstracts.html>.

This ROSS-98 NRA solicits proposals for research in astrophysics whose dominant emphasis is the analysis and interpretation of data from past, current, and future space astrophysics missions. In support of that activity, but as a secondary emphasis, the proposed research may include theoretical research, numerical modeling, use of existing data from ground-based or suborbital observations, and laboratory astrophysics measurements. In addition, NASA will consider requests for support for new ground-based observations provided that the requests are clearly described, the observations are important to the success of the proposed effort, and their expense (including salary, travel, etc.) constitutes no more than 10 percent of the proposal's total budget.

The LTSA Research Program is intended to support research in space astrophysics that is substantial and cohesive, and whose duration and scope go beyond those of the typical proposal funded by other NASA space astrophysics programs. Conversely, this LTSA Research Program is not intended to support:

- investigations whose primary emphasis is theoretical research, numerical modeling, the use of existing data from ground-based or suborbital observations, laboratory astrophysics measurements or detector development, since there exist other NASA programs that support research with these kinds of emphases;
- investigations whose primary focus is on solar system objects or on the solar-terrestrial interaction, since other NASA programs support this kind of research;
- proposals primarily for the education and training of students;
- proposals for the organizing and/or hosting of scientific meetings; and
- proposals for substantial computing facilities or resources, beyond nominal workstation or networking fees.

NASA recognizes that a proposal for a five-year research program cannot be as specific as a proposal for a small near-term research task. Nevertheless, the proposer must convincingly describe the research program with enough clarity to give peer reviewers a clear understanding and appreciation of the proposed effort, as well as its need for a long term period of performance.

2. Types of Proposals

For the purpose of this ROSS-98 NRA, NASA recognizes LTSA proposals from two different groups of researchers, "Junior Researchers" and "Senior Researchers."

Junior Researchers are researchers who are early in their careers and still establishing themselves, such as postdoctoral fellows (beyond their first postdoctoral fellowship), and tenure-track faculty. Based on recommendations from peer reviewers of prior cycles of the LTSA program, Junior Researchers are defined as those more than two years after having received their Ph.D. and fewer than eight years after the Ph.D. The rationale for the lower threshold is that many programs exist for first postdoctoral fellowships with a duration of at least two years. The rationale for the upper threshold is that most universities with tenure-track positions decide on awarding, or not awarding, tenure by the seventh year after the candidate's Ph.D. This simple criterion of using boundaries for "time after Ph.D." is also necessary because it treats researchers in academia, industry, Government, and other organizations on an equal basis. Note that where a Junior Researcher is prevented from proposing as Principal Investigator because of institutional restrictions, a Principal Investigator may submit the proposal on behalf of a Co-Investigator who serves as the actual "Science Principal Investigator," provided that the latter's name and individual research program are clearly identified in the abstract and list of investigators (see Section 1.3 of Appendix C)

Senior Researchers are proposers who are more experienced, as well as better established, such as tenured faculty at the university level and senior scientists at universities and research laboratories. This distinction between Junior Researchers and Senior Researchers should be clear for most potential proposers. Any questions regarding eligibility for Junior or Senior categories should be directed via E-mail to <ltsa@hq.nasa.gov>.

Support for Junior Researchers is essential to the long term health of the U.S. research effort in space astrophysics, while the experience of the Senior Researchers is needed to maximize the near-term research results in space astrophysics. Therefore, the intended funds distribution for this NRA will favor proposals from Junior Researchers, provided that their proposals are on a par with those from Senior Researchers. The target is to award two-thirds of the available LTSA program funding for the LTSA to Junior Researchers, contingent upon the submission of an adequate number of highly ranked proposals, and the remaining one-third for Senior Researchers. During the last proposal review cycle, 47% of available funds were awarded to Junior Researchers.

Because of the long duration of long term research projects, it is possible that a substantial portion of the necessary data will be obtained from future space astrophysics observations. However, approval of a LTSA proposal does not constitute approval of the specific observing programs contemplated or described by the proposer. It will be the proposer's responsibility to propose specific observations and to obtain the desired data via the appropriate mission-specific observing programs or archival research programs.

The cost portions of such observing or archival-data proposals should be very low; it may include requests for travel support or other costs, but may not duplicate any salary costs.

3. Proposal Category and Research Area

Each LTSA proposal must be identified as to Junior or Senior category by checking the appropriate box on the Cover Page (see Appendix C.5.3 for instructions for electronically accessing and submitting the Cover Page). For all Types of LTSA proposals, the Cover Page also provides for designation of the Research Area, as defined below, that forms the primary focus of the proposal. The primary use of these Research Areas is to facilitate the assignment of the proposal to an appropriate review panel. Note that each proposal, regardless of Type, must identify one primary Research Area (a secondary Area may be designated if appropriate). NASA reserves the right to reassign a proposal to a different primary or secondary Research Area(s). The eight currently defined Research Areas are:

1. *Solar System* (note: proposals whose primary focus is solar system research using the IRAS Asteroid and Comet Survey or Voyager data should be submitted to other OSS NRA's relevant to those objectives);
2. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars);
3. *Main Sequence Stars*;
4. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae);
5. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
6. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
7. *Galaxies* (normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, quasars, radio galaxies);
8. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, cosmology).

4. Programmatic Information

This program was begun during the FY 1990 award cycle and currently provides support for about 90 research groups and individuals, with a budget level of approximately \$8.2M per year. It is anticipated that approximately \$2M will be available through this ROSS-98 NRA for the funding of new awards for this program element, to fund proposals of a maximum of five years duration.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>;

proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Long-Term Space Astrophysics Research Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

For further information, contact the Discipline Scientist:

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A.2.3 Ultraviolet, Visible, and Gravitational Astrophysics Program

1. Scope of Program

This program element solicits basic research proposals to conduct investigations that are relevant to the NASA Ultraviolet (UV), Visible, and Gravitational Astrophysics (UVGA) program. There are two primary goals: to obtain a better understanding of astrophysical objects and phenomena as revealed through their ultraviolet and visible radiation (over the range of roughly 100 Angstroms to H-alpha), and to investigate topics in general relativistic and gravitational astrophysics. Proposed research may include observational topics (note limitations described below), as well as experimental laboratory astrophysics, provided that such studies pertain directly to NASA UV, visible, and gravitational astrophysics related space missions. Supporting technology studies and laboratory facilities of importance to the future of UV/Visible flight programs are also included within the scope of this program. While excellence of proposed research is the primary selection criterion, relevance to NASA missions is of nearly equal weight and must be explicitly described in the proposal. A list of past, present, and future missions of interest is given in Table 1, which is furnished only as a guide to assessing relevance of proposals for this program element.

Topics of interest to this NRA fall into the following four research categories listed here in priority order as set by the NASA UVGA Program Working Group:

- *Supporting ultraviolet technology studies* - for example, UV photocathodes, ultra-light holographic grating development, thin films in the EUV, lightweight composite mirrors;
- *Laboratory ultraviolet astrophysics* - for example, predissociation in diatomic molecules, electron-ion collisions, compilation of transition probability data, measurement of absolute oscillator strengths for UV transitions, UV characteristics for polycyclic aromatic hydrocarbons;
- *General relativity and physics of gravitation* - for example, lunar-laser ranging tests of relativity, solar-system tests of gravitational theories using satellite data, low frequency gravitational wave astronomy; and
- *Ground-based astronomy* - for example, optical imaging and spectroscopy of the Ultraviolet Imaging Telescope fields, calibration of supergiants for the Hubble Space Telescope.

Proposals for ground-based observations will be considered only if (a) they are in direct support of NASA UV/Visible related missions (for example, see Table 1 below in this section), and (b) the proposers are ineligible, by virtue of their institutional affiliation, to receive direct or indirect support from the National Science Foundation for ground-based astronomy.

Table 1 - Past, Current, and Future Missions Relevant to the UV, Visible, and Gravitational Astrophysics Research and Analysis Program

(Note: Links to mission home pages may be found through the World Wide Web URL <<http://www.hq.nasa.gov/office/oss/missions/index.htm>>.)

<u>MISSION</u>	<u>LAUNCH YEAR</u>	<u>REMARKS</u>
• International Ultraviolet Explorer (IUE) 1200–3200Å	1978	Terminated in 1996.
• Hipparcos	1989	ESA astrometry mission.
• Hubble Space Telescope (HST) <i>Goddard High Resolution Spectrograph (GHRS)</i> 1150–8000Å <i>Faint Object Camera (FOC)</i> 1150–6500Å <i>Faint Object Spectrograph (FOS)</i> 1050–3200Å <i>Wide Field/Planetary Camera 2 (WF/PC2)</i> 1150–11000Å <i>Space Telescope Imaging Spectrograph (STIS)</i> 1150–11000Å	1990	In operation. Ceased operation. In operation. Ceased operation. In operation. In operation.
• Astro-1	1990	Completed 9 day mission.
• Astro-2 400 – 3000 Å <i>Hopkins Ultraviolet Telescope (HUT)</i> <i>Ultraviolet Imaging Telescope (UIT)</i> <i>Wisconsin UV Photopolarimeter Experiment (WUPPE)</i>	1995	Completed 16 day mission.
• Extreme Ultraviolet Explorer (EUVE) 80–800Å	1992	In operation, Guest Observer program.
• Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometer (ORFEUS)/ Interstellar Medium Absorption Profile Spectrograph (IMAPS) 400–1200Å	1993	Completed 5 day mission.
• ORFEUS II / MAPS	1996	Completed 13 day mission.
• On-going tests of relativity	—	Various current interplanetary spacecraft.
• Far Ultraviolet Spectroscopic Explorer (FUSE) 800–1200Å	1998	3 year mission.
• HST Advanced Camera for Surveys (ACS)	1999	HST replacement instrument.
• Gravity Probe-B (GP-B) - Lense Thirring Effect	2000	2 year mission.
• The Galaxy Evolution Explorer (GALEX) 1350 – 3000Å	2001	28 month mission.
• Cosmic Origins Spectrograph (COS)	2002	HST replacement instrument.
• Space Interferometry Mission (SIM)	TBD	Selected for study.

2. Programmatic Information

It is expected that roughly \$1M will be available in FY 1999 for the funding of about 20 new three-year projects split among four categories: supporting UV technology, laboratory UV/Visible astrophysics, gravitation and general relativity, and ground-based astronomy.

Proposers are encouraged to define a program that may be accomplished in a three-year period. It is recognized that the proposed investigation may evolve with time. Accordingly, emphasis should be placed upon the first year's effort, with as much detail as possible provided relevant to the planned second and third year's activities. Proposals for investigations requiring less than a three-year time scale to complete are also acceptable, as are those which require a longer time scale to complete, though the latter must undergo peer review after three years. Key projected milestones and accomplishments during each period of the proposed effort should be identified.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

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A.2.4 Astrophysics Data Program (ADP)

1. Scope of Program

This NRA solicits proposals for (A) research involving the NASA space astrophysics data sets currently archived in the public domain, and (B) the analysis of new observations obtained by the ASCA or ROSAT satellites and awarded through competitive peer review. The period of performance for solicited proposals may be from one to three years. Abstracts of currently funded Astrophysics Data projects can be found at <http://www.hq.nasa.gov/office/oss/codesr/ADP_Abstracts.html>.

Proposers to the previous ADP “Type 2” opportunity for applied research (tools for data analysis and/or data management) should note that this category has been transferred from the ADP program to the Applied Information Systems Research (AISR) Program. Proposers are referred to the AISR NRA in section A.5.2 of Appendix A in this NRA.

• *Type A Proposals*

This Announcement solicits Type A proposals for research in astrophysics whose dominant emphasis is the analysis and interpretation of public-domain, archival data from past, current, and upcoming space astrophysics missions. In particular, public-domain data sets now exist for the following missions that have undergone considerable calibrations, ordering, and refinements, and for which extensive data analysis software tools exist:

- Advanced Satellite for Cosmology and Astrophysics (ASCA);
- Astro Shuttle Experiments [Hopkins Ultraviolet Telescope (HUT), Wisconsin Ultraviolet Photopolarimetry Experiment (WUPPE), Ultraviolet Imaging Telescope (UIT), and Broad-Band X-Ray Telescope (BBXRT)];
- Beppo Satellite di Astronomia X (SAX);
- Cosmic Background Explorer (COBE);
- European X-Ray Astronomy Satellite (EXOSAT);
- Extreme Ultraviolet Explorer (EUVE);
- Ginga;
- High Energy Astronomy Observatories (HEAO-1, 2, and 3);
- Infrared Astronomical Satellite (IRAS);
- International Ultraviolet Explorer (IUE);
- ORFEUS-SPAS I
- Roentgen Satellite (ROSAT);
- Rossi X-ray Timing Explorer (RXTE);
- Voyager Ultraviolet Spectrometer (UVS).

Note that public-domain archival data from the preceding and other space astrophysics missions are included in this NRA, but that proposals for archival research using data from the Hubble Space Telescope (HST) and the Compton Gamma Ray Observatory (CGRO) are solicited through separate announcements.

- *Type B Proposals*

As a new feature for this ADP proposal solicitation, Type B proposals may be submitted by proposers who have already been awarded observing time on current observing cycles for ROSAT (Cycle 8) or ASCA (Cycle 6), and seek funding support for data reduction and analysis of the resulting observations. Type B Proposals may supplement the primary ROSAT/ASCA data reduction and analysis of new observations with data analysis of relevant public-domain archival data from ROSAT, ASCA, and other space astrophysics missions. Proposals for data reduction and analysis of new observations (only) should have a duration of one year, whereas proposals that also include relevant public-domain archival data analysis may request periods of performance for up to three years.

Type B Proposals may contain either the text originally submitted to ROSAT/ASCA for observing time, or merged/revised text, provided they comply with the generic guidelines for preparation of proposals in Appendix C, Section 5. Note that Type A and Type B proposals will compete together in the same science panels.

- *Requirements for Type A and Type B Proposals*

In support of these activities, but as a secondary emphasis, the proposed research may include theoretical research, numerical modeling, use of existing data from ground-based or suborbital observations, and laboratory astrophysics measurements. In addition, NASA will consider requests for support for new ground-based observations provided that the requests are clearly described, the observations are important to the success of the proposed effort, and their expense (including salary, travel, etc.) constitutes no more than 10 percent of the proposal's total budget.

Proposers to this NRA should note that the ADP is not intended to support:

- investigations whose primary emphasis is theoretical research, numerical modeling, laboratory astrophysics measurements, or detector development, since there exist other NASA programs that support research with these kinds of emphases;
- investigations whose primary focus is on solar system objects or on the solar-terrestrial interaction, since other NASA programs support this kind of research;
- proposals primarily for the education and training of students;
- proposals for the organizing and/or hosting of scientific meetings; and
- proposals for the acquisition of substantial computing facilities or resources, beyond nominal workstation or network requests.

Prospective submitters should also be aware that considerable research has already been done using these archival data sets both by the original mission science teams, as well as previously selected participants in the ADP. Therefore, proposals should demonstrate how the proposed research clearly extends the frontier of existing knowledge in a

fundamental and important manner rather than merely repeating a type of analysis on heretofore unstudied objects of some class or type. If this proposal is itself based on a previously funded research effort, the proposal should identify that work and clearly summarize all significant results from it.

2. Proposal Type, Data Sets, and Research Area

Each proposal must be identified as to Type A or B by checking the appropriate box on the Cover Page (see Section 5.3 in Appendix C). For all Types of proposals, the Cover Page also provides for designation of the data sets proposed to be used and also of the Research Area, as defined below, that designates the primary focus of the proposal. The primary use of these Research Areas is to facilitate the assignment of each proposal, regardless of Type, to the appropriate review panel. Note that each proposal, regardless of Type, must identify one primary Research Area (a secondary Area may be designated if necessary). In any case, NASA reserves the right to reassign a proposal to a different primary or secondary Research Area(s). As in previous ADP NRA's, the eight defined Research Areas are:

1. *Solar System* (note: proposals whose primary focus is solar system research using the IRAS Asteroid and Comet Survey or Voyager data should be submitted to other NRA's or program elements in this NRA that are relevant to those objectives);
2. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars);
3. *Main Sequence Stars*;
4. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae);
5. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
6. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
7. *Galaxies* (normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, quasars, radio galaxies);
8. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, cosmology).

3. Programmatic Information

It is anticipated that approximately \$2.5M will be available through this ROSS-98 NRA for the funding of new Type A and B awards for the Astrophysics Data Program, to fund proposals of a maximum of three years duration. The typical level of support per year is expected to be in the range of \$50K.

See Table 1 of this NRA's summary cover letter for the due dates for both the NOI and for the proposal. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>;

proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Astrophysics Data Program (ADP)
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

For further information, contact the Discipline Scientist:

Dr. Howard Smith
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0247
E-mail: adp@hq.nasa.gov.

A.2.5 Cosmic Ray Physics

1. Scope of Program

A. Cosmic Ray Physics Experimental Program.

This experimental program supports studies of the origin, acceleration, and transport of galactic cosmic rays. Fundamental measurements include the elemental abundance, isotopic composition, and energy spectra of galactic cosmic rays, as well as antimatter, exotic particles, and dark matter to provide tests of cosmological models. This experimental research program primarily supports science investigations utilizing large stratospheric balloons to carry instruments above about 99% of the Earth's atmosphere. It also supports the exploration and demonstration of new instrument concepts pertinent to the science goals of the discipline. The balloon payloads funded over the past decade have been similar in many respects to space flight instruments for a focused science investigation (e.g., level of technological sophistication, management approach, etc.). In fact, the term "balloon mission" would be appropriate for describing several of the investigations that have been supported.

This program will undergo a comprehensive review in 1998 in response to this NRA, with the intent to support a balanced experimental program in cosmic ray astrophysics research. Note, however, that only a fraction of the balloon investigations selected as a result of the last major review of this program in 1995 is reaching a natural completion in FY 1998. Therefore, most of the available funds in FY 1999 will be required to continue the development and observational phases of the ongoing projects, subject, of course, to their receiving high rating in the peer review. It is estimated that less than \$1M will be available in FY 1999 for starting new research projects. All projects selected under this NRA must demonstrate high scientific merit and a credible development plan for rapid completion. Preference will also be given to investigations that promise rapid dissemination of results and incorporate new technological developments.

The current fiscal climate and budget pressures demand that the total life-cycle costs of all flight projects be known, including the costs through publication of the results even if those publications may not occur within the nominal three-year award. The annual funding needs, the total project cost, the performance on recent, prior investigations (if applicable), and the extent to which an investigation contributes to the U.S. technological capability will be major factors in continuing ongoing projects and in selecting new investigations in response to this NRA. All proposed investigations should include a viable schedule, a cost plan, a management plan, and the anticipated balloon flight requirements to carry the proposed project, new or ongoing, to completion. Serious consideration will be given to providing a tentative commitment to fund selected projects to completion, up to a maximum of five years, contingent upon detailed progress reports and interim reviews that indicate continued funding is warranted. However, the total out-

year commitments, even though they are only tentative, must still allow for a stimulating future program of new investigations within budget constraints.

Owing to the greater degree of complexity of the proposals expected for this Cosmic Ray Experimental Program, the *Science/Technical/Management* section of the proposals may be 20 pages long instead of the default 15 pages specified in Section 5.1 of Appendix C.

B. Cosmic-Ray Theory and Data Analysis Program

Note that theoretical investigations of galactic cosmic rays should be submitted to the Astrophysics Theory Program (ATP) element described in Section A.2.6 of this Appendix A, while investigators interested in proposing to the Advanced Composition Explorer (ACE) Guest Investigator Program should see Section A.4.7.

2. Programmatic Considerations

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Cosmic Ray Physics
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Question concerning this program element may be addressed to the Discipline Scientist:

Dr. W. Vernon Jones
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington DC 20546-0001
Telephone: (202) 358-0885
Fax: (202) 358-3097
E-mail: wvjones@hq.nasa.gov

A.2.6 Astrophysics Theory Program (ATP)

1. Scope of Program

The Astrophysics Theory Program is intended to support efforts to develop basic theory needed for NASA's space astrophysics programs. The periods of performance of investigations that may be submitted for this research element ranges from one to three years, although most proposals that are selected have a duration of three years. Abstracts of currently funded ATP projects can be found at

<http://www.hq.nasa.gov/office/oss/codesr/ATP_Abstracts.html>

Proposals submitted for the ATP should:

- be directly relevant to space astrophysics: the proposed studies should facilitate the interpretation of existing data from space astrophysics missions, foreign as well as domestic, or should lead to predictions that can be tested with space astrophysics observations; and
- address theoretical problems in space astrophysics that are either broadly applicable across astrophysics or narrowly focused on a particular subdiscipline of space astrophysics, for example, infrared and radio astrophysics, ultraviolet and visible astrophysics, high energy astrophysics, relativity and gravitational astrophysics, galactic cosmic ray/particle astrophysics; the proposals should consist predominantly of theoretical studies and the development of theoretical models that may also incidentally include data analysis and comparison tests of theory against data from space astrophysics missions.

Conversely, proposals to the Astrophysics Theory Program may not:

- consist primarily of data reduction or data analysis (such proposals should be directed to the mission-specific programs, the Astrophysics Data Program, or the Long-Term Space Astrophysics Research Program);
- address theoretical topics that are predominantly unrelated to space astrophysics needs (such proposals should be directed to the appropriate Federal agencies);
- deal strictly or predominantly with solar system objects or solar-terrestrial interaction studies, including solar energetic particles;
- request support for organizing and/or hosting scientific meetings; or
- request support for substantial computing facilities or resources.

2. Topic Categories

For the purposes of conducting the review, every proposal for this ATP must be labeled with one (or more if appropriate) suggested Topic Categories from the current list below in both its Notice of Intent and in the proposal submission itself (note that the electronic

format for the *Cover Page* will include a line for entry of one of these topics; see Section C.5.3 of Appendix C). The primary use of these Topic Categories is to facilitate the assignment of the proposal to an appropriate review panel; NASA reserves the right to assign a proposal to a different Topic Category(s).

1. *Atomic and Molecular Astrophysics*
2. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars, brown dwarfs; dust and astrochemistry)
3. *Main Sequence Stars*;
4. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae);
5. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
6. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
7. *Galaxies* (normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, Active Galactic Nucleus (AGN's), quasars, radio galaxies);
8. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, relativity and gravity, cosmology).
9. *Cosmic Ray/Particle Astrophysics*

3. Programmatic Considerations

Two types of proposals will be considered: Proposals from Principal Investigators who head research groups, and proposals from individual researchers. A proposal from a research group must clearly justify the scientific need for and logic of the team effort; a set of unrelated or only loosely related research topics by several investigators does not constitute a valid group effort. All proposals, regardless of the size of their budget requests, are competitively reviewed against each other.

It is anticipated that approximately \$2.5M will be available through this ROSS-98 NRA for the funding of new awards for this program element, to fund proposals of nominally three years duration each. The typical level of support per year is expected to be in the range of \$50K to \$100K for individuals and up to a maximum of \$300K for research groups. The file called "ATP Statistics" located with the abstracts of previously awarded ATP grants (see URL address above) also contains funding statistics for the last review cycle.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Deborah Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance.

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Astrophysics Theory Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

For further information, contact the Discipline Scientist for this program element:

Dr. Howard Smith
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0247
E-mail: theory@hq.nasa.gov

A.2.7 Infrared/Submillimeter/Radio/Interferometry Astronomy Program

1. Scope of Program

This program element supports detector, payload, and laboratory research activities relevant to NASA Infrared, Submillimeter, Radio, and Interferometry (ISRI) Astronomy flight programs. In addition to the basic scientific and technical merit of the proposed research, its relevance to the ISRI Astronomy flight programs, both existing and planned, will be a significant factor in the evaluation process. These projects include the Stratospheric Observatory for Infrared Astronomy (SOFIA), the Terrestrial Planet Finder (TPF), balloon and sounding rocket experiments, and possible Explorer and Discovery missions. Proposals to develop balloon and rocket payloads are encouraged and additional resources are being sought to support technology in ground-based interferometry. Laboratory astrophysics investigations involving atomic, molecular, and solid state spectroscopy of relevance to the natural phenomena occurring in the universe are also encouraged.

Investigations to develop detectors relevant to the requirements of the Next Generation Space Telescope (NGST), including its stretch goals, are not appropriate to this program element, but are being solicited via a separate opportunity originating with the NGST Project.

Theoretical investigations that are generally relevant to this science area are solicited separately under the Astrophysical Theory Program (see Section 2.6 in this Appendix), while projects directed mainly toward the analysis of archival data are covered under the Astrophysics Data Program (Section 2.4).

2. Programmatic Information and Special Future Opportunities

The ISRI program has traditionally been announced and proposals selected only every three years. The last such selection was in 1996, and the next opportunity is expected to be announced in spring of 1999. Therefore, proposals for participation in the ISRI Program are not solicited by this ROSS-98 NRA. Detailed information pertaining to the schedule for the 1999 opportunity will be provided in the ROSS-99 NRA to be issued approximately one year from now.

Individuals who would normally expect to propose to the regular ISRI opportunity are encouraged to also consider proposing in response to a new program for advanced detectors that is expected to be announced in late spring of 1998 via a separate OSS NRA. In particular, it is expected that this NRA will include a special opportunity to propose the development of future detector technologies for the SOFIA program. Such proposals will be strongly encouraged also to demonstrate the value of their proposed investigations to activities or missions other than SOFIA. Note, however, that this NRA is not expected to solicit proposals for the development of complete instruments for SOFIA.

Additional information about this future advanced detector NRA may be obtained from:

Mr. Glenn H. Mucklow
Sensors and Instruments Program
Code SM
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-2235
Facsimile: (202) 358-2697
E-mail: glenn.mucklow@hq.nasa.gov

while additional information concerning the ISRI program in general may be obtained from the Discipline Scientist:

Dr. Harley Thronson
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202) 358-0362
E-mail: harley.thronson@hq.nasa.gov

A.3.1 Cosmochemistry Program (CCP)

1. Scope of Program

The Cosmochemistry Program (CCP) supports scientific investigations that are cosmochemical in nature that may involve laboratory studies of a variety of extraterrestrial materials (meteorites, cosmic dust, and lunar samples); or that are aimed at understanding the geochemical nature of the solar system bodies (planets, satellites including the Earth's Moon, and small solar system bodies); or studies concerned with the formation and chemical development of the solar system. The goals of this program are to support cosmochemical research projects that increase the understanding of the origin of the solar system, and the processes by which its planets and small bodies have evolved to their present state; and/or yield direct information about the formation of the solar system, the exact time scales for planetary formation and history, the nature and development of planetary surfaces, and the past activity of the Sun and cosmic rays. NASA is particularly interested in proposals for sample research projects that closely support its activities for exploring the solar system; determining its nature, origin, and history; and/or that contribute to the development of techniques for further such exploration. Individual investigations may involve direct measurements of physical and chemical properties, or research efforts that contribute new data, that analyze and synthesize existing data, or that combine both kinds of activities.

Examples of the kinds of research supported by this program include:

- cosmochemical studies of solar system formation;
- studies of chemical differentiation of planetary bodies;
- laboratory studies of phase stability, thermal emission, chemical partitioning, and other processes necessary to interpret planetary data;
- synthesis of previously obtained geochemical data;
- direct measurements of mineral compositions, major and trace element chemistry, isotopic compositions, radiometric ages, magnetism, radiation exposure effects;
- lunar highlands and mare petrology, lunar studies, lunar craters and microcraters, lunar physical and mechanical properties; and
- proposals that are designed to obtain basic scientific information that might enable the utilization of extraterrestrial resources.

However, the CCP will not consider proposals that are designed to demonstrate a technology that could be important to extraterrestrial resource utilization. Though no priorities are imposed on the general kinds of investigations, an ideal program is envisaged as a balance among these objectives, consistent with the quality of submitted proposals and their relevance to the current CCP.

Proposals for topical conferences, workshops, symposia, or other new initiatives related to the Cosmochemistry Program are also solicited through this NRA.

An important goal of the Solar System Exploration effort is to facilitate access to data and extraterrestrial sample material for certain scientific and educational purposes in addition to NASA-supported research projects. The NASA Johnson Space Center, Houston, TX, is responsible for the security and access to the lunar sample collection, as well as the interplanetary dust particles collected by high altitude aircraft, and meteorites collected in the Antarctic by field parties supported by the National Science Foundation (NSF). For information on how to obtain any of the specimens in these collection, contact:

Office of the Curator
Code SN21
Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058-3696.

This program is also interested in supporting certain types of research on terrestrial samples or with terrestrial analogs when such efforts contribute to overall program goals in cosmochemistry. Specific objectives of such terrestrial research should address key geochemical processes in early terrestrial evolution, terrestrial history in terms of general solar system processes, or the reasons for differences in evolution among the various planetary bodies, including Earth, the Moon, and parent bodies of meteorites. Proposals to analyze terrestrial samples or their analogs should clearly develop the nature of the planetary connection. The specific connection to the wider range of planetary processes is a key factor in determining the success of such proposals.

2. Programmatic Considerations

The National Science Foundation (NSF) may consider a wide range of proposals (from domestic organizations only) that contribute new knowledge in the area of cosmochemistry and related fields. The same proposal may be submitted to both NASA and NSF if desired; however, such proposals must clearly state they are being submitted to both agencies in the proposal section entitled *Current and Pending Support* (see Section 5.3 of Appendix C).

It is estimated that the funding level for this program for Fiscal Year 1999 will be approximately \$12.3M and that this level of funding will support approximately 100 research investigations, including both new proposals as well as in-progress multiple year awards for which progress reports are due.

Holders of existing Cosmochemistry multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report* by the same deadline as given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The five page limit does not include a *Cover Page*, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site should contact The Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Cosmochemistry Program

The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: (713) 486-2166

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce
Cosmochemistry Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-001
Telephone: (202) 358-0302
FAX: (202) 358-3097
E-mail: jboyce@hq.nasa.gov

A.3.2 Planetary Astronomy Program

1. Scope of Program

The Planetary Astronomy activity supports ground-based telescopic observations that contribute to the understanding of the general properties and evolution of the planets and their satellites, and of asteroids and comets. It includes observations made over a wide range of wavelengths from ultraviolet to radio and their analysis. The data obtained must be useful for basic research in support of planetary program objectives that either cannot be met by current spacecraft missions or directly support specific flight missions.

Proposals are sought for new projects that fall within the scope of the Planetary Astronomy Program. Ground-based observations supplementing NASA missions that will be returning significant amounts of data within the next three years are encouraged. These missions include the Galileo Europa Mission(GEM) and the Near Earth Asteroid Rendezvous (NEAR) Mission.

2. Programmatic Considerations

Presently about \$10.7M is budgeted for this program of which \$3.5M is dedicated to facilities support (principally the Infrared Telescope Facility (IRTF)). Approximately 100 investigations are supported with the remaining funds. Approximately one-third of these grants are expiring, allowing proposers to this ROSS-98 NRA to compete for about \$2.4M.

The National Science Foundation (NSF) also accepts proposals (from domestic organizations only) that contribute new knowledge in planetary astronomy. The same planetary astronomy proposal may be submitted to both NASA in response to this NRA, as well as to NSF. In such a case, the proposal must clearly state that it is being submitted to both agencies. The Planetary Astronomy Programs at NASA and NSF coordinate their reviews.

As a departure from past nomenclature for this program element, and in accordance with Appendix C.3, all proposals for this Planetary Astronomy program are now considered as “new” proposals regardless of past funding history, i.e., the old term of “Renewal (Full) Proposal” is no longer used. However, proposals that are a logical follow-on to work that has been selected and funded through previous Planetary Astronomy NRA’s should provide their existing NASA award number on the requested *Cover Page*, and describe the work that has been accomplished both in the required *Program Summary*, as well as in the body of the *Science/Technical/Management* section (see Appendix C.5).

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is

<<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute by

E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement

Planetary Astronomy Program

The Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery: (713) 486-2166.

Additional information may be obtained from the Discipline Scientist:

Dr. Thomas Morgan

Research Program Management Division

Code SR

NASA Headquarters

Office of Space Science

Washington, DC 20546-0001

Telephone: (202) 358-0828

E-mail: thomas.morgan@hq.nasa.gov

A.3.3 Planetary Atmospheres Program

1. Scope of Program

The Planetary Atmospheres program activity supports scientific investigations that contribute to the understanding of the general properties, origins, and evolution of the neutral and ionized atmospheres of planets and their satellites and of comets. Its broad objectives include the determination of compositions and chemical behaviors of planetary atmospheres; sources of and mechanisms for deposition of energy; characterization and understanding of dynamical processes; and relationships between currently observed properties and/or states of matter, chemical abundances, physical conditions, and processes that prevailed at the time the planets were formed. The scope of the Planetary Atmospheres activity includes laboratory investigations that supply basic physical measurements needed to interpret planetary data. These include measurements and calculations of spectroscopic properties, excitation/dissociation/ionization cross-sections, optical properties, and thermodynamic properties of materials found in planetary atmospheres. Proposals for analysis of data from NASA missions that return significant amounts of data, which is in the public domain, are encouraged. These include released data from the Galileo, Mars Pathfinder, and Mars Global Surveyor missions. Note that atmospheres of extrasolar planets are included within the scope of the Planetary Atmospheres activity, but investigations of the Earth's atmosphere and atmospheres of nonplanetary astrophysical objects are not.

2. Programmatic Considerations

Proposals are sought for new projects that fall within the scope of the Planetary Atmospheres Program. Presently, about \$7M is budgeted for this program, and approximately 100 investigations are expected to be supported by these funds. Many projects are funded for two and three years, thus releasing approximately one-third of the resources for annual competition.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance .

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Planetary Atmospheres Program

The Lunar and Planetary Institute

3600 Bay Area Boulevard

Houston, TX 77058

Phone number for commercial delivery: (713) 486-2149

For further information, contact the Discipline Scientist:

Dr. Reta Beebe

Research Program Management Division

Code SR

Office of Space Science

NASA Headquarters

Washington, DC 20546-0001

Telephone: (202) 358-0359

E-mail: reta.beebe@hq.nasa.gov.

A.3.4 Planetary Geology and Geophysics (PGG) Program

1. Scope of Program

The Planetary Geology and Geophysics (PGG) program supports scientific investigations of the planetary surfaces and interiors, satellites (including the Moon), satellite and ring systems, and smaller solar system bodies such as asteroids and comets. The goals of the PGG program are to foster the gathering, synthesis, analysis, and comparative study of data that will improve the understanding of the extent and influence of planetary geological and geophysical processes on the bodies of the solar system, the origin and evolution of the solar system, and the nature of Earth and its history in comparison with other planets.

The PGG program supports research investigations relevant to the scientific interpretation of data from past and existing planetary missions, as well as the science objectives of future missions. These investigations involve several types of research efforts such as, but not limited to: analysis and synthesis of existing data; theoretical and numerical modeling of data and processes; generation of new basic data in a laboratory environment; and combinations of these kinds of activities. Examples of the kinds of research supported by this program include:

- direct analysis of data from planetary missions;
- theoretical modeling of geologic and geophysical processes;
- photogeologic analysis and geologic interpretation of planetary surfaces;
- compositional and geologic mapping of planetary surfaces;
- laboratory and remote sensing studies;
- experimental studies of materials under conditions relevant to objects in the solar system;
- theoretical studies of the interiors of planetary bodies;
- the dynamical evolution of the planets, satellites, small solar-system bodies and ring systems; and
- geologic field studies of terrestrial analogs to planetary phenomena in the context of providing a better understanding of the planetary phenomena.

In addition, the program supports the development and production of cartographic products of planetary data sets. Proposals to study or develop flight instruments or study future planetary missions are beyond the scope of this program.

Proposed investigations of any planetary or satellite surface that are intended, as a by-product of the scientific research, to produce a geologic map suitable for publication by the U.S. Geological Survey (USGS) should check the relevant box on the *Cover Sheet* (see Section 5.3 of Appendix C) and clearly indicate this intention in the *Proposal Summary*, as well as the text of the proposal. Information on geologic maps that have been produced or are currently in production may be obtained from Dr. Kenneth Tanaka of the USGS at E-mail: <ktanaka@flagmail.wr.usgs.gov>.

Efforts to acquire observations of planetary surfaces and interiors may produce data of wide scientific interest. It is expected that these data sets would, after a reasonable amount of time, be archived within the Planetary Data System (PDS). Contact R. E. Arvidson (PDS Geoscience Node) for further information regarding the types of data sets that might be of interest for archiving purposes (E-mail: <arvidson@wunder.wustl.edu> or telephone: (314) 935-5609).

2. Experimental Facilities Available for the PGG Program

The following facilities are widely available to investigators supported by the PGG program, and, therefore, their use may be discussed in the submitted proposals (note especially the provisions for such discussion in the proposal section entitled *Facilities and Equipment*, in Section 5.3 of Appendix C).

- Planetary Aeolian Facility: The Planetary Aeolian Facility at NASA Ames Research Center consists of wind tunnels to simulate atmosphere-surface interactions on Earth, Mars, and Venus. For more information contact:

Dr. Ronald Greeley
Department of Geology
Arizona State University
Tempe, AZ 85287
Telephone: (602) 965-7029
Facsimile: (602) 965-8102
E-mail: greeley@asu.edu

- Reflectance Experiment Laboratory (RELAB): The RELAB facility at Brown University provides a mechanism for researchers to obtain laboratory spectra of geologic materials for use in compositional and/or geologic applications. The RELAB is supported by NASA as a multiuser spectroscopy facility, and laboratory time can be made available at no charge to investigators funded by NASA programs. For information on this facility and/or requests to receive a *RELAB User's Manual*, contact:

Dr. Carle M. Pieters
RELAB Science Manager
Department of Geological Sciences
Box 1846
Brown University
Providence, RI 02912
Telephone: (401) 863-2417
Facsimile: (401) 863-3978
E-mail: pieters@porter.geo.brown.edu

- NASA-Ames Vertical Gun Range (AVGR): The NASA AVGR is a national facility funded by the NASA Office of Space Sciences to enable investigations of impact

phenomena and processes. Exploratory or proof-of-concept programs requiring a limited number of experiments can be accommodated at no cost. More extensive programs are subject to review in order to assess feasibility and cost effectiveness. For more information, potential users of the AVGR should contact:

Dr. Peter Schultz
Department of Geological Sciences
Box 1846
Brown University
Providence, RI 02912
Telephone: (401) 863-2417
Facsimile: (401) 863-3978
E-mail: peter_schultz@brown.edu

3. Data Sources Available for the PGG Program

Prospective proposers should be aware of sources for data that might be used in their research and whether the required data are available. Useful contacts for making these determinations are given below:

- General Lunar and Planetary Information: The Lunar and Planetary Institute (LPI) is the most concentrated and readily accessible source of information in lunar science. Information about its services can be found on the LPI home page on the World Wide Web at URL <<http://cass.jsc.nasa.gov/lpi.html>>, and/or contact:

Director
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Telephone: (713) 486-2180

- Data from Completed NASA Flight Programs: The National Space Science Data Center (NSSDC) stores digital and other data from completed flight experiments. Such data include: (1) lunar and planetary photographs, (2) digital planetary images, (3) data from numerous flight experiments, and (4) lunar cartographic products. Investigators are responsible for acquiring the data needed for their proposal. Modest requests for imaging and nonimaging data are free of charge, while charges are made for large requests. Requests from U.S. investigators for data products and information may be made to:

National Space Science Data Center
Code 633.4
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
Telephone: (301) 286-6695

while requests from non-U.S. investigators for NSSDC data products and product availability information may be made to:

World Data Center A for Rockets and Satellites
Code 633
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771
USA

Telephone: (301) 286-6695

- Planetary Cartographic Products: A variety of planetary cartographic products such as topographic, orthophoto, geological, and other special maps and geodetic information are available. Requests from NASA-funded investigators for production of special maps or other cartographic materials will be accommodated when possible. Request available data or specific maps from:

Branch of Distribution
U.S. Geological Survey
Federal Center
Box 25286
Denver, CO 80225

Telephone: (303) 236-7477

Request information related to the availability of base maps and related materials or U.S. Geological Survey criteria for map publication from:

Branch of Astrogeology
U.S. Geological Survey
2255 North Gemini Drive
Flagstaff, AZ 86001

Telephone: (602) 556-7262

- Regional Planetary Image Facilities: Regional Planetary Image Facilities (RPIF's) contain nearly half a million images of the planets and their satellites taken both from Earth and manned and unmanned spacecraft, as well as topographic and geologic maps produced from these images. The RPIF's, located at institutions worldwide, are intended for use by individuals and groups who use photographic and cartographic materials of the planets and satellites in their research programs. These programs include geologic, photometric, colorimetric, photogrammetric, and atmospheric dynamical studies.

In addition to the local scientists and their associates who use these data on a daily basis, investigators throughout the world are encouraged to use the RPIF's. Send inquiries to the nearest facility in care of the Director, Regional Planetary Image Facility. Note that while these centers may be used for on-site study and selection of planetary and satellite images, they are not facilities for the production of photographs for users. Instead such

materials may be obtained from the NSSDC at the NASA Goddard Space Flight Center at the address given above. Additional information, including a listing of RPIF locations worldwide, can be found on the RPIF home page at URL <<http://cass.jsc.nasa.gov/library/RPIF/RPIF.html>>.

- Decalibrated Digital Planetary Image Data: Digital planetary image data are available through the discipline nodes of the Planetary Data System. Submit requests for imaging data and support documentation to:

Planetary Data System/Imaging Node
U.S. Geological Survey
2255 North Gemini Drive
Flagstaff, AZ 86001
Telephone: (602) 556-7262

while requests for other planetary geoscience data may be submitted to:

Planetary Data System/Geosciences Node
Washington University
Campus Box 1169
One Brookings Drive
St. Louis, MO 63130
Telephone: (314) 935-6652

4. Programmatic Information

Anticipated funding for this program is approximately \$12.5M for FY 1999, which is expected to support approximately 150 investigations, including both new proposals and in-progress multiple year awards.

Holders of existing PGG multiple year awards (e.g., the second or third year of a three-year award from a previous NRA) must submit a request for an annual funding allotment of their award in the form of a *Progress Report* by the same deadline as given in Table 1 for new proposals for this program element. These *Progress Reports* will be screened by the peer review panel that will be reviewing new proposals to aid NASA's evaluation of progress. The Project Description in such a request for allotment, including a report of progress made during the past year, should be limited to no more than five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress made during the previous year, a budget, and an estimate of the amount of previously awarded funds that will remain available at the end of the award year. The five page limit does not include a *Cover Page*, a listing of proposal personnel, *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices.

The schedules for submission of the Notice of Intent and proposal is given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the *Cover Page/Proposal Summary* (see Appendix C.5) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance . Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Planetary Geology and Geophysics Program

The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: (713) 486-2166

Additional information may be obtained from Discipline Scientist:

Dr. Patricia G. Rogers
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0294
E-mail: patricia.rogers@hq.nasa.gov

A.3.5 Planetary Instrument Definition and Development Program

1. Scope of Program

The Planetary Instrument Definition and Development Program (PIDDP) 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. Therefore, the proposed instrument technology must address specific scientific objectives of candidate future missions. New measurement concepts can be proposed, as well as methods to significantly improve the performance of existing instruments and/or the development of technologies to enable integrated instrument packaging (architectures). The emphasis in this NRA is also on the development of miniaturized, low power, and low cost instruments for Discovery-class and other similar missions. Instrument definition and development studies can take place at several stages, from feasibility studies, to conceptual design, to laboratory breadboarding (but not brassboarding) of critical components and complete instruments.

Results of PIDDP work have contributed to the eventual development of flight hardware flown on or selected for many NASA missions. Since this is the goal of the PIDDP program, proposals should consider the potential of the proposed effort for enhancing future technology validation and science missions. This NRA also solicits proposals for instrument concepts addressing goals of NASA's Exobiology Program. Instrument development activities that were previously funded under the Exobiology Research and Analysis Program are now included exclusively in the PIDDP.

Proposals not appropriate for this NRA are those that would seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, or onboard data processing or data compression studies.

While this program element will be advertised annually, the nature of specific efforts selected for funding will vary, with emphasis in any given year placed on preparation for the nearest term missions for which instruments have not yet been selected. However, there can also be support provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technology for missions further in the future, and/or for detector development studies that may advance the technology for a wide range of planetary instrumentation applications. Therefore, proposers are encouraged to relate their proposed efforts as closely as possible to specific future planetary missions and demonstrate how their technology addresses the scientific goals of these missions.

2. PIDDP-Focused Future Missions

Proposals for instrument definition and development for certain of the following future missions will be considered for funding through the PIDDP.

- *Discovery Program*

The Discovery Program is envisaged as a series of focused, quick-turnaround missions. Development time will be approximately 36 months, and launch vehicles will not be larger than a Delta-II. The first two Discovery missions, the Near Earth Asteroid Rendezvous (NEAR) and the Mars Pathfinder, have been launched. A mission to the Moon, Lunar Prospector, and a comet sample return mission, Stardust, are the next two selected missions. The two newest missions, CONTOUR and Genesis, were selected in 1997. Future solicitations are planned approximately every 18 months.

The Discovery missions may include flyby, orbiter, lander, Earth orbiting, and sample return missions to a variety of solar system objects to study surface and atmospheric composition, thermal structure, meteorology, geoscience, topography, dynamics, and field and particle environments. Instrumentation and techniques addressing seminal scientific questions in this broad range are appropriate development efforts under the PIDDP. Technology applicable to multiple missions and investigations will have higher priority for funding. However, instrument definition and development will be considered only for missions that follow the NEAR, Mars Pathfinder, Lunar Prospector, Stardust, CONTOUR, and Genesis missions. Proposals for the development of new instruments for missions already selected for Discovery Phase A study and/or development will not be accepted under this NRA.

- *Mars Surveyor Missions*

The Mars Surveyor missions include orbiters and landers that utilize small to medium spacecraft. The first of these is the Mars Global Surveyor, launched in November 1996. Instruments for two follow-on missions, an orbiter and lander, have been selected for launch in 1998. Instruments for the Mars 2001 orbiter and lander mission were selected in 1997. Future launches to Mars will occur approximately every 26 months. Although the scientific objectives of each of these missions vary greatly, their scientific payloads will consist of small, lightweight, low power consumption instruments.

Instrument development proposals for both U.S. and international follow-on missions to Mars (i.e., beyond the Mars 2001 mission) are appropriate under this NRA. Consideration will also be given to proposals addressing the development of instrumentation for Mars sample return missions, a major focus of Mars exploration in 2003 and beyond. Instrument technologies for the *in situ* exploration of Mars are of particular interest for future missions. The PIDDP seeks new concepts for Mars surface science, including but not limited to, potential instruments for radiometric age-dating, soil/rock mineralogy and chemistry, water/ice detection and characterization, exobiology assessment, drilling/coring, and atmospheric analyses.

- *Outer Solar System Missions*

Missions to the outer planets and satellites are a specific NASA objective. An AO may be released in 1998 for a mission to Europa or Pluto. Additional future opportunities might also include focused science missions under the Discovery Program, or entry probes for outer planet atmospheric studies. Therefore, the PIDDP solicits instrument concepts for future outer planet missions, including but not limited to Europa, Pluto, Jupiter, or Titan probes, and comet nucleus sample returns. These missions may include flybys, orbiters, landers (e.g., Titan, Europa, or comets), or aerobots (e.g., Titan), so science instruments relevant to remote and *in situ* studies of these bodies are solicited. Instrument concepts include but are not limited to ice-penetrating radar sounding systems, laser altimeters, and lightweight imaging systems with broad spectral range. Atmospheric entry probe concepts, including a miniature mass spectrometer, will also receive consideration.

- *Origins of Solar Systems*

NASA's long-range strategy includes flight missions that will follow and extend the ground-based phase of the search for planets about other stars, and several approaches for space-based platforms addressing the search for extrasolar planetary systems have been identified. Breadboard studies of technologies and instruments (consistent with the limited scope of the PIDDP) that could contribute to the space-based search for extrasolar planets are appropriate for this ROSS NRA.

3. Programmatic Considerations

Proposals are solicited under this NRA for instrument definition and development only for the missions or classes of missions described in Section 2 above. It is anticipated that the scientific payloads on all future solar system exploration missions will be limited to small, low mass, low power consumption, and low cost instruments. For this reason, only proposals for instrument definition and development satisfying these general specifications will be considered for support. Therefore, all proposals submitted for this PIDDP must specify:

- The mission or class of missions for which the proposed instrument is applicable. Instruments that might fly on a number of missions will be given priority over those applicable to only a single mission.
- The science objectives of the proposed instrument. The relationship between the science objectives and the instrumental capabilities must be clearly demonstrated. For those instruments applicable to many missions or capable of meeting multiple science objectives, examples of science objectives for the proposed mission or missions should be given.

- Technological advances to be pursued as an inherent element of achieving the science objectives. Proposers are also asked to identify potential mechanisms that could facilitate transfer of these technologies to other users, including the private sector, for possible application beyond the immediate one of meeting mission science objectives.

The evaluation criteria in Section 1.4 of Appendix C are fully applicable to the PIDDP. In addition, however, the determination of a proposal's relevance shall also take into account the following factors:

- The extent to which the proposed instrument is applicable to multiple missions in the Solar System Exploration science theme and/or Origins of Solar System program element (see Section A.1.1 in this Appendix);
- The extent to which the instrument addresses a priority science goal of the mission or missions for which it would be a candidate for flight; and
- Either the near-term nature of the mission or missions in question, or the necessity of embarking on a long lead-time development of a very important instrument contemplated for flight on a mission that is of high priority, even though it is not in the near-term queue.

It should be noted that the contemplated sequence of missions described in this NRA is a best current estimate and is subject to change. NASA reserves the right to make a determination of relevance based on the contemplated sequence of missions as it is understood at the time of proposal evaluation and selection.

Full, new proposals are sought for either entirely new studies or for the extension of PIDDP studies terminating in FY 1998. Proposals may specify periods of performance of up to three years. A final report will be required at the termination of the period of performance. It is expected that there will be approximately \$3M dollars available for new (and extension) proposals, and that 12 to 15 studies will be supported with these funds. Studies selected previously for multiple year periods of performance and that are continuing beyond FY 1998 require submission of brief renewal proposals at least 90 days prior to their anniversary dates consisting of a progress report and an updated budget (excluding contracts), but do not require submission of a full proposal.

As a modification to the default specification in Section 5.1 of Appendix C, 17 copies of the proposal are required, including one with original signatures.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance.

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Planetary Instrument Definition and Development Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Additional information may be obtained from the Discipline Scientist:

Dr. Bruce A. Campbell
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0297
E-mail: bruce.campbell@hq.nasa.

A.3.6 Planetary Major Equipment Program

1. Scope of Program

This program element allows proposals for upgrading the analytical, computational, telescopic, and other instrumentation required by investigations sponsored by the Solar System Exploration programs, including Exobiology. New major instrumentation that is necessary for the conduct and/or quality of proposed research or that would significantly benefit the broad science community, may also be proposed. Major Equipment proposals may be submitted in conjunction with new scientific research proposals or as an augmentation to multiple year proposals that are currently funded through OSS for support of the Solar System Exploration science theme or Exobiology program element. Major Equipment proposals that are not affiliated with such OSS research proposals will not be considered.

It is estimated that \$1M will be available through this program element to support approximately 20 grants. In order to make the best possible use of the funds that may be available, proposers who request funds for equipment are encouraged to seek cost sharing where appropriate and to propose collective use where that is reasonable, i.e., instruments that could be made available for use by other qualified members of the planetary science community. Cost-shared proposals would be especially attractive for very high cost instruments; the partners of such proposals must provide a written statement regarding long term funding and institutional commitment.

However, proposers need to recognize that NASA interprets cost-sharing arrangements as joint ownership, and, therefore, NASA has the option to retain title to instruments acquired under such arrangements. Issues of ownership and title may be especially complicated under arrangements that involve other Federal agencies (e.g., the National Science Foundation). When joint ownership cannot be avoided, and the requested NASA contribution will exceed \$1000, agreement regarding NASA's retention of its option to take title, and the conditions under which the option (if retained) will be exercised, shall be reached and documented prior to purchase.

2. Exclusions and Restrictions

- Instrumentation or support equipment costing less than approximately \$20K is not considered major; requests for such items should be included in the body of the research proposal submitted to the appropriate Solar System Exploration program element in Section A.3 of this ROSS-98 NRA.
- Instrumentation or equipment considered inappropriate for this Major Equipment program element includes personal computers or computer peripherals (unless these are

integral parts of the instrumentation requested), miscellaneous support equipment, support contracts, and equipment repair where the repair does not involve significant enhancement of the instrument's basic capabilities, nor should funds be sought to support maintenance and continued operations of any instrument requested.

- In no event will proposals be considered that seek to design, develop, test, or evaluate new instruments that are to be considered for sale.

3. Proposal Requirements

- Format

A proposal for major equipment should be written so that it can be reviewed as a stand-alone proposal, although it will be reviewed in connection with the appropriate science proposal. This is especially important for proposers who are operating under multiple year awards and who normally would submit only a progress report to request an additional funding allotment to complete a period of performance. This is also important because Major Equipment requests may also be reviewed by a multidisciplinary group external to the normal review process. All proposals should contain a short abstract and sections on project description, management, and costs.

- Objectives

Types and/or classes of instruments that are considered appropriate to be proposed for this program element are listed below, although requests for instruments not specifically identified in the list will receive equal consideration. Note that this list is not intended to be inclusive, but rather illustrative of the range of instrument types (and hence costs) that are appropriate:

- Solid source, light element, and noble gas mass spectrometers;
- Electron microprobe;
- Scanning electron microscope;
- Transmission electron microscope;
- Camera-class ion microprobe;
- Activation analysis equipment;
- X-ray fluorescence analyzer;
- Organic analysis instrumentation;
- Static high pressure instrumentation;
- Portable high-speed charge-coupled device for occultation measurements;
- Telescopic instrumentation;
- High resolution infrared spectrometer;

- Large format optical charge-coupled device (2000 x 2000 pixels) with coronagraph;
 - Faint object infrared spectrometer;
 - Near infrared array camera with coronagraph;
 - Coolable white cells;
 - Instrumentation for planetary atmospheres laboratory studies; Tunable dye-laser high resolution spectrometer; and
 - Instrumentation for measurement of gas phase reaction rates, photochemical reaction rates and branching rates, and collisional disassociation, ionization, or recombination cross-sections.
- Project Description

The main body of the proposal should first identify the instrument to be acquired or developed and the type of use proposed. It should contain a strong justification, including a description of why the instrument is necessary for the investigator's research or how it would enhance that research, citing specific examples wherever possible. It should also demonstrate why the enhanced capability is important to planetary science in general. If an instrument is proposed for the benefit of the science community, the justification should emphasize, as well, how the enhanced capability would benefit the larger planetary science community. All justifications should address how the requested instrument relates to existing capabilities, both in the investigator's own laboratory and to others in the community.

Any substantial collaboration with individuals not referred to in the budget, or use of consultants, should be described. Any anticipated cost-sharing or substantial institutional contributions should be described. It should be noted that cost sharing (between NASA and other agencies such as the Department of Energy or the National Science Foundation) is encouraged to the extent that NASA's share of the cost will ensure adequate use by NASA investigators. This aspect of any proposed cost-sharing acquisition must be discussed in the proposal. If other agencies have been approached or have made tentative commitments, the proposal should document that and provide names and telephone numbers of appropriate officers in those agencies who can discuss their agencies' interest.

When it is expected that the acquisition or development of an instrument or facility will require more than one year, the proposal should cover the complete project but with a clear distinction between the efforts involved in each requested year.

- Instrument Management and User Access

In addition to use by Principal Investigator, if the proposed instrumentation is intended to be offered for use by the scientific community at large, a management section is required that should describe how the requested instrument would be managed. This description should include a statement of the percentage of the instrument's time that would be available to other users and a general statement regarding aspects of user access, such as time of day when access would be granted, whether access would be "hands on" or only by an operator or collaborator in the PI's group, any costs to be charged for use and how costing would be handled, and how users would gain access (personal communication, proposal, etc.).

Requests for an instrument should specify how the instrument is to be used, whether by Principal Investigator (PI) and the PI research group only, or by the PI group as well as other investigators (facility instrument). These categories are defined below.

Investigator Instrument: An investigator instrument is an instrument acquired or developed by an investigator to support his or her research where he or she has full authority for its exclusive use and where there are no commitments to make the instrument available to other investigators.

Investigator Facility Instrument: An investigator facility instrument is an instrument acquired or developed by an investigator to support his or her research where an identified portion of its time is to be reserved for use by the PI but where an additional, specified portion of its time will be made available to other knowledgeable NASA planetary program investigators, and where all details of access, method of use, charging, and data rights are determined by the PI in negotiation with potential users.

Regional Facility Instrument: A regional facility instrument is an instrument of considerable cost or one that is limited to one location by virtue of its use on a specific beam source or telescope facility, but is acquired by a PI to support his or her research. A significant, specified portion of a regional facility instrument's time will be reserved for use by the PI, but a significant, specified portion of its time must also be available to other planetary program investigators. Unlike an investigator facility instrument, however, all details of access, announcement of availability, assistance to be provided on its use and methods of use (whether hands on or by an operator), charges, and data rights must be documented and agreed to by NASA and the sponsoring institution before NASA support is provided.

- Costs

If the proposed instrument is to be acquired from commercial sources, only those costs directly associated with the acquisition, installation, and check-out of the instrument should be requested. No costs for maintenance or operation beyond the check-out period should be included. These must be requested in research proposals submitted to the appropriate discipline programs. If the instrument is to be developed by the investigator, all costs associated with the development and final check-out should be requested. Multiple year requests would be expected in these cases. In all cases, however, provision of an adequately documented cost section will facilitate evaluation, and, if selected, improve the likelihood of a timely award. It is especially important that each relevant cost category (Direct Labor, Fringe Benefits, Overhead, and Other Direct Costs such as Computer Use, Equipment, Travel, etc.) be detailed, explained, and substantiated in the proposal.

4. Programmatic Considerations

Evaluation factors will be those employed in evaluation of proposals received in response to this NRA, given in Section C.1.4 of Appendix C with the following additions. In considering the relevance of the Major Equipment request to NASA's planetary and exobiology sciences objectives, attention will be focused on the added value that would be gained by the addition of the instrument capability to ongoing and anticipated research of the proposer, in particular, and to NASA's objectives in general. In evaluating the intrinsic merit of the request, additional factors that will be considered of equal weight are the scientific merit of the original proposal to which the request is tied and the value that the new or enhanced capability would add to science and/or education beyond that offered specifically to planetary science.

The process to be followed in the evaluation is to have the Major Equipment request reviewed by each discipline peer review panel during the full proposal review and in the context of proposed research proposed. Those requests that most clearly meet the criteria outlined in terms of scientific merit, program balance, and funding as judged by the peer panels will be considered by the OSS Discipline Scientist on the basis of programmatic merit. Funding recommendations will then be referred to the Director, Research Program Management Division for final selection.

A requests selected for Major Equipment support will be funded through augmentation to the grant/contract that provide support for the Principal Investigator's basic research program. If such a request involves a multiple year period of performance for its development activities, an annual funding allotment to the basic continuing award will be provided only upon receipt, review, and approval of a progress report and up-dated budget and/or statement of work as may be appropriate.

As noted in Section 1 of this program element, a Major Equipment proposal is to be submitted only in conjunction with a new scientific research proposal, or as an augmentation to an existing multiple year investigation currently funded in support of the OSS Solar System Exploration science theme. Therefore, the schedules for submission of Major Equipment NOI's and proposals are the same as those given in Table 1 of the cover letter of this NRA for the relevant Solar System Exploration program elements. The World Wide Web site for submitting both the NOI and proposal *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281)486-2156 or-2166 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Planetary Major Equipment Program

The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: (713) 486-2166

Additional information about this Major Equipment program element may be obtained from the respective Discipline Scientists for the program elements in Section A.3 of this ROSS-98 NRA to which the central scientific research proposal has been submitted, or is relevant in those cases where a Major Equipment supplement is planned for an existing multiple year award.

A.4.0 Overview: The Sun-Earth Connection Science Theme

1. Program Description

The Sun-Earth Connection (SEC) science theme of NASA's Office of Space Science (OSS) supports investigations of the Sun and planetary space environments, including the origin, evolution, and interactions of space plasmas and electromagnetic fields in the heliosphere and in connection with the galaxy. Understanding the origin and nature of solar activity and its effect on the space environment of the Earth is a particular focus. Current discipline interests are:

- Heliospheric Physics: the origin and behavior of the solar wind, energetic particles, and magnetic fields in the heliosphere and their interaction with the interstellar medium;
- Solar Physics: the Sun as a typical dwarf star, and as the dominant, time-varying source of energy, plasma, and energetic particles in the solar system, especially concerning its influence on the Earth;
- Magnetospheric Physics: the physics of magnetospheres, including their formation and fundamental interactions with plasmas, fields, and particles; the Earth's magnetosphere is emphasized, but studies of the magnetospheres of planets, comets, and other primordial bodies are also supported; and
- Ionospheric, Thermospheric, Mesospheric (ITM) Physics: the physics of the mesosphere, thermosphere, ionosphere, and aurorae of the Earth, including the coupling of these phenomena to the lower atmosphere and magnetosphere.

The emphasis in all of these disciplines is the study of processes that occur naturally in the space environment and/or the study of artificially induced perturbations that elucidate natural plasma processes. Details of the purview of these disciplines are given in respective subsections of Section A.4 of Appendix A of this ROSS-98 NRA.

The strategic vision for the Sun-Earth Connection is embodied in the *Sun-Earth Connection Roadmap - Strategic Planning for the Years 2000-2020*. This document is accessible through the World Wide Web at <<http://epsun.space.swri.edu/~roadmap/index.html>>.

2. Program Types

Proposals for several different types of program elements of the Sun-Earth Connection research program are solicited in this NRA. These include the Supporting Research and Technology (SR&T) and suborbital programs in the various disciplines, The Sun-Earth Connection Theory Program, as well several Guest Investigator programs. Generic program descriptions follow immediately below, while discipline specific information can be found in the individual SEC program elements in Section A.4 of this Appendix.

(1) Supporting Research and Technology Program. The SEC theme program elements support between 20 and 80 individual research tasks each that employ a variety of research techniques, *e.g.*, theory, numerical simulation, and modeling; analysis and interpretation of space data; development of new instrument concepts; and laboratory measurements of relevant atomic and plasma parameters, all to the extent they have a clearly stated and specific application to contemporary problems of the natural phenomena and to the NASA Sun-Earth Connection program. The individual SR&T programs are described further in Sections A.4.2, A.4.3, A.4.4, and A.4.5 that follow.

(2) Suborbital Programs. The objectives of the suborbital programs are: (i) to allow the study of naturally-occurring phenomena in space or near-space that can be obtained with relatively low cost instruments flown from unique locations and/or in conjunction with special events (*e.g.*, a solar eclipse or to gather ancillary data for a related orbiting spacecraft); and (ii) to proof-test new concepts in experimental techniques that may ultimately find application for orbital missions for Sun-Earth Connection program objectives. The suborbital program for Solar Physics is treated in Section A.4.5 of this NRA and the combined suborbital program for Magnetospheric and ITM physics is treated in Section A.4.6.

(3) Sun-Earth Connection Theory Program (SECTP). This program supports efforts to attack problems concerning phenomena relating to the Sun-Earth Connection program that are beyond the scope of the nominally smaller SR&T tasks discussed above using relatively large "critical mass" groups of investigators. Funding for SECTP is competed in its entirety every three years, and proposals for the period FY 1999 through FY 2001 are being solicited in this ROSS-98 NRA; see Section A.4.1 of this Appendix.

(4) Guest Investigator (GI) Programs. Guest Investigator Programs are intended to maximize the return from currently ongoing missions by providing support for research which heavily utilizes mission specific data from currently operating spacecraft. This NRA solicits proposals for an Advanced Composition Explorer (ACE) GI Program (see Section A.4.7) and an interdisciplinary SEC GI Program (see Section A.4.8).

(5) Data Restoration Program. This program has as its goal to identify space physics data archives that are considered of significant value to the OSS scientific community at large and provides funding to restore, archive, and prepare these holdings for public access. This program activity has been integrated into the Applied Information Systems Research Program (see Section A.5.2).

Proposals to any of the SEC program elements are expected to present, within their *Scientific/Technical/Management Section* (see Section C.5.3 of Appendix C):

- 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.

3. Limitations on Objectives of Proposals

Proposals whose intent or purpose is to extend or directly supplement investigations selected for approved space flight missions are not appropriate for this NRA. Investigators who are members of the science teams of ongoing missions and who propose to use data from these missions in their SR&T efforts must clearly delineate between their mission responsibilities and the proposed efforts.

Proposals for fabrication of complete flight instruments are not appropriate to this NRA except in the suborbital programs. However, the development of instrument concepts and/or critical subassemblies (e.g., detectors, filters, etc. through to the stage of laboratory ("brass board")) verification may be proposed as SR&T tasks, provided the proposed activity is in the context of a clearly defined science objective.

Proposals that focus on reprocessing, archiving, and/or routine reduction of flight data are appropriate only for the Data Restoration Program (see above).

Some areas of study within the Sun-Earth Connection theme overlap with research objectives supported by other OSS disciplines. In particular, proposals dealing with the following disciplines are outside the purview of the SEC program elements in this Appendix: galactic cosmic rays, cosmic x-rays and gamma rays; the neutral components of planetary toruses, rings, and/or atmospheres of extra-terrestrial planets; comparison of the Sun to other stars; and the chemistry and/or dynamics of the lower, neutral terrestrial atmosphere (i.e., below the mesosphere). If there are any questions, contact the appropriate Discipline Scientist(s) as identified in this Appendix.

A.4.1 Sun-Earth Connection Theory Program (SECTP)

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of the NASA Office of Space Science (OSS) Sun-Earth Connection (SEC) science theme.

The SECTP is a continuation of the previously funded Space Physics Theory Program (SPTP), with the exception of galactic cosmic rays investigations, which beginning with this ROSS-98 NRA are now included in the Astrophysics Theory Program (see Section A.2.6). The scientific purview of the SECTP encompasses solar physics; heliospheric physics; magnetospheric physics; and ionospheric, thermospheric and mesospheric physics. The new title and scope of this program element reflect organizational changes within OSS.

The SECTP supports theory and modeling investigations of the highest scientific quality dealing with problems of fundamental importance within or transcending the boundaries of these individual disciplines. The key characteristics of successful SECTP investigations are that they are of the highest intrinsic scientific quality, and that they also propose to attack problems falling within OSS SEC science theme of sufficient breadth that their successful completion requires the efforts of a synergistically interacting group of investigators. Proposals that serve only as an umbrella for a variety of separate research tasks, even though the tasks are related by a common theme, are not appropriate for the SECTP. Likewise, proposals for narrowly focused and/or smaller scope theoretical efforts should be submitted to the individual SEC science discipline program elements described in Section A.4 of this Appendix.

The group perspective of SECTP is sufficiently important that proposing teams, especially those without a prior history of close associations, should address carefully how future collaboration will be organized and effected. An important characteristic of the SECTP is that it encourages the exploration and development of new areas in The Sun-Earth Connection theme, especially interdisciplinary ones, and, in so doing, may develop objectives for future but as yet undefined space missions.

Anyone seeking funding from the SECTP for the current cycle must submit a proposal in response to this NRA. Funding for proposals selected for the next three-year period of performance will begin in the first quarter of FY 1999.

Proposals should include a clear, concise, and incisive description of the scientific problem(s) to be addressed, the methodologies to be used, and the significance of the expected results in the context of the SEC. The bearing of the proposed science on observational programs, past and future, should be discussed briefly but explicitly.

It is also important that proposals clearly indicate the role of each investigator, the commitment of his/her time, and the nature and extent of support to be provided by the proposers' institutions.

Groups proposing to continue participation from the last triennium selection should include a clear but concise statement of what they previously proposed and the specific portions thereof that were carried out, successfully or unsuccessfully. Achievements should be documented in the form of a list of references to relevant publications. Such materials dealing with prior performance may be presented in an Appendix to the main proposal.

An important aspect of the SECTP has been the support rendered by the investigators' home institution(s), should the proposal be chosen. Such support may take the form of institutionally provided resources and/or concrete measures, e.g., the establishment of permanent positions, which manifests the importance of SEC science to the organizational mission. Such support plays a role in the selection process, and it is important that it be clearly identified in the main proposal in a short section entitled "Proposed Institutional Support." In addition, those seeking continuation should include in their Appendix a review of the last three years' activity a statement of prior commitments and how they have been fulfilled. Since SECTP objectives frequently use supercomputers, such usage should be pointed out, resources identified, and costs estimated (note especially the availability of NASA-sponsored computer facilities; see Section C.1.1 of Appendix C of this NRA).

2. Programmatic Information

All SECTP proposals will be evaluated and selected as indicated in Sections C.1.4 and C.1.5 of Appendix C. It is stressed again, however, that adherence to the unique programmatic guidelines for this program will play an important role in determining selection: scientific and programmatic merits will be considered on an equal basis. Continuity of support for a currently selected SECTP group (i.e., one from the SPTP selection activity carried out in 1995) will be considered only as needed to discriminate between two proposals of otherwise equal merit. Finally, achievement of a balanced distribution of investigations across the various SEC disciplines is a goal, but such will be effected only to the extent that proposals of the highest merit exist in all areas.

Selections will be nominally for a three-year period of performance with annual funding allotments contingent upon the submission of a satisfactory progress reports and available funding. Funding for the previous SPTP in Fiscal Year (FY) 1998 was \$4M, which was distributed to 14 participating groups. In part owing to the redefined scope of SECTP as discussed in the beginning of Section 1.1 of this program element, the FY 1999 funding for SECTP is expected to be about \$3.5 M, with no increase anticipated for the

rest of the triennium. This lower budget, plus the need to allow for inflation, may necessitate a reduction in the total number of selections from that carried in the past.

Owing to the larger scope and personnel involvement in SECTP proposals, the page limit identified in Section C.5.1 of Appendix C is revised to 20 pages for the proposal's Science/Technical/Management Section instead of 15 pages. All other page limits identified in Appendix C.5.2 apply.

The schedules for submission of the Notice of Intent (NOI) and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://props.oss.hq.nasa.gov>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Sun-Earth Connection Theory Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Questions concerning this program may be addressed to the Discipline Scientist:

Dr. David S. Evans
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202) 358-0894
Facsimile: (202) 358-3087
E-mail: devans@hq.nasa.gov

A.4.2 Heliospheric Physics.

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection science theme of the NASA Office of Space Science.

Investigators interested in proposing to the Advanced Composition Explorer (ACE) Guest Investigator Program should see Section A.4.7 of this Appendix.

This program element supports research aimed at understanding:

- How the Sun accelerates the solar wind and causes temporal and spatial variability in the solar wind;
- The global dynamic character of the heliosphere, and the local particles and fields processes from that change with distance and in three dimensions, in response to solar activity and rotation;
- How the Sun interacts with our galaxy, the Milky Way, including the solar modulation of galactic cosmic rays; and
- Acceleration and interaction of energetic particles in the solar corona and heliosphere.

This program specifically supports research projects involving data analysis, theory, simulation, and modeling directed towards the objectives of heliospheric science and energetic particles studies. In addition, up to ten percent of the available funding may be used to support preliminary studies of new instrumental techniques for heliospheric sciences, if warranted by proposal merit and relevance to the objectives of this program.

2. Programmatic Considerations

This program underwent comprehensive review in 1997, resulting in three-year awards that fully subscribe the available budget through Fiscal Year 2000. Therefore, new proposals are not solicited for this program element for this ROSS-98 NRA. Questions concerning the program element may be addressed to the discipline Scientist:

Dr. J. C. Ling
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington DC 20546-0001
Telephone: (202) 358-0897
E-mail: jling@hq.nasa.gov

A.4.3 Ionospheric, Thermospheric, and Mesospheric Physics

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection science theme of the NASA Office of Space Science.

The Ionospheric, Thermospheric, and Mesospheric (ITM) Physics program supports studies of the mesosphere and thermosphere regions of the upper atmosphere, the ionosphere, and the auroral processes of Earth through theory, simulation, modeling, indepth data analysis and synthesis, and laboratory studies. It also supports the exploration and demonstration of new instrument concepts pertinent to discipline goals, but does not support the development of space flight instruments *per se*. The goal of the ITM program is to understand the formation, structure, coupling, and dynamics of these systems. Magnetosphere-ionosphere coupling (which includes auroral phenomena) is treated within the ITM program. The primary emphasis in all cases is the study of processes that occur naturally in space, including the study of artificially induced perturbations that elucidate natural processes. Earth's ITM regions are an important part of the solar-terrestrial chain. This program element thus also supports studies of solar-terrestrial processes, including studies of coupling processes outward into the magnetosphere and inward to the upper atmosphere.

2. Programmatic Information

Proposals based on any *in situ* and/or space-based remote sensing data relevant to these study areas are appropriate. However, the use of ground-based data is appropriate only if it can be shown that it is clearly and directly relevant to flight program goals. The program also supports laboratory studies that directly address problems in ITM physics.

Total funding for the existing ITM program has been about \$4M per year. Of the 59 grants currently being funded, approximately one third will expire in FY 1998.

NASA OSS also supports research on magnetospheric, ionospheric, thermospheric, and mesospheric physics using a variety of methods for providing low cost access to space, including standard and long-duration balloons, sounding rockets, Shuttle-based carriers, Space Station, and sounding rocket-class payloads flown as secondary payloads or on other flights of opportunity. See the separate Magnetospheric and ITM Suborbital Program description in Section A.4.6 of this Appendix for further details.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C, Section C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who

experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Ionospheric, Thermospheric, and Mesospheric Physics
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Questions about this program element may be addressed to the Discipline Scientist:

Dr. Mary Mellott
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202) 358-0893
Facsimile: (202) 358-3097
E-mail: mary.mellott@hq.nasa.gov

A.4.4 Magnetospheric Physics

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection space science theme of the NASA Office of Space Science.

The Magnetospheric Physics program supports the studies of the structure and dynamics of magnetospheres and the interactions of solar system space plasmas with planetary magnetospheres and natural space bodies. The discipline focus is on naturally occurring space plasma phenomena with attention given to both the large-scale system structures and processes and to the underlying physics giving rise to those structures and processes. Within that focus, the emphasis is on the geospace portion of the solar-terrestrial linkage including solar-wind magnetosphere interactions and the behavior of particles and fields within the magnetosphere whether as a consequence of those interactions or other, internal processes. Research addressing science questions concerning comparative magnetospheres and plasma-solar system body interactions are also appropriate. Research activities include development of fundamental theories, numerical modeling and simulation, and the analysis and interpretation of data obtained by space-based *in situ* and remote sensing techniques and ground-based observations that are complementary to and supportive of the space data.

This program element supports theoretical research, the development and exercise of models and simulations, and the analysis and interpretation of data for the purposes of identifying and understanding the physical processes important to magnetospheric structure and dynamics. The development and testing of new instrument concepts or of new observing techniques that are pertinent to discipline goals may also be supported, providing the proposed activity is in the context of a clearly defined magnetospheric physics science problem. The program does not support the development of specific engineering, protoflight, or flight instrumentation nor the routine, long-term gathering of observational data.

2. Programmatic Information

Total funding in this program element has been about \$4M per year. Of the approximately 65 investigations currently being funded, about one third will expire in FY 1998.

NASA OSS also supports research on magnetospheric, ionospheric, thermospheric, and mesospheric physics using a variety of methods for providing low cost access to space, including standard and long-duration balloons, sounding rockets, Shuttle-based carriers, Space Station, and sounding rocket-class payloads flown as secondary payloads or on other flights of opportunity. See the separate Magnetospheric and ITM Suborbital Program description in Section A.4.6 of this Appendix for further details.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the proposal *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Magnetospheric Physics
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Obtain further information about this program element from the Discipline Scientist:

Dr. David Evans
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202) 358-0894
Facsimile: (202) 358-3097
E-mail devans@hq.nasa.gov

A.4.5 Solar Physics Research, Analysis, and Suborbital Program

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection science theme of the NASA Office of Space Science.

The Solar Physics program has as its objective the comprehensive study of all solar regimes and source regions of the solar wind; these regimes are defined as the solar interior, the quiet solar atmosphere, solar activity, and the solar corona. Proposals focused on extended analysis of data demonstrably in the public domain from solar space science missions are encouraged, as are proposals that aid the planning of possible future solar flight programs, especially the:

- Mechanisms of Solar Variability - Phase Zero (MSV-0) program that was started in FY 1994 (contact the Discipline Scientist below for further information); and the
- High Energy Solar Spectroscopic Imager (HESSI), to be launched in 2000 and operated under an open data policy (for further information see the World Wide Web site at <<http://hesperia.gsfc.nasa.gov/hessi/>>).

Note that it is anticipated that preparations for other future solar missions , such as the cooperative Japanese Solar-B mission and Solar Terrestrial Relations Observatory (STEREO) will be addressed in separate program announcements; therefore, proposals dealing with these missions are not appropriate for this ROSS-98 NRA.

A. Solar Physics Supporting Research and Technology (SR&T) Program

The Solar Physics SR&T program supports investigations involving analyses of existing data that are open in the public domain. Such acceptable SR&T investigations include the development of theoretical models and numerical simulation techniques pertinent to solar physics, and, in special cases, the development or coordination of solar ground-based observing capabilities that support NASA Solar Physics flight programs. This Solar Physics SR&T program also supports the exploration and demonstration of new instrument concepts pertinent to discipline goals, but it does not support the development of space flight instruments per se.

For purposes of the management of program balance, the NASA Solar Physics program element is organized into a matrix of five techniques, viz.,

- Ground- and Space-based Observations,
- Theory,
- Data Analysis, and
- Ancillary Laboratory Research (*e.g.*, derivation of atomic constants or photometric calibrations),

and the four solar research regimes noted above. Investigations in all matrix categories are invited. Proposals that seek to develop laboratory concepts for new instruments for future suborbital or orbital flight opportunities are especially welcome. Although no priorities are imposed on these categories, an ideal program is envisaged as a balance among them, consistent with the quality of submitted proposals and their relevance to the current Solar Physics flight programs. To aid in the identification of peer reviewers, it is essential that the electronically submitted *Cover Sheet* for Solar Physics proposals include a single choice of discipline descriptor (*e.g.*, Theory/Corona; Ground-based Observations/Solar Interior; *etc.*) as the "Technique/Research Area" designation that will appear on the Web site format (see Section C.5.3 of Appendix C for directions).

As part of a mission-oriented agency, the Sun-Earth Connection theme seeks to fund those efforts that directly impact NASA missions or interpretation of their data. Solar research topics likely to contribute to the characterization and/or prediction of radiation exposure to astronauts are appropriate for this NRA. However, other investigations, even if of considerable merit, will not be given high priority for funding through this NRA if they are judged to be more appropriate for submission to other Federal agencies.

No elements of this NRA are intended to support development of instruments for the Solar-B phase (the second element) of MSV. To carry on the tradition of educational outreach that has been established in Solar Physics, opportunity is offered by the Education/Public Outreach component of this NRA (Section A.5.1).

Note that Solar Physics will review, select, and directly fund only complete investigations proposed by a single PI. Funding of Co-I's from other institutions to an investigation must be accomplished by the PI institution of that investigation.

The Solar Physics SR&T program has had several comprehensive reviews since 1988, resulting in a distribution of one-, two-, and three-year grants. Therefore, only a portion of the program is available for competition each year. Total program funds in FY 1998 of \$6.2 M supported approximately 75 grants, of which 25 are expiring.

B. Suborbital Program in Solar Physics.

The suborbital solar rocket program is expected to continue to lead the way in the development of instrument concepts for future solar missions. Proposals will also be considered, however, that address the approaching solar activity cycle maximum using a variety of methods for providing low-cost access to space. These include standard and long-duration balloons, sounding rockets, Spartan and other Shuttle-based carriers, and sounding rocket-class payloads flown as secondary payloads or on other flights of opportunity.

Approximately \$1.7 M will be available for selection through this ROSS-98 NRA of three to five suborbital investigations of up to three years duration each beginning in FY 1999.

2. Programmatic Information

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Solar Physics Research, Analysis, and Suborbital Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Further information about this program element may be obtained from the Discipline Scientist:

Dr. William J. Wagner
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington, DC 20546-0001
Telephone: (202)358-0911
Facsimile: (202)358-3097
E-mail: william.wagner@hq.nasa.gov

A.4.6 Suborbital Program in Magnetospheric, Ionospheric, Thermospheric, and Mesospheric (MITM) Physics

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection (SEC) science theme of the NASA Office of Space Science.

The MITM program supports research in magnetospheric, ionospheric, thermospheric, and mesospheric physics using a variety of methods for providing low cost access to space. These include standard and long-duration balloons, sounding rockets, Shuttle-based carriers, Space Station, and sounding rocket-class payloads flown as secondary payloads or on other flights of opportunity. The emphasis is on the study of processes that occur naturally in space and/or the study of artificially induced perturbations that elucidate natural plasma processes. Owing to budgetary restrictions, it is extremely unlikely that plasma physics experiments made possible only through access to space can be supported. The base MITM program consists of a minimum number of balloon- and rocket-based investigations. Additional resources are used to provide further balloon and rocket payloads, Shuttle-based investigations, secondary payloads, and/or flights of opportunity investigations. Selection from among these additional investigations will be based on science merit, cost-effectiveness, and overall programmatic balance. Proposals may submit budgets for up to three years that are expected to cover a complete suborbital investigation, including payload construction, launch phase, and data analysis. An appropriate data analysis effort must be included as part of any flight program proposal.

It is necessary to minimize the operational costs to NASA for the preparation (payload integration and test) and field operations (especially the need for campaigns and/or launches from remote or non-U.S. sites) for its suborbital programs. Investigators are, therefore, strongly encouraged to propose investigations that minimize these operational factors, especially with regard to payload complexity and nontraditional launch sites. All those who intend to propose to the MITM program are strongly urged to discuss prospective investigations with operations personnel at NASA Wallops Flight Facility in order to ensure that probable operational costs are properly anticipated. Questions concerning sounding rockets should be addressed to:

Mr. Bobby Flowers
Code 830
Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
Telephone: (757) 824-2202
E-mail: bobby.j.flowers@gsfc.nasa.gov

while questions concerning balloon investigations should be addressed to:

Mr. Harvey Needleman
Code 834
Wallops Flight Facility
National Aeronautics and Space Administration
Wallops Island, VA 23337
Telephone: (757) 824-1453
E-mail: harvey.c.needleman@gsfc.nasa.gov.

2. Programmatic Issues

Support for extended data analysis. Proposals for support for data analysis extending beyond the nominal three-year proposal must be submitted separately to the appropriate SEC program element in this or a future similar NRA.

Sounding Rocket Launch Sites. The two standard U.S. launch sites for sounding rockets are White Sands Missile Range (WSMR), New Mexico, and Wallops Island, Virginia. Although launches from Poker Flat Rocket Range (PFRR) in Alaska require support from mobile launch crews, they do not require separate "campaign" proposals (see further below). However, prospective proposers should be aware that PFRR is closed in alternate years; current plans call for PFRR to be open during the winters of 1998-99 and 2000-01. Campaign proposals are also not required for the use of established non-U.S. launch sites such as those at Andoya, Norway, and Kiruna, Sweden.

Prospective investigators should also be aware that NASA sounding rocket flights from WSMR require the payment by NASA of significant fees. While the current operations budget contains sufficient funds to support a small number of flights from WSMR every year, it is difficult to accommodate investigations with extended launch windows at WSMR.

Campaigns for Multiple Launches. In addition to flights from WSMR, Wallops Island, and PFRR, the MITM program has historically been able to support up to one campaign per year consisting of a series of rockets flown from a common but nonstandard launch location. Campaigns are usually planned several years in advance. Those presently scheduled are for Puerto Rico in February/March of 1998 and for PFRR during winter 1998-99.

In proposing for a campaign, the following protocol must be followed:

- A Campaign Scientist should submit a "Campaign Summary" proposal describing the overall effort and listing prospective investigations. The following issues must also be addressed: the rationale for requesting the proposed launch site, the desired launch time, and/or other special launch conditions (moon-down, night time, etc.); any expected foreign involvement; required ground and/or

airplane support ; any other information that defines the overall scope of the proposed campaign; and an overall cost budget.

- Each investigator who wishes to participate in a campaign must submit a separate investigation proposal, each of which will be independently reviewed. Clear cross-reference must be made to the Campaign proposal on the MITM *Cover Sheet* (see Appendix C.5.3).

Proposals from Multiple Institutions. Proposals to the MITM program often involve the development of payloads that require collaboration among several institutions. In such cases, the lead PI may propose a direct subcontracting arrangement between the PI institution and the Co-I institutions. To avoid the payment of multiple overhead fees, however, NASA may prefer to provide separate awards to each institution involved in such multiple institutional investigations, with an investigator from each Co-Investigator institution serving as the *Institutional PI* for the award to that institution (see special provisions Section C.1.3 in Appendix C of this NRA). The following applies to MITM proposals involving such separately funded contributions from multiple institutions.

- Only the primary proposal for the overall investigation, submitted by the single Principal Investigator (see Section C.1.3), will be reviewed. This primary proposal must include the PI's work statement (included in the page limit) and budget, followed by short task statements and budgets (not counted in the page limit) from all other collaborating Co-I institutions. The MITM proposal *Cover Sheet* of the leading proposal must show separately the dollar amounts requested by the leading institution and each Co-I institution, plus the yearly total requests for the total investigation.
- The appended task statement(s) from Co-I collaborating institution(s), not to exceed five pages, must describe that institution's contribution to the investigation, the roles of the Co-I(s) at that institution (if more than one, a single investigator to serve as the *Institutional PI* for that institution must be chosen) and a summary budget for the task following the formats as specified in Appendix C.
- Each Co-I institution must additionally submit a full formal, signed proposal incorporating the task statement noted above, all prefatory materials indicated in Appendix C, and a full institutional budget. Such Co-I proposals must be clearly cross-referenced on the Cover sheet to the lead PI proposal and must have the same title as the PI proposal.

MITM program proposals selected under this NRA will be phased into the program as rapidly as resources permit. As a rule, new investigations are awarded definition-level funding in their first year, full funding for development in their second year, leading to flight early in their third year, which concludes with data analysis. Total funding in this program has been about \$4M per year; annual funding levels have averaged \$250K per

investigation and \$100K per individual investigator. Of the 21 investigations currently being funded, 10 will end in FY 1998.

Owing to the larger scope and personnel involvement in MITM proposals, the default page limit given in Section C.5.1 of Appendix C is revised to 20 pages for the *Science/Technical/Management Section* instead of 15 pages. All other page limits identified in Appendix C apply.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <http://props.oss.hq.nasa.gov>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Suborbital Program in MITM Physics
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Further information may be obtained from the Discipline Scientist:

Dr. Mary Mellott
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0893
Facsimile: (202) 358-3097
E-mail: mary.mellott@hq.nasa.gov

A.4.7 Advanced Composition Explorer (ACE) Guest Investigator Program

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection science theme of the NASA Office of Space Science.

This program element supports research proposals relating to the analysis, interpretation, and theoretical modeling of data from the Advanced Composition Explorer (ACE) that was launched in August 1997. The prime objective of ACE is to determine and compare the elemental and isotopic composition of several distinct samples of matter, including the solar corona, the interplanetary medium, the local interstellar medium, and galactic matter. ACE consists of nine instruments, the:

- Solar Isotope Spectrometer (SIS),
- Cosmic Ray Isotope Spectrometer (CRIS),
- Ultra Low Energy Isotope Spectrometer (ULEIS),
- Solar Energetic Particle Ionic Charge Analyzer (SEPICA),
- Solar Wind Electron, Proton and Alpha Monitor (SWEPAM),
- Solar Wind Ion Composition Spectrometer (SWICS),
- Solar Wind Ion Mass Spectrometer (SWIMS),
- Electron, Proton and Alpha Monitor (EPAM), and
- Magnetic Field Monitor (MAG).

A description of these instruments can be found at the World Wide Web site: <http://www.gsfc.nasa.gov/ace/ace.html>. Papers providing a detailed description of the instruments can be obtained directly from the instrument Co-Investigators. It is strongly recommended that proposals to participate in analyzing data from one or more of the ACE instruments for a specific scientific investigation should include a plan that has been coordinated with the relevant lead Co-Investigators and affirms their cooperation if the proposed plan is accepted. Only data taken after February 1, 1998, when the mission begins its prime phase at L1, will be available to guest investigators. Current mission status, browse files, and other information is provided by the ACE Science Center at <http://www.srl.caltech.edu/ACE/ASC/>.

2. Programmatic Information

Proposals are solicited through this NRA from investigators who are not already funded as science team members for the experiments whose data they propose to use. Approximately \$700K per year is expected to support guest investigations up to three years in duration starting in Fiscal Year 1999. Note that this program element does not

include investigations using Real Time Solar Wind Data, which should instead be proposed to the Sun-Earth Connection Guest Investigator Program (Section A.4.8 in this Appendix).

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
ACE Guest Investigator Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Question concerning this program element should be addressed to Discipline Scientist:

Dr. J. C. Ling
Research Program Management Division
Code SR
NASA Headquarters
Washington DC 20546-0001
Telephone: 202-358-0897
Facsimile: 202-358-3097
E-mail: jliling@hq.nasa.gov

A.4.8 Sun-Earth Connection Guest Investigator Program

1. Scope of Program

Proposers interested in submitting in response to this program element should also read Section A.4.0 of this Appendix for an overview of The Sun-Earth Connection (SEC) science theme the NASA Office of Space Science.

A multiple year Sun-Earth Connection (SEC) Guest Investigator Program (GIP) is offered for investigations that extensively utilize the operating SEC missions' data sets. Guidelines for these interdisciplinary objectives are taken from the SEC Senior Review that took place in mid 1997; see the World Wide Web site at URL http://www.hq.nasa.gov/office/oss/strategy/SEC_review/finalsun.htm. Note that the Solar Maximum objectives specified by the SEC Senior Review are included as recommended, which include solving the more complex and different problems associated with solar cycle maximum conditions than those addressed to date during solar cycle minimum. Therefore, broad expertise beyond that included in the present Solar Minimum mission teams is needed to interpret data from multiple spacecraft and other correlative sources, and to carry out the essential interpretative data analysis, theory, and modeling.

The objectives of this SEC GIP are: 1) to understand the solar interior and the solar atmosphere, including the evolution of mass and energy ejected from the solar atmosphere; 2) to understand the propagation of disturbances in the three-dimensional as well as the distant heliosphere; and 3) to investigate the flow of mass, energy and momentum throughout the near space environment of the Earth. With the integration of observations and analysis, and of simulations and theory, investigators can proceed from the present static understanding of the Sun-Earth system to the realistic dynamics of the connection process; knowledge that is especially needed for the complex problems of the upcoming solar maximum period. Nevertheless, all problems of all scales within the SEC realm are to be addressed by the solicited investigations, not exclusively global, multiple spacecraft efforts. Guest Investigator Programs are intended to maximize the return from currently operating missions by providing support for research of breadth and complexity beyond that of presently funded, often individually mission oriented, investigations.

This SEC GIP is intended to analyze data from the following missions:

- Magnetospheric Physics: Polar, Wind, Geotail, FAST, Equator-S and ACE/RTSW;
- Heliospheric Physics: Ulysses, Voyager, SAMPEX, and IMP-8; and
- Solar Physics: SOHO, TRACE and Yohkoh.
-

These analyses may also incorporate associated ground-based data and simulation, theory, and modeling activities.

2. Information on Specific SEC Mission Data Sets

This section describes a number of ongoing programs within the SEC mission fleet and their accommodation within this broader SEC GIP. Future and new missions typically have specific data rules and realities not shared by established and archived data sets (e.g. ACE); these missions will similarly be included in the SEC GIP as they mature. While the overall scope and objectives of the SEC GIP are described above, the following information is provided for specific data sets and programs.

A. Magnetospheric Missions

Incorporated into this SEC GIP is the presently funded ISTP GIP for correlative scientific research--data analysis, theory, and simulations--that heavily utilize the data base of Polar, Wind, Geotail, and the associated ground-based and theory investigations; additional data bases are those of FAST, Equator-S, and ACE Real Time Solar Wind (RTSW) (see also Section A.4.7 of this Appendix for the ACE GIP) data. Proposals combining data from these with other SEC mission data sets are especially pertinent. The selections for this opportunity must strongly focus upon research goals of SEC, especially toward the Solar Maximum era; the use of the multiple mission data base to address problems is encouraged. Relatively new mission data analysis will be chiefly limited to "quick-look" products accessible on the World Wide Web (or other, appropriate and openly available data); missions in extended phase are generally providing higher resolution and reduced data. Information on the various missions, personnel and data sets is found at the following Web sites:

- Polar, Wind, Geotail: <<http://www-istp.gsfc.nasa.gov/>>;
- FAST: <<http://sprg.ssl.berkeley.edu/fast/>>;
- Equator-S: <http://www.mpe-garching.mpg.de/www_plas/EQS/eq-s-home.html>;
- ACE RTSW: <<http://www.sel.noaa.gov/sec.html>>; and
- Associated ground-based, general spacecraft data archives: <<http://nssdc.gsfc.nasa.gov/space/netdex.html>>

A PI or Co-I on a qualifying magnetospheric mission may also propose as a PI to this SEC GIP. However, such SEC mission personnel must include in their proposal a description of their mission responsibilities, which are not to duplicate the research proposed for the SEC GIP (similar non-duplication rules apply to presently active ISTP Guest Investigator Program investigations selected for FY 1997 and FY 1998).

Questions concerning the Magnetospheric missions should be addressed to:

Dr. Lawrence Zanetti
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington DC 20546-0001
Telephone: (202) 358-0888
Facsimile: (202) 358-3097
E-mail: lzanetti@hq.nasa.gov

B. Heliospheric Missions

A Heliospheric Physics Guest Investigator program that supports research relating to the analysis of data from the heliospheric missions (Pioneer 10 and 11, the Voyager Interstellar Mission, Ulysses, IMP-8, and the Solar Anomalous, and Magnetospheric Particle Explorer (SAMPEX)) underwent comprehensive review in 1997, resulting in three-year awards that subscribed the available budget for this activity through Fiscal Year 2000. However, additional proposals of exceptional scientific merit utilizing heliospheric mission data will be considered under this SEC GIP. Proposals combining data from Heliospheric missions with other SEC mission data are especially pertinent. Questions concerning Heliospheric Missions should be addressed to:

Dr. James C. Ling
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington DC 20546-0001
Telephone: (202) 358-0897
Facsimile: (202) 358-3097
E-mail: jling@hq.nasa.gov

C. Solar Missions

- Solar and Heliospheric Observatory (SOHO): SOHO is a mission of international cooperation between ESA and NASA. Proposals are invited as part of the SEC GIP requiring new SOHO observations, analysis of existing data, theoretical analysis in relation to SOHO observations, or ancillary ground-based observations. Two types of Guest Investigator participation in the SOHO mission are foreseen.

- For the coronal experiments, GI's will be attached to an experiment team, and within that team have priority rights for the analysis of certain data sets or priority rights for a certain type of analysis. This mode of participation will apply to data from the following investigations: Coronal Diagnostic Spectrometer (CDS), Extreme-ultraviolet

Imaging Telescope (EIT), White Light and Spectrometric Coronagraph (LASCO), Solar Ultraviolet Emitted Radiation (SUMER), Solar Wind Anisotropies (SWAN), and Ultraviolet Coronagraph Spectrometer (UVCS).

- The data for the particle and helioseismology experiments do not lend themselves to being split up into 'events,' observing sequences, or time intervals, and, therefore, approved GI's will be included as members of the PI teams and share the rights and obligations of the team members. This mode of participation will apply to data from the following investigations: Charge, Element, and Isotope Analysis (CELIAS), Suprathermal and Energetic Particle analyzer (COSTEP), Energetic Particle Analyzer (ERNE), Global Oscillations at Low Frequencies (GOLF), Variability of Solar Irradiance (VIRGO), and the Michelson Doppler Imager/Solar Oscillations Imager (MDI/SOI).

The recommendations for selection of GI proposals addressing SOHO will be made by the SOHO Guest Investigator Selection Committee (GISC) whose members are appointed by ESA and NASA. The mission PI teams will be asked for their comments on relevant proposals. Proposals will be evaluated according to their overall scientific merit, relevance to the SOHO mission, compatibility with declared SOHO PI team objectives, and feasibility. It is necessary but not sufficient for approval for a GI proposal addressing SOHO that the proposed work add to the expertise existing within the SOHO experiment team rather than simply duplicating it. Proposals combining data from SOHO with other SEC mission data are especially pertinent. GI's proposing from non-U.S. institutions are expected to obtain funding for their research from their national institution (see Section C.4 in Appendix C).

Prospective Guest Investigators are strongly encouraged to contact the PI team to which they wish to be attached in an early stage of their proposal preparation in order to achieve early clarification of the following two critical questions:

- 1) Are the proposed observations feasible using SOHO instruments, and, if so, can they be carried out with a reasonable amount of effort and time?
- 2) Is the proposed investigation in direct conflict with that of the SOHO PI teams, either through duplication of declared major PI team objectives, or interference with planned observations? Note that in this regard, SOHO PI teams may recommend to prospective GI's that they consider different SOHO teams if this seems more appropriate.

Interested parties may consult the December 1995 issue of *Solar Physics*, or may see the detailed SOHO information found at the World Wide Web site <<http://sohowww.nascom.nasa.gov/>>.

Eligibility: U.S. PI's on the SOHO mission may not receive funding from or propose as a PI to this Guest Investigator program. SOHO Co-I's may propose as GIP PI's but must include in their proposal a description of their mission responsibilities, which must not duplicate the research proposed in the GI program.

- Transition Region and Coronal Explorer (TRACE). Proposals are invited as part of the SEC GIP for TRACE scientific research--data analysis and theory--that heavily utilize the publicly open database (all data from TRACE, regardless of age). The TRACE PI may not receive funding from or propose as a PI to this Guest Investigator program. TRACE Co-I's may propose to this GI program as PI's but must include in their proposal a description of their mission responsibilities, which must not duplicate the research proposed in the GI program. Proposals combining data from TRACE with other SEC mission data are especially pertinent. Information on TRACE may be found at URL <<http://www.space.lockheed.com/TRACE/welcome.html>>.
- Yohkoh. Proposals are invited as part of the SEC GIP for Yohkoh scientific research--data analysis and theory--that heavily utilize the publicly open database (data older than one year, see <http://umbra.nascom.nasa.gov/yohkoh/data_availability.html>. The U.S. PI on Yohkoh may not receive funding from or propose as a PI to this Guest Investigator program. Yohkoh Co-I's may propose to this GI program as PI's but must include in their proposal a description of their mission responsibilities, which must not duplicate the research proposed in the GI program. Proposals combining data from Yohkoh with other SEC mission data are especially pertinent. Information on Yohkoh may be found at: <<http://www.space.lockheed.com/SXT/homepage.html>>.

Questions concerning the GI programs for these Solar Physics missions should be addressed to the Discipline Scientist:

Dr. William Wagner
 Research Program Management Division
 Code SR
 NASA Headquarters
 Office of Space Science
 Washington DC 20546-0001
 Telephone: (202) 358-091
 Facsimile: (202) 358-3097
 E-mail: william.wagner@hq.nasa.gov

3. Programmatic Information

Proposals whose intent or purpose is to extend or directly supplement existing investigations already funded for approved space flight missions or SR&T programs are not appropriate for this SEC GIP. Investigators who are members of the science teams of ongoing missions and who propose to use data from those missions must clearly demonstrate that the research proposed is distinct from the existing efforts.

For all SEC missions, one to three year awards at a funding level of about \$75K to \$100K per year are expected to result from this opportunity, for which total funding is expected to be up to \$2M in the first year. For multiple year awards, funding approval for the subsequent year(s) will be based upon the tangible scientific achievements of the first

year and the continued program need and funds thereafter. This program is expected to increase to approximately 10 to 15 percent of the participating missions' funding in subsequent years. At those subsequent year levels, it is expected that cooperative projects for groups of scientists can be competed.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the Cover Page/Proposal Summary (see Appendix C.5) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance. Note that the NOI, as well as the Cover Page, will request an indication of the mission or missions whose data are called for in the proposed investigation.

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Sun-Earth Connection Guest Investigator Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

General questions concerning this program element should be addressed to:

Dr. Lawrence Zanetti
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0888
Facsimile: (202) 358-3097
E-mail: lzanetti@hq.nasa.gov

A.5.1 Education/Public Outreach Proposals

1. Scope of Program

The Office of Space Science (OSS) has developed a comprehensive approach for making education at all levels (with a particular emphasis on precollege education) and the enhancement of public understanding of space science integral parts of all of its missions and research programs. The two key documents that establish the basic policies and guide all OSS Education and Outreach activities are a strategic plan entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995) and an implementation plan entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (October 1996). Both may be obtained either from the World Wide Web (select *Education and Public Outreach* from the menu on the OSS homepage at <<http://www.hq.nasa.gov/office/oss/>>), or from Dr. Jeffrey Rosendhal, Code S, Office of Space Science, NASA Headquarters, Washington, DC 20546-0001, USA.

In accord with these established OSS policies, proposers to any program element advertised through this NRA are strongly encouraged to include an Education/Public Outreach (E/PO) component as part of their scientific research proposal. In addition, anyone holding an existing multiple year OSS research award with a period of performance extending at least into FY 1999 is encouraged to propose an E/PO supplement to their award (see more detailed instructions below). In either case, E/PO activities may be funded only in conjunction with a "parent" research proposal, and the proposed activities should have some degree of intellectual linkage with the objectives of that parent research proposal and/or the science expertise of its Principal Investigator. Up to \$10K per year may be proposed for an E/PO program, although larger budgets will be considered based on the merits of the proposed activity. E/PO proposals will be funded using the currently available yearly budget of about \$1.5M for E/PO support of Fiscal Year 1998 OSS NRA's.

E/PO proposals will be evaluated (see criteria below) by appropriate scientific, education, and outreach personnel, and the results of these reviews will be provided to the cognizant Discipline Scientist in time for use in the selection process (see Section C.1.5 of Appendix C). The OSS Selecting Official will specifically take into account proposed E/PO tasks and their review ratings when deciding on final selections and funding levels. Results of these E/PO reviews will be used to aid in discriminating between research proposals having otherwise comparable merits. The reviews of E/PO proposals will be conveyed to the proposers as part of their debriefings.

In general, the broad evaluation criteria against which a proposed E/PO activity will be considered are:

- The quality, scope, and realism of the proposed E/PO program;
- The establishment of effective, long-duration partnerships with institutions and/or personnel in the fields of educational and/or public outreach as the basis for and an integral element of the proposed E/PO program;
- The linkage of the proposed E/PO task with existing NASA science or education programs and activities, and its compliance with NASA and OSS guidance;
- The potential of the proposed E/PO activity to have a “multiplier effect” (e.g., prospects for broad dissemination or replication of an E/PO product);
- For proposals dealing with the formal education system, the degree to which the proposed E/PO effort promotes nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The adequacy of plans for evaluating the effectiveness and impact of the proposed education/outreach activity;
- The degree to which the proposed E/PO effort contributes to the training of, involvement in, and broad understanding of science and technology by underserved and/or underutilized groups;
- The prospects for building on, taking advantage of, and leveraging existing and/or ancillary resources beyond those directly requested in the proposal;
- The capability and commitment of the proposer to carry out the proposed E/PO program; and
- The adequacy and realism of the proposed budget (including any additional resources outside those requested from NASA).

Note that originality of the proposed effort is not a criterion. Rather, NASA OSS seeks assurance that the PI is committed to carrying out a meaningful, effective, credible, and appropriate E/PO activity.

2. Assistance for the Preparation of E/PO Proposals

To directly aid space science personnel in identifying and developing high quality E/PO opportunities, and establishing partnerships between the space science and E/PO communities, NASA OSS has established a national space science education/outreach infrastructure. The purpose of this infrastructure is to provide the coordination, background, linkages, and services needed for a vital national, coordinated, long-term E/PO program.

Of particular interest to proposers to this NRA are two elements of this system (which is described in more detail in the OSS education/outreach implementation plan referred to above):

- (i) Four OSS science theme oriented “E/PO Forums” have been established to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science missions and research programs and provide ready access to relevant E/PO programs and products to both the space science and education communities.
- (ii) Five regional E/PO “Broker/Facilitators” have also been selected to search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported scientists, and help scientists turn results from space science missions and programs into educationally-appropriate activities to be disseminated regionally and nationally.

Prospective proposers are strongly encouraged to make use of these infrastructure resources to help identify suitable E/PO opportunities and arrange appropriate alliances. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators may be found by opening *Education and Public Outreach* from the menu of the OSS homepage at <http://www.hq.nasa.gov/office/oss/>.

3. Programmatic Information

The guidelines for the preparation and submission of the E/PO component of a research proposal submitted in response to any program element in this NRA are:

- The body of an E/PO proposal should be restricted to five pages and include the following information: A brief abstract of the proposed program; an expanded description of the objectives and planned activities; a description of the intended involvement of the Principal Investigator of the “parent” research proposal, as well as that of any additional personnel who are proposed to be responsible for the E/PO effort and/or the respective institutional responsibilities if a partnership is proposed; and a brief statement and explanation of the requested E/PO budget.
- The budget for the E/PO activity should be integrated into that for the parent research proposal, which is finally summarized on the specified *Budget Summary* form (see Section C.5.3 of Appendix C). The period of performance of an E/PO activity is restricted to that of the parent proposal.
- The E/PO proposal should be bound as part of the total proposal in the order specified in Appendix C.5.3, and the *Cover Page* (see also Appendix C.5.3) must indicate that an E/PO proposal is included as part of the total research proposal.

- E/PO proposals are also to be submitted electronically by uploading its text to the secure Web site at URL <<http://cass.jsc.nasa.gov/panel/>>. This site will provide complete instructions for accomplishing this activity using a wide variety of formats. Proposers without access to the Web or who experience difficulty in using this site may contact the Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance.
- The PI of an existing multiple year award having a period of performance extending at least into FY 1999 may also submit an E/PO proposal as a supplement to their OSS investigation. Such a proposal should be prepared as a stand-alone proposal following the guidelines given above and submitted as a single hard copy in conjunction with their annual progress report and budget for the funding allotment needed to continue their multiple year award. In addition, such an E/PO supplement must be submitted electronically as described above. For that purpose, the specified Web site will contain instructions for entering appropriate identifying information (in particular, the names of the relevant program element and Discipline Scientist, and the grant/contract number and name of the existing NASA investigation). In any case, the period of performance for such a supplemental E/PO activity is restricted to the balance of the period of performance of the existing parent research award. Such proposals will be peer reviewed using the evaluation criteria described above.

Questions about an E/PO program for any of the program elements in this NRA may be directed to:

Dr. David Bohlin
 Research Program Management Division
 Code SR
 Office of Space Science
 NASA Headquarters
 Washington DC 20546-0001
 Telephone: (202) 358-0880
 E-mail: david.bohlin@hq.nasa.gov

Finally, attention is also called to the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program administered by the Space Telescope Science Institute (STScI) on behalf of OSS. This program, which currently selects proposals yearly, provides awards of up to \$10K (with a few up to \$40K) to enhance and encourage the participation of space scientists in E/PO activities. Annual solicitations for the IDEAS program are typically released in July with proposals due in October. The IDEAS program is open to any space scientist based in the U.S. regardless of whether or not they hold a research grant from NASA OSS. E-mail inquiries about IDEAS may be directed to <IDEAS@stsci.edu>.

The current request for proposals is posted on the World Wide Web at <http://oposite.stsci.edu/pubinfo/edugroup/ideas.html>. Inquiries also may be addressed to:

IDEAS Program
Office of Public Outreach
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218.

A.5.2 Applied Information Systems Research Program

1. Scope of Program

The Science Information Systems Program supports all the OSS science themes by providing the globally distributed research community with access to data, high performance computing, and communications services. The program also conducts information systems research to apply new developments in computer science and information technology to improve and enhance on-going support for OSS science programs. The goals of the Applied Information Systems Research (AISR) Program are to:

- Increase the scientific return on research within OSS by making advanced tools and capabilities available for the acquisition and utilization of science data and information;
- Support an evolutionary environment to exploit advances in information technology; and
- Promote strong collaborations involving the space science community, computer science community, data system engineers and technologists, academia, and the private sector and technology innovators.

OSS seeks proposals through this program element of the ROSS-98 NRA to apply state-of-the-art computer science and information technology to improve efficiency and effectiveness of OSS scientific research endeavors. Note that this solicitation consolidates proposals formerly solicited under separate announcements for the AISR Program, the Astrophysical Data Program Type II (Tools), and the Sun-Earth Connection Data Restoration Program.

2. Areas of Interest

A. Advanced Tools and Capabilities

OSS seeks innovative applications of information technology across a broad range of areas that span the scientific process, including:

- Modeling, simulation, and design;
- Science planning, operations, and data product generation;
- Science data management; and
- Science data analysis and visualization.

A wide spectrum of information technology fields may be applied in the above areas, that include, but are not limited to, computational methods and algorithms; data storage and distribution; data mining and exploration; data compression; software technology; collaborative tools; and adaptive techniques such as genetic algorithms and neural networks. Proposers are encouraged to propose original, innovative applications of information technology that will be more generally applicable across multiple science disciplines and/or projects. In particular, proposals that foster and facilitate interdisciplinary research, with specific emphasis on contributions to an interoperable space science data services environment, providing expedient location, access, retrieval, and analysis of widely distributed science data sets will be given priority consideration.

B. Science Data Products

Original proposals are sought that identify valuable space science data products that should be prepared in a readily accessible and usable form and made available to the entire science community via OSS data centers. This includes restoration of current space science data sets, either those in danger of being lost to scientific community or of such value that they should be more readily available, and generation of new, higher level products deemed of value to the overall OSS data environment. Also relevant to this activity are compilations of electronically accessible data bases of other data relevant to the space sciences such as nuclear/atomic/molecular cross-sections and rate coefficients, equations of state and thermodynamic calculations, etc.

3. Documentation and Delivery

All resulting products developed under this program will be made openly available to the community at the end of the award period. Therefore, adequate documentation must accompany the product to allow use by the general community, which includes complete description of application, explanations of algorithms, user instructions, demonstration examples, etc. Proposals must clearly describe how they plan to assure the quality of such final products.

It is expected that successful products and capabilities resulting from this program will be registered in and made available through the Space Science Data Services (SSDS) infrastructure. Information on current resources, services, and data centers can be found at URL <<http://www.hq.nasa.gov/office/oss/ssds/>>.

4. Programmatic Information

It is anticipated that approximately \$3.5M will be available through this ROSS-98 NRA for the funding of new awards for this program element, which is expected to be sufficient to fund between 20 and 25 grants of nominally 3 years duration each.

The schedules for submission of the Notice of Intent and for proposals is given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the *Cover Page/Proposal Summary* (see Appendix C.5) is <<http://cass.jsc.nasa.gov/panel/>>; proposers without access to the Web or who experience difficulty in using this site may contact The Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2156 or -2166 for assistance . Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Applied Information Systems Research Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058

Phone number for commercial delivery: (281)486-2166

For further information, contact the Discipline Scientist for this program element:

Mr. Joseph H. Bredekamp
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-2348
E-mail: joe.bredekamp@hq.nasa.gov

Background information on the AISR program and current investigations being conducted can be found on the World Wide Web at <<http://www.hq.nasa.gov/office/oss/aisr/>>. Further background information can also be found in the *Science Information Systems Newsletter* at <<http://www-sisn.jpl.nasa.gov>>.

A.5.3 Mission Concepts for Ultra Long Duration Ballooning (ULDB)

1. Scope of Program

This program supports the development of new mission concepts for Ultra Long Duration Balloon (ULDB) instruments to be flown on the NASA ULDB platform after year 2002. Recent advances in composite super pressure balloon materials have enabled NASA to begin development of the ULDB program as an inexpensive alternative to place payloads into a near-space environment. A ULDB demonstration platform is currently being developed at the NASA Wallops Flight Facility (WFF) for a test flight in 2000. It is expected to be capable of supporting up to ~1 ton of scientific payload on a 16-28 million cubic foot super pressure balloon for 100 days (~5 circumnavigations of the globe in either the northern or southern hemisphere).

This program is opened to all space science disciplines. NASA expects to select up to approximately five instrument/mission concepts at ~\$200K per concept for one to two year studies under this NRA. A formal report is required at the end of the study. NASA reserves the right to select one or more of the concepts at the end of the study for further definition and/or flight development. The payloads could be either new or conversions of existing payloads. In either case, the PI will be required to work closely with the WFF/ULDB project to ensure total compatibility between the instrument/mission and the ballooncraft vehicle. The concept study must have the potential to lead to a fully integrated "sciencecraft" concept that is both technically sound and cost effective. All proposed investigations should include a detailed schedule, and a credible cost and management plan leading to a post-2002 launch.

2. Programmatic Considerations

Owing to the greater degree of complexity of the proposals expected for this ULDB mission concept program, the *Science/Technical/Management Section* of the proposals may be 20 pages long instead of the default 15 pages specified in Section C.5.1 of Appendix C.

The schedules for submission of the Notice of Intent and proposal are given in Table 1 of the cover letter of this NRA. The World Wide Web site for submitting both the NOI and the *Cover Page/Proposal Summary* (see Appendix C.5.3) is <<http://props.oss.hq.nasa.gov>>; proposers without access to the Web or who experience difficulty in using this site may contact Ms. Debra Tripp (E-mail: deb.tripp@hq.nasa.gov) for assistance.

Hard copies of the proposals are to be delivered to:

ROSS-98 NASA Research Announcement
Mission Concepts for Ultra Long Duration Ballooning
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
Washington, DC 20024
Phone number for commercial delivery: (202) 554-2775

Question concerning this program element should be addressed to the Discipline Scientist:

Dr. W. Vernon Jones
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington DC 20546-0001
Telephone: (202) 358-0885
Facsimile: (202) 358-3097
E-mail: wvjones@hq.nasa.gov