

SCIENCE PROGRAM ELEMENTS SOLICITED BY THE ROSS-99 NRAA.1.1 Origins of Solar Systems Program (OSSP)1. Scope of Program

This program element 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. For more information about the type of research supported by this program, abstracts for currently funded investigations are available at <http://www.hq.nasa.gov/office/oss/codesr/welcome.html>.

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) 2000 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 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) 486-2189

Obtain additional information from the Discipline Scientist:

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Research Program Management Division
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Office of Space Science
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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 centered around the origin of life and is focused on achieving this goal by tracing the pathways taken by the biogenic elements, leading from the origin of the universe through the major epochs in the evolution of living systems and their precursors. 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 areas of research emphasis in this program are as follows:

- *Cosmic Evolution of the Biogenic Compounds*

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.

- *Pre Biotic Evolution*

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.

- *Early Evolution of Life*

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.

- *Evolution of Advanced Life*

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 seek approaches to investigations furthering our understanding of the distribution of life elsewhere in the universe. Note that an Evolutionary Biology NRA is planned that will focus on the process of evolution and the future of life on Earth and in space.

- *Planetary Protection Research*

There are numerous areas of research in exobiology that also have implications with respect to preventing the contamination of extraterrestrial environments by terrestrial organisms carried by spacecraft, and for understanding the potential survival of extraterrestrial organisms that may be returned to Earth. Research is required in order to allow NASA to understand the potential for contamination and to set standards in these areas for spacecraft preparation and operating procedures and for returned-sample analysis. Many of these research requirements derive directly from recent National Research Council reports on planetary protection requirements for solar system exploration missions (see National Academy Press at <<http://www.nap.edu/>>).

Therefore, this ROSS-99 NRA is also soliciting exobiology research pertinent to planetary protection goals in the following areas:

The widest possible spectrum of Earth microbes, the use of modern molecular analytical methods to detect and classify organisms on spacecraft surfaces during assembly and launch processing, as well as the development of new methods for the same purposes; Procedures for detection, preliminary characterization, and containment of organisms (living, dead, or fossil) in returned samples;

Procedures for sample sterilization which largely preserve sample information; and
The limits of life, including the potential for organisms to originate and thrive on bodies such as Europa, Ganymede, Callisto, Phobos, Deimos, P-type asteroids, D-type asteroids, C-type asteroids, undifferentiated metamorphosed asteroids, differentiated asteroids, and/or comets.

- *Instrumentation*

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. 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. Note: Beyond advanced instrument concepts, the Planetary Instrument Definition and Development Program supports the development of exobiology instruments through the breadboard stage (see Program Element A.3.5 in this 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 1999 or in the first half of 2000. 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. Also note that NASA procurement regulations require that any task accepted for a period of performance longer than three years requires the submission of a complete proposal for review at the end of the first three years.

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

Funds are available under the Planetary Major Equipment Program (Program Element A.3.6 in this NRA) to provide for upgrading of analytical instruments required by investigations sponsored by the Exobiology Program. New, major analytical instrumentation that is necessary for the conduct of proposed research, or that would substantially improve its quality, should be identified and requested in a special section of each proposal, to be titled "Major Equipment Request." Details of specific guidelines, restrictions, and exclusions are provided in the Planetary Major Equipment Program section of this NRA.

Progress reports for funding the second or subsequent years of research, for previously approved multiple year awards, will be considered separately and should be sent directly to the Exobiology Program Scientist at least 90 days before their funding anniversary date.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

A Notice of Intent is requested for this program element. 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 Planetary Institute by E-mail at <exorp@lpi.jsc.nasa.gov> or by phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

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Research in Exobiology
The Lunar and Planetary Institute
3600 Bay Area Boulevard
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Phone number for commercial delivery: (281) 486-2189

Obtain additional information from:

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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. The 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 100 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-100 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 ground-based observations of phenomena defined primarily by their high-energy characteristics, provided that such studies pertain directly to NASA HEA space missions. **However, proposals for laboratory astrophysics investigations relevant to High Energy Astrophysics are no longer solicited under this Program Element; such investigations are now solicited under the Program Element entitled “Space Astrophysics Research and Analysis (SARA) Program” (see A.2.10).** 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 I and II 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 (Section A.2.6 of this Appendix), and projects directed mainly toward the analysis of archival data are covered under the Astrophysics Data Program (Section A.2.4). Investigations that fall into either of these categories are not within the scope of the HEA SR&T program.

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

MISSION	PRIMARY EMPHASIS
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 II - NASA Gamma-ray Astronomy Missions Relevant to the HEA SR&T Program

MISSION	PRIMARY EMPHASIS
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

Proposals for investigations under the HEA SR&T program are solicited on a three year cycle, with the last solicitation in 1995. Therefore, proposals for participation in the HEA SR&T Program are solicited by this ROSS-99 NRA. It is anticipated that roughly \$9M will be available in FY 2000 for the funding of about 30-40 new three year projects, with modest increases above this level in FY 2001 and 2002. The schedule (due dates for Notices of Intent to propose and the proposals themselves) is provided in Table 1 of the cover letter of this NRA.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 NASA Research Announcement
High Energy Astrophysics Program
Jorge Scientific Corporation
Suite 700
400 Virginia Avenue, SW
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Phone number for commercial delivery: (202)554-2775

Additional information may be obtained from the Discipline Scientist:

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A.2.2 Long-Term Space 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/results/LTSA_Abstracts.html.

This ROSS-99 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 (note that this NRA neither solicits nor shall support research/work by graduate 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-99 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 (i.e., between May 1991 and May 1997 for LTSA-99). 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 the definition of proposal personnel in Section C.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-99 NRA for the funding of new awards for this program element, to fund proposals of a maximum of five years duration.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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

Starting with this ROSS-99 NRA, the Program Elements previously known as the Ultraviolet, Visible, and Gravitational Astrophysics (UVGA) program, and the Infrared/Submillimeter/Radio/Interferometry (ISRI) Astronomy program, have been combined into the following Program Elements.

- Space Astrophysics Detector Development Program (A.2.8)
- Astrophysics Suborbital Program (A.2.9)
- Space Astrophysics Research and Analysis Program (A.2.10).

Please consult the appropriate sections of Appendix A of this NRA for details.

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, RXTE, or BeppoSAX 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/research.htm>**Error! Reference source not found.**>.

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 opportunity in Appendix A.5.2 of this ROSS 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);
 - Infrared Space Observatory (ISO);
- 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*

This ADP proposal solicitation includes a Type B category for proposers who have already been awarded observing time on current observing cycles RXTE (Cycle 4), ASCA (Cycle 7), or BeppoSAX (Cycle 3) and seek funding support for data reduction and analysis of the resulting observations. Type B Proposals may supplement the primary RXTE/ASCA/SAX data reduction and analysis of new observations with data analysis of relevant public-domain, archival data from RXTE, ASCA, SAX, and other space astrophysics missions. Type B Proposals may contain either the text originally submitted to RXTE/ASCA/SAX 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. 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.

RXTE Targets Of Opportunity (TOO): Type B proposals may be submitted for support of approved RXTE Cycle 4 TOO observations. If selected, funding of such 'conditional awards' will not be initiated until after the TOO observation(s) have been satisfactorily completed.

- *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-99 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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 Program

1. Scope of Program

A. Cosmic Ray Physics Experimental Program.

This experimental research 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 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 underwent a comprehensive review in 1998, which resulted in a substantial number of awards that fully subscribe the available funds through 2001. Consequently, proposals to this program are not solicited in this ROSS-99 NRA.

B. Cosmic-Ray Theory and Data Analysis Program

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. .

2. Programmatic Considerations

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

Dr. James C. Ling
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington DC 20546-0001
Telephone: (202) 358-0897
Fax: (202) 358-3097
E-mail: jl原因@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_Abtracts.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.

Note that this year "Atomic and Molecular Astrophysics" theory proposals should apply to the "Space Astrophysics Research and Analysis (SARA)" program, Appendix A.2.10 in this ROSS 99, and not to ATP.

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. *Star Formation and Pre-Main Sequence Stars* (star forming clouds, protoplanetary and debris disks, protostars, T Tauri stars, brown dwarfs; dust and astrochemistry)
2. *Main Sequence Stars*;
3. *Post-Main Sequence Stars and Collapsed Objects* (giants, isolated white dwarfs, isolated neutron stars, central stars of planetary nebulae);
4. *Binary Systems* (cataclysmic variables, x-ray binaries, black hole binaries);
5. *Interstellar Medium and Galactic Structure* (supernova remnants, dark clouds, interstellar dust, H II regions, diffuse galactic emission, planetary nebulae);
6. *Galaxies* (normal galaxies, interacting galaxies, starburst galaxies, Seyfert galaxies, Active Galactic Nucleus (AGN's), quasars, radio galaxies);
7. *Large Scale Cosmic Structures* (clusters of galaxies, galaxy environment and evolution, intracluster medium, diffuse x-ray background, relativity and gravity, cosmology).
8. *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-99 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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

Starting with this ROSS-99 NRA, the Program Elements previously known as the Ultraviolet, Visible, and Gravitational Astrophysics (UVGA) program, and the Infrared/Submillimeter/Radio/Interferometry (ISRI) Astronomy program, have been combined into the following Program Elements.

- Space Astrophysics Detector Development Program (A.2.8)
- Astrophysics Suborbital Program (A.2.9)
- Space Astrophysics Research and Analysis Program (A.2.10).

Please consult the appropriate sections of Appendix A of this NRA for details.

A.2.8 Space Astrophysics Detector Development Program

1. Scope of Program

This Space Astrophysics Detector Development (SADD) program element solicits proposals for basic supporting research and technology in the area of detector development for space astronomy missions in the wavelength range greater than 100 Å. This range of wavelengths spans the extreme ultraviolet, ultraviolet, and visible spectral regimes, the three decades from the near-infrared to the millimeter regime, and extends several decades into the radio spectrum. This Program Element is for new development efforts, as well as for ongoing programs. Investigators currently receiving NASA support for detector development and who are interested in continuing this support must respond to this NRA. **Note that this program replaces the Space Ultraviolet and Visible Detector Development program and elements of the Infrared/Submillimeter/Radio/Interferometry Astronomy.** Solicitations for this newly defined program will be made annually.

The primary goal of the Space Astrophysics Detector Development (SADD) program is research into and the development of detectors representing the best possible state-of-the-art detector technology for instruments that may be proposed as candidate experiments for future space flight opportunities. Potential future astrophysics missions include instruments which might be flown on the Space Shuttle, Space Station, Small Explorer (SMEX) missions, Medium-class Explorer (MIDEX) missions, future space interferometers, and the Stratospheric Observatory for Infrared Astronomy (SOFIA). The intent of the SADD program is not to develop flight qualified hardware for specific instruments, but rather to understand the fundamental operational aspects of detectors and to develop them to the point where they can be proposed as part of an instrument for future announcements of flight opportunity.

Although any detector technology may be proposed to this opportunity, the Next Generation Space Telescope (NGST) project is currently actively supporting detector programs for that mission. Thus, proposals in response to this current NRA would be given a lower priority for developing detectors specifically to achieve NGST detector sensitivity goals. However, proposals are encouraged to increase the demonstrated wavelength coverage of detectors that might be used on NGST or to increase significantly the effective array size.

Considering currently available technology for detectors for space astronomy, the greatest emphasis of SADD will be towards those developmental efforts that address the technological problems associated with achieving some of the following desirable detector attributes (not in priority order):

- (1) High quantum efficiency;
- (2) Large array format (>2000 x 2000 pixels);
- (3) High spatial resolution;
- (4) Large dynamic range (both locally and globally on the detector);
- (5) High speed, high resolution read-out techniques;
- (6) Reduced noise;

- (7) Extending wavelength coverage (e.g., operation of submillimeter and radio receivers at high frequency or near-IR detectors to shorter wavelengths);
and/or
- (8) Resistance to effects of operation in space.

Since the environment and constraints of space flight are far stricter than those for ground-based applications, research groups considering development of space detectors must be cognizant of the following characteristics that are highly desirable in reliable, space-quality detection systems: low mass, low sensitivity to particle radiation (“radiation hardness”), low power consumption, compactness, ability to operate in an “open face” mode for sensitivity at wavelengths shorter than 1100 Å, designed for operation in a vacuum (such that high voltage arcing is minimized), vibration tolerance, and ease of remote operation, including reduced transient effects and ease of calibration.

New measurement concepts may be proposed, as well as methods to improve the performance of existing detectors. Research into the basic properties of detector systems that could be considered for use in space is also strongly encouraged. It is not, however, the purpose of the SADD to support development of detectors that are primarily suitable for ground-based astronomy. Although ground-based observing with newly developed detectors may be necessary to verify the total detection system, this should not be the main thrust of a space detector development effort.

Proposers are asked to identify potential mechanisms which could facilitate transfer of these detector technologies to other users, including the private sector, for possible application beyond the immediate one of meeting mission science objectives. If at all possible, student participation in this SADD program is strongly encouraged, especially if it can be concluded within the nominal tenure of a graduate training. Therefore, brief details of the educational goals and training of such personnel should be included in the proposal. Note that such student participation is not to be confused with the Education and Outreach Program described in Section A.5.1.

2. Programmatic Information

It is expected that roughly \$2.7M will be available in FY 2000 for the funding of about 15 new projects. 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 NASA Research Announcement
Space Astrophysics Detector 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 following Discipline Scientists:

Dr. Hashima Hasan
Ultraviolet, Visible, and Gravitational Astrophysics Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0377
E-mail: hashima.hasan@hq.nasa.gov

Dr. Guy Stringfellow
Infrared, Submillimeter, Radio and Interferometry Astrophysics Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0311
E-mail: guy.stringfellow@hq.nasa.gov

A.2.9 Astrophysics Suborbital Research Program

1. Scope of Program

This Astrophysics Suborbital Research program element solicits proposals for basic supporting research and technology in the area of astrophysics greater than 100 Å, and for the study of gravitational physics and general relativistic phenomena, as carried out by experiments flown as part of NASA's Suborbital Program. Solicitation for this program will be made every three years. This program solicits science investigations, the completion of which involves the flight of instruments as payloads either (i) on suborbital sounding rockets or from stratospheric balloons; or (ii) on moderate duration, reusable platforms, such as the Spartan free-flying platform that is carried to and retrieved from low Earth orbit by the Space Shuttle. The latter type of program will be evaluated on a contingency basis, with no expectation of flight. This NRA is for new development efforts, as well as for ongoing programs. In all cases, such a proposed investigation must include appropriate plans and resources for the reduction and analysis of the data that are expected to be taken. **Note that this solicitation replaces the Ultraviolet, Visible, and Gravitational Astrophysics Suborbital Program and elements of the Infrared/Submillimeter/Radio/Interferometry Astronomy Research and Analysis Program.**

2. Programmatic Information

This program typically plans launches several years in advance, with several flights per year for astrophysics sounding rockets and balloons. Proposals submitted in response to this NRA, therefore, may submit budgets for up to three years. These budgets are expected to cover complete suborbital investigations, including payload development and construction, instrument calibration, launch phase, and data analysis. The proposals selected will be funded on a yearly basis. Yearly funding allotments to complete a period of performance after the first year require an Annual Progress Report, which should include a summary sufficient to demonstrate that satisfactory progress has been made, and an updated budget.

From time to time, astrophysics disciplines receive opportunities to fly small space instruments as secondary attached payloads on expendable launch vehicles, or payloads on reusable platforms, such as the Spartan platform, or the ejectable Hitchhiker. Flight opportunities of this type are infrequent and do not arise on a regular or predictable basis. They usually have a significant cost uncertainty. Therefore, these types of nontraditional suborbital flight opportunities are being solicited under this NRA on a contingency basis only, with no expectation of funding or flight. Submittal through this NRA allows these types of payloads to be peer reviewed and to provide a ready list of scientifically and technically excellent payloads that could be flown if the opportunity and funding arise. If

proposing this type of payload, the proposer should identify the type of platform that would be suitable for the proposed experiment.

One goal of this Program Element is to maintain the continuity of both instrumental expertise and laboratory facilities of research groups specializing in the fields of experimental astrophysics. Hence, the number of groups that can be supported to fly sounding rockets (and other forms of flight opportunity) is limited and heavily dependent on the funds available to this program. NASA does not carry reserves to accommodate any cost overrun incurred by a particular investigation. Such a situation may entail either descopeing the initially proposed investigation, or delaying or canceling a particular launch date opportunity.

The total funding available for this program is expected to be approximately \$4.5M beginning in FY 2000. At present, the program supports eight sounding rocket investigations, three balloons, one Hitchhiker payload (launched on the Space Shuttle in October 1998), and two investigations on the ORFEUS-SPAS II mission (launched on the Space Shuttle in November 1996.)

Current plans call for issuance of this call for Astrophysics Suborbital Research investigations at least once every three years. However, proposers may specify shorter periods of performance if the full three-year period is not required to complete their intended program. Proposers are encouraged, but not required, to define a program which may be accomplished within a three-year period. It is recognized that the proposed investigation may evolve with time. Therefore, emphasis should be placed on describing the first year's effort and include as much detail as possible regarding planned second and third year activities, including the planned flight phase and data analysis. Similarly, a detailed budget supporting the first-year's work is required, together with a reliable estimate for succeeding years. For proposals requesting support beyond three years, key projected activities occurring after the initial three-year interval should be identified. Such programs will be subject to full competitive review at the end of the three-year period.

During the next decade, NASA and the European Space Agency (ESA) expect to launch satellites to explore, in detail, the cosmic microwave background (CMBR). Consequently, individuals proposing CMBR investigations should endeavor to complete their program within one or two review cycles (three to six years).

If at all possible, student participation in this Astrophysics Suborbital program is strongly encouraged, especially if it can be concluded within the nominal tenure of graduate training. Therefore, brief details of the educational goals and training of such personnel should be included in the proposal. Note that such student participation is not to be confused with the Education and Outreach Program described in Section A.5.1. Additionally, a brief description of the plans for the reduction and analysis of data should also be included in the proposal.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal.

The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 NASA Research Announcement
Astrophysics Suborbital Research 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 following Discipline Scientists:

Dr. Hashima Hasan
Ultraviolet, Visible, and Gravitational Astrophysics Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
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Dr. Guy Stringfellow
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E-mail: guy.stringfellow@hq.nasa.gov

A.2.10 Space Astrophysics Research and Analysis (SARA) Program

1. Scope of Program

The Space Astrophysics Research and Analysis (SARA) program solicits basic research proposals for investigations that are relevant to NASA's programs in astronomy and astrophysics in the wavelength regime greater than approximately 100 Å through the radio spectrum (except within Laboratory Astrophysics, as noted below). There are two primary goals: (i) to obtain a better understanding of astrophysical objects and phenomena as revealed by their electromagnetic radiation; and (ii) to investigate topics in general relativistic and gravitational astrophysics. While excellence of proposed research is the primary selection criterion, relevance to NASA missions is a necessary criterion and must be explicitly described in the proposal. Lists of past, present, and future missions of interest are given in Tables I and II below, which are furnished only as a guide to assessing relevance of proposals for this Program Element.

This SARA Program Element combines the Ultraviolet, Visible, and Gravitational Astrophysics program, and elements of the Infrared, Submillimeter, Radio, Interferometry Astronomy program as advertised in ROSS-98. Note that the **Laboratory Astrophysics** component of the SARA program now includes aspects previously contained in ROSS-98 of the High Energy Astrophysics Program and the Astrophysics Theory Program (ATP). Thus, the "Atomic and Molecular Astrophysics" component of the ROSS-98 ATP is now included within SARA. However, compilation of large databases of parameters should be directed to the Applied Information Systems Research Program (described in Appendix A.5.2). Proposals for ground-based observations will be considered only if: (a) they are in direct support of NASA space astrophysics goals, 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.

Topics of interest to this SARA program fall into the following four research categories:

- *Laboratory astrophysics (theoretical or experimental for all wavelengths)* - for example, predissociation in diatomic molecules, electron-ion collisions, compilation of transition probability data, measurement of absolute oscillator strengths, spectroscopic studies of PAH's, investigation of carbon clusters, computation of atomic or molecular parameters;
- *Supporting technology studies (longward of 100 Å)* - for example, ultra-light holographic/diffraction grating development, thin films, lightweight composite mirrors, spectrometers, interferometers, infrared cameras;

- *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 (longward of 100 Å)* - for example, calibration of supergiants for Hubble Space Telescope, development of observational techniques.

Table I - Past, Current, and Future NASA Missions Having Objectives for UV, Visible, and Gravitational Astrophysics

(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)	1990	In operation.
<i>Goddard High Resolution Spectrograph (GHRS)</i> 1150–8000Å		Ceased operation.
<i>Faint Object Camera (FOC)</i> 1150–6500Å		Ceased operation.
<i>Faint Object Spectrograph (FOS)</i> 1050–3200Å		Ceased operation.
<i>Wide Field/Planetary Camera 2 (WF/PC2)</i> 1150–11000Å		In operation.
<i>Space Telescope Imaging Spectrograph (STIS)</i> 1150–11000Å		In operation.
• Astro-1	1990	Completed 9 day mission.
• Astro-2 400 – 3000 Å	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	1999	3 year mission.
• HST Advanced Camera for Surveys (ACS)	2000	HST replacement instrument.
• Gravity Probe-B (GP-B) - Lense Thirring Effect	2000	2 year mission.

Table I - CONTINUED

• The Galaxy Evolution Explorer (GALEX) 1350 – 3000Å	2001	28 month mission.
• The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)90 – 260Å	2001	12 month mission.
• Cosmic Origins Spectrograph (COS)	2003	HST replacement instrument.
• Space Interferometry Mission (SIM)	TBD	Selected for study.

Table II - Past, Current, and Future NASA Missions Having Objectives in Infrared, Submillimeter, and Radio Astrophysics

<u>MISSION</u>	<u>LAUNCH YEAR</u>	<u>REMARKS</u>
• Hubble Space Telescope (HST) Near Infrared Camera and Multi-object Spectrometer (NICMOS)	1990	In operation. Ceased operation
• Infrared Space Observatory (ISO)	1995	Terminated in 1998.
• Space Very Long Baseline Interferometry (SVLBI)	1996	In operation
• Submillimeter Wave Astronomy Satellite (SWAS)	1998	In operation
• Wide-field Infrared Explorer (WIRE)	1999	Survey of IR emission from galaxies and GO Programs
• Space Infrared Telescope Facility (SIRTF)	2002	Great Observatory
• Stratospheric Observatory for Infrared Astronomy (SOFIA)	2002	Multipurpose Observatory
• Next Generation Space Telescope (NGST)	2007	Study of the Universe at high red shift
• Microwave Anisotropy Probe (MAP)	2000	CMBR
• Far Infrared Space Telescope (FIRST)	2007	
• PLANCK	2007	
• Terrestrial Planet Finder	2011	

2. Programmatic Information

It is expected that roughly \$3M will be available in FY 2000 for the funding of about 50 new three-year projects split among four categories: supporting technology, laboratory astrophysics, gravitation and general relativity, and ground-based astronomy.

Investigators may propose programs of any size. The actual amount of funding awarded to a particular program will be determined by the merit of the program and programmatic goals of the Office of Space Science.

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 on the planned second and third year's activities. Proposals for investigations requiring less than a three-year time scale to complete are encouraged, as are those which require a longer time scale to complete, though the latter must undergo subsequent peer reviews every three years. Key projected milestones and accomplishments during each period of the proposed effort should be identified.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

The schedules for submission of the Notice of Intent (NOI) and proposals are given in Table 1 of the cover letter of this NRA. The 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 sent to:

ROSS-99 NASA Research Announcement
Space Astrophysics Research and Analysis 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 following Discipline Scientists:

Dr. Hashima Hasan
Ultraviolet, Visible, and Gravitational Astrophysics Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0377
E-mail: hashima.hasan@hq.nasa.gov

Dr. Guy Stringfellow
Infrared, Submillimeter, Radio, and Interferometry Astrophysics Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0311
E-mail: guy.stringfellow@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 satellites of the outer planets, and small solar system bodies); or cosmochemical 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 such further 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;
- petrologic studies of materials from Solar System bodies;
- lunar geochemical and petrologic 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.

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.

Proposals for topical conferences, workshops, symposia, or other new initiatives related to the Cosmochemistry Program are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available on the World Wide Web at URL <http://www.hq.nasa.gov/office/oss/codesr/welcome.html>.

An important goal of the Astronomical Search for Origins and the Solar System Exploration efforts 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.

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 2000 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Cosmochemistry Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189

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 Program 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. Note that in a change from the ROSS-98 NRA, the observations of Near Earth Objects (NEO's) are now to be supported through a separate program element; see Section A.3.10. The Planetary Astronomy Program as now redefined 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 that supplement NASA missions that will be returning significant amounts of data within the next three years are especially encouraged.

2. Programmatic Considerations

Presently about \$8.2M is budgeted for this program, of which \$3.5M is dedicated to facilities support (principally the Infrared Telescope Facility (IRTF)). Approximately 90 investigations are supported with the remaining funds. Approximately one-third of these awards are expiring, allowing proposers to this ROSS-99 NRA to compete for about \$2M.

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 Section C.3 of Appendix C, all proposals for this Planetary Astronomy program are now considered “new” 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.5.3).

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Planetary Astronomy Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189.

Additional information may be obtained from the Discipline Scientist:

Dr. Thomas Morgan
Planetary Astronomy Program
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 that are currently needed to interpret planetary data. These include measurements and calculations of spectroscopic properties, (excitation, dissociation, and 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 are in the public domain, are encouraged. These include released data from the Galileo, Mars Pathfinder, and Mars Global Surveyor missions.

In all cases, a Planetary Atmospheres investigation should propose to attack a specific problem of the highest intrinsic scientific value. Proposals that serve as an umbrella for a variety of research tasks are not appropriate. 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 Information

Proposals are sought for new projects that fall within the scope of the Planetary Atmospheres Program. Presently, about \$7M is budgeted for this program in Fiscal Year 2000, for which this NRA solicits proposals, and approximately 100 investigations are expected to be supported by these funds. Of these, approximately 25 new proposals are expected to be selected through this NRA. Investigations may be proposed for a one, two or three-year period of performance. For multiyear grants, a progress report should be submitted to the Discipline Scientist (see address below) 90 days before the renewal date of the annual agreement. The Project Description 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, publications generated by this research, a budget, and an estimate of the amount of previously awarded funds that remain available at the end of the award year. The five page limit does not include a Cover Page, detailed budgetary information, or reprints.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance . Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Planetary Atmospheres Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189

For further information, contact the Discipline Scientist:

Dr. Reta Beebe
Planetary Atmospheres Program
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> or from the World Wide Web at URL <http://www.flag.wr.usgs.gov/USGSFlag/Space/GEOMAP/PGM_home.html>

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 (especially note the provision 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 the 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 multi user 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 and planetary 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: (281) 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 will be 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 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 the World Wide Web at URL <http://www.flag.wr.usgs.gov/USGSFlag/Space/GEOMAP/PGM_home.html > and/or contact:

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 \$12.4 M for FY 2000, which is expected to support approximately 150 investigations, including both new proposals and in-progress multiple year awards. Of these, approximately 60 investigations are expected to be selected through this NRA. All proposals must be received at the Lunar and Planetary Institute (see next page for address) by the close of business on the date given in Table 1 or they may not be considered for funding (see general policy on late proposals in Section C.1.1 in Appendix C).

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 five (5) copies of 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, a one page (or less) *Proposal Summary* (Abstract), *Budget Summary*, *Table of Contents*, *PI Current and Pending Support*, references, figures, requests for equipment augmentations, detailed budgetary information, reprints, or appendices. Please note that Letters of Commitment for Co-I's and collaborators are not required on *Progress Reports* unless there are new participants that did not submit letters with the original proposal.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance . Hard copies of the proposals are to be delivered to:

ROSS-99 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: (281) 486-2189

Additional information may be obtained from Discipline Scientist:

Dr. John A. Grant
Planetary Geology Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0294
E-mail: john.grant@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. 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 that enable integrated instrument packaging (architectures). The emphasis in this NRA is also on the development of miniaturized, low power, 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. Particularly for immature or very complex new instruments, proposers initially may choose to only define or develop the most risky components. However, in all cases of component only development, one or more likely scenarios for possible follow on instrument development should be described. For all (instrument or component) proposals, scientific objectives of those instruments (or proposed follow on instruments), and future candidate missions should be discussed in the proposal. Proposed instruments must address significant scientific questions relevant to stated NASA goals.

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 Astrobiology Program. Spacecraft 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 seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, onboard data processing or data compression studies, or any spacecraft technology that does not directly address science instrumentation.

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 farther 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 Discovery missions, the Near Earth Asteroid Rendezvous (NEAR), Mars Pathfinder, and Lunar Prospector have been launched, and Stardust is scheduled to be launched in February 1999. CONTOUR and Genesis were selected in 1997, and five new missions were selected for Phase A study in November 1998 (final mission selection is scheduled for the spring of 1999). Future solicitations are planned approximately every 18 months.

The Discovery missions may include flyby, orbiter, lander, Earth orbiting telescopes, 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 critical 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 NEAR, Mars Pathfinder, Lunar Prospector, Stardust, CONTOUR, and the missions selected in 1999. 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 are the Mars Global Surveyor, launched in November 1996, and the Mars Climate Orbiter and Mars Polar Lander, launched in December 1998, and January 1999. U.S. science instruments for the Mars Surveyor 2001 orbiter and lander missions and for the Mars Surveyor 2003 missions have already been selected. Future launches to Mars will occur approximately every 26 months. 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 2003 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. Some, but not all of these, are truly new and complex instrument concepts for planetary exploration. As such, proposers may choose to initially pursue only development of the most challenging components, as long as discussion of their connection to possible future instruments and scientific objectives is clearly discussed.

- *Micromissions*

At the time of the writing of this NRA, NASA anticipates opportunities in the coming years for micromissions. These micromissions could target Mars or other inner Solar System bodies, and possibly outer Solar System bodies. *Total* science payloads will be very small in mass (estimated 5 to 30 kg depending strongly on type of mission, e.g., flyby, orbiter, or lander, and the object to be visited; the lower bound is more likely than the upper bound), as well as power and volume. Instrument definition and development relevant to these possible micromissions is considered appropriate for this PIDDP NRA.

- *Outer Solar System Missions*

Missions to the outer planets and satellites are a specific NASA objective. By the time of selection of the proposals called for under this NRA, instruments will have already been selected for a Europa Orbiter mission and a Pluto/Kuiper Express mission, so instruments for these specific missions are not appropriate under this NRA. Although no other outer planet missions are in the near term queue, additional future opportunities might include focused science missions under the Discovery Program, or entry probes for outer planet atmospheric studies, or landers, particularly for Europa. Therefore, the PIDDP solicits instrument concepts for future outer planet missions, including but not limited to Europa

landers, 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, *in situ* instruments for icy bodies, particularly Europa, including chemical and related exobiological analyses, geophysical analyses (e.g., seismic and heat flow), shallow (~10 cm) sampling techniques, and lightweight imaging systems with broad spectral range. As stated previously, because of the newness and complexity of some of these techniques, particularly under Europa-like conditions, proposers may choose initially only to define or develop the most challenging or unknown components, but connections to possible instrument follow-on's and science objectives must be discussed. Atmospheric entry probe instrument concepts, 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 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. Therefore, all proposals submitted to 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.

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.

The evaluation criteria in Section 1.4 of Appendix C are fully applicable to the PIDDP, including evaluation of scientific and technical merit, uniqueness and innovation, team and institutional capabilities, and cost. 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;
- 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; and
- Whether the instrument is deemed to fall within the scope of PIDDP, including whether it too developmentally mature for PIDDP.

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.

4. Proposal Submission

Full, new proposals are sought for either entirely new studies or for the extension of PIDDP studies terminating in FY 1999. 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 18 studies will be supported with these funds.

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

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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

Proposals previously selected for multiple year periods of performance that are continuing beyond FY 1999 require the submission of an Annual Progress Report and updated budget in order to allow processing of their annual funding allotment. Two copies should be sent to the Discipline Scientist listed below at least 90 days prior to the anniversary date of the funding instrument.

Additional information may be obtained from the Discipline Scientist:

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

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 existing multiple year proposals that are currently funded through OSS, for support of the Solar System Exploration science theme or Exobiology program element. A Major Equipment proposal that is not affiliated with such a “parent” OSS research proposal 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 Major 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 encouraged for very high cost instruments; the partners of such proposals must provide a written statement regarding long term funding and/or institutional commitments.

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-99 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 “parent” science proposal or existing multiple year award. This is especially important for proposers who are operating under awards and who normally would submit only a progress report to request an additional funding allotment to complete a period of performance and because Major Equipment requests may also be reviewed by a multidisciplinary group external to the normal review process. Therefore, all such 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 inclusive, but rather illustrative of the range of instrument types 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
- 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 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 as well as other facilities.

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 section is required that describes 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 apply to gain access (personal communication, formal 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. Costs for maintenance or operation beyond the check-out period should not be included but instead 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 (see details in Section C.5.3 of Appendix C) should be fully explained and substantiated.

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.

Major Equipment proposals will be reviewed by the relevant discipline peer review panel during the full proposal review and in the context of its "parent" research proposal. 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 are then referred to the Director, Research Program Management Division for final selection.

All requests selected for Major Equipment support will be funded through augmentation to the "parent" grant/contract for the 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 an Annual Progress Report and updated budget and/or statement of work as may be appropriate.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Planetary Major Equipment Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189

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 NRA to which the “parent” scientific research proposal is being submitted, or who is cognizant for an existing multiple year award for which a Major Equipment supplement is proposed.

A.3.7 Jovian System Data Analysis Program

1. Scope of Program

The objective of this Jovian System Data Analysis Program (JSDAP) is to enhance the scientific return from the Galileo Europa Mission (GEM) by broadening the scientific participation in the analysis and interpretation of the Galileo Orbiter data. This program will support scientific investigations that stress GEM data. However analysis of some primary Galileo mission data that is directly related to the GEM data may be incorporated in the proposal.

Proposals are solicited that involve refinement of specific data sets, and analysis and modeling to interpret the Galileo data to increase knowledge of the physical state and structure and the dynamic processes acting on the satellites, planetary atmosphere, or interior, rings and magnetosphere. Data from other sources may be combined with Galileo data to further the understanding of some aspect of the Jovian system. These data could come from other spacecraft, orbiting telescopes, or ground-based observations. The proposed existing data sets from other sources should be described and the manner in which they augment the Galileo data must be clearly specified. Funds from this program will not be authorized to obtain new observations or to support observing facilities.

2. Sources of Information and Data

In order that the JSDAP can be implemented in a timely manner, the NASA Planetary Data System (PDS) will make the Galileo data available to the science community via an on-line interface before the peer review process has been completed. These data sets may or may not be in PDS compliant format. In addition, some documentation, ancillary files and other supporting products may not be available. PDS will make available validated data sets that have been released and delivered to the PDS by the Galileo science teams. The levels of completion of on-line data sets are a function of data structure and calibration problems. Before submitting a proposal, an investigator is responsible for determining that necessary and sufficient data to allow completion of the proposed research have been acquired and are being validated. Proposers must identify relevant derived data products that will be generated within this program, and, on completion of their analysis, funded investigators must document and deposit these data sets in the PDS. This task should be included in the work plan of proposals involving data analysis.

The Galileo Web site is at URL <<http://www.jpl.nasa.gov/galileo/>>, which is located at the Jet Propulsion laboratory. The 'related pages' references various instrument Web pages, some with associated bibliographies of articles produced by the team. Additional assistance in understanding the scope of the imaging data that were obtained by the Orbiter is available at a site generated by the Solid State Imaging (SSI) team that is located at the U.S. Geological Survey through URL <<http://pele.wr.usgs.gov/Galileo>>. The basic descriptions of the Galileo Probe and Orbiter and the associated

instrumentation are available in *Space Science Reviews*, 60, Nos. 1-4 (1992). Initial probe results were published in *Science*, 272, 837-860 (1996), and preliminary orbiter results were reported in *Science*, 274, 309-464 (1996).

A master summary that specifies the current schedule for release of Galileo data to the PDS is available at <<http://sdtss10.fltops.jpl.nasa.gov/archive/archive.html>>. The PDS, a distributed system with the central node located at the Jet Propulsion Laboratory, has tasked individual discipline nodes to archive specific Galileo data sets. URL addresses of nodes pertinent to this NRA are listed below along with designated individuals to contact for assistance in locating and transferring data sets:

Central Node: <http://pds.jpl.nasa.gov>

Atmospheres Discipline Node (ATM): <http://atmos.nmsu.edu>
Lyle Huber: E-mail: lhuber@nmsu.edu; Telephone: (505) 646-1862

Imaging Node (IMAG): <http://www-pdsimage.jpl.nasa.gov/pds>
Sue Lavoie: E-mail: sue.lavoie@jpl.nasa.gov; Telephone: (818) 354-5677

Planetary Plasma Interactions Node (PPI) <http://www.igpp.ucla.edu/ssc/pdsppi>
Steve Joy: E-mail: sjoy@igpp.ucla.edu; Telephone: (310) 825-3506

Radio Science Node (RS) :
Richard Simpson: E-mail: rsimpson@magellan.stanford.edu;
Telephone: (415) 723-3525

3. Programmatic Information

The Galileo Europa Mission component of the Jupiter System Data Analysis is envisioned as a two-year program. It is anticipated that approximately \$2.0M dollars per year will be available in Fiscal Years 2000 and 2001 to cover the selection of 25 to 35 investigations having either a one or two-year period of performance. NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Jupiter System Data Analysis Program (JSDAP)
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189

For awards granted through this JSDAP program, two copies of the Progress Report for two-year grants should be submitted to the Discipline Scientist (see address below) 90 days before the anniversary date of the award to allow for processing of its annual funding allotment. This Progress Report must be limited to five single-spaced, typewritten pages and include a brief statement of planned work for the coming year, a report of progress during the previous year, publications generated by this research, a budget, and an estimate of the amount of previously awarded funds that remain available at the end of the award year. The five-page limit does not include a Cover Page, detailed budgetary information, or reprints.

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.3.8 Lunar Data Analysis Program

1. Scope of Program

The objective of the Lunar Data Analysis Program (LDAP) is to enhance the scientific return from the Lunar Prospector Missions (LPM) by broadening the scientific participation in the analysis of the LPM data. The LDAP supports scientific investigations using data obtained during the primary mission phase.

An investigator may propose a study (scientific, cartographic, topographic, geodetic research) based on analysis of Lunar data collected by LPM (additional information about LPM and references containing preliminary science results can be found on the Lunar Prospector Mission homepage at <<http://www.lunar.arc.nasa.gov>>). In addition, correlative studies that use Lunar data from another source with LPM flight mission data to further the understanding of some aspect of Lunar science are also included in this category. The other data could come from ground-based observations or from other spacecraft. Funds awarded for correlative studies will be used to cover data analysis and expenses involved in collaboration with other Lunar investigators. Funds will not be authorized for taking new observations or for support of observing facilities. In anticipation that selected investigations may result in by-products (e.g., compositional, topographic, planometric, cartographic, and geologic maps, and calibration data) that are of broad use to the science community, a plan for archiving and making such by-products readily available must be included in the proposal.

Proposals for topical conferences, workshops, consortia, symposia, or other new initiatives related to LDAP are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available at <<http://www.hq.nasa.gov/office/oss/codesr/welcome.html>>.

2. Sources of Information and Data

It is the responsibility of the investigator to acquire any required data. Before submitting a proposal, each proposer should determine that the required data are available. LDAP, as well as data from previous Lunar missions, are available from the Planetary Data System (PDS) that can be accessed on the PDS home page at <<http://pds.jpl.nasa.gov/pds.home.html>>. Proposers who wish to use photographic and cartographic materials may find such data at the nearest Regional Planetary Image Facility (RPIF). Locations of RPIF's are listed on the RPIF home page at URL <<http://cass.jsc.nasa.gov/library/RPIF/RPIF.html>>. Additional information about the Lunar Prospector Mission can be found on the Lunar Prospector Mission homepage at URL <<http://www.lunar.arc.nasa.gov>>.

3. Programmatic Information

The LDAP is envisioned to be a multiyear program and it is anticipated that approximately \$1.2M dollars will be available for the LDAP in Fiscal Year 2000. It is estimated that 20 to 25 investigations may be selected from proposals submitted in response to this Announcement. Investigations may be proposed for either a one or two year period of performance. Funding of investigations will be phased to ensure new starts each successive year of the program. Awards under this NRA are subject to the availability of program funds.

Holders of existing LDAP multiple year awards (e.g., the second- or third-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 deadline 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 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.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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 and Planetary Science Institute by E-mail at <panel@lpi.jsc.nasa.gov> or phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Lunar Data Analysis Program (LDAP)
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston TX 77058
Phone contact for commercial delivery: (281) 486-2189

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0302
E-mail: joseph.boyce@hq.nasa.gov

A.3.9 Mars Data Analysis Program (MDAP)

1. Scope of Program

The objective of the Mars Data Analysis Program (MDAP) is to enhance the scientific return from the Mars Pathfinder (MPF) and Mars Global Surveyor (MGS) Missions by broadening the scientific participation in the analysis of the MPF and MGS data. The MDAP supports scientific investigations using data obtained during and after the aerobraking phase of MGS and data obtained by MPF in its primary and extended mission phases on the surface of Mars.

An investigator may propose a study (scientific, landing site science, cartographic, topographic, geodetic research) based on analysis of Mars data collected by the MPF and/or MGS missions (additional information about the MPF and MGS Missions, and references containing preliminary science results can be found on the Mars Program homepage at URL <<http://mpfwww.jpl.nasa.gov>>). In addition, correlative studies that use Mars data from another source with flight mission data to further the understanding of some aspect of Mars science are also included in this category. The other data could come from ground-based observations or from other spacecraft. Funds awarded for correlative studies will be used to cover data analysis and expenses involved in collaboration with other Mars investigators. Funds will not be authorized for taking new observations or for support of observing facilities. In anticipation that selected investigations may result in by-products (e.g., mineral, topographic, planometric, cartographic, and geologic maps, and calibration data) that are of broad use to the science community, a plan for archiving and making such by-products readily available must be included in the proposal.

Proposals for topical conferences, workshops, consortia, symposia, or other new initiatives related to MDAP are also solicited through this NRA. For more information about the type of research supported by this program, abstracts for currently funded investigations are available at <<http://www.hq.nasa.gov/office/oss/codesr/welcome.html>>.

2. Sources of Information and Data

It is the responsibility of the investigator to acquire any required data. Before submitting a proposal, each proposer should determine that the required data are available. MPF and MGS, as well as data from previous Mars missions, are available from the Planetary Data System (PDS) that can be accessed on the PDS home page at <<http://pds.jpl.nasa.gov/pds.home.html>>. Proposers who wish to use photographic and cartographic materials may find such data at the nearest Regional Planetary Image Facility (RPIF). Locations of RPIF's are listed on the RPIF home page at URL <<http://cass.jsc.nasa.gov/library/RPIF/RPIF.html>>.

3. Programmatic Information

The MDAP is envisioned to be a multiyear program that will support analysis of data returned by the planned series of Mars Surveyor missions over the next decade. It is anticipated that approximately \$2.3M will be available for the MDAP in Fiscal Year 2000. It is estimated that 25 to 50 investigations (both new and in-progress multiple-year proposals) may be selected from proposals submitted in response to this Announcement. Investigations may be proposed for a one-, two-, or three-year period of performance. Funding of investigations will be phased to ensure new starts each successive year of the program. Awards under this NRA are subject to availability of program funds.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

Holders of existing MDAP multiple year awards (e.g., the second- or third-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 deadline 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 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 and Planetary Science Institute by E-mail at <panel@lpi.jsc.nasa.gov> or phone at (281) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Mars Data Analysis Program (MDAP)
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston TX 77058
Phone contact for commercial delivery: (281) 486-2189

Obtain additional information from the Discipline Scientist:

Mr. Joseph M. Boyce
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0302
E-mail: joseph.boyce@hq.nasa.gov

A.3.10 Near Earth Object Observations Program

1. Scope of Program

The Near Earth Object (NEO) Observations program supports ground-based telescopic observations to inventory the population of Near Earth Objects and to characterize a representative sample of them. However, the highest priority of this NEO program is to inventory the population of these objects. Therefore, NASA seeks investigations that promise a sustained, productive search for NEO's or that obtain follow-up observations sufficient astrometric precision to allow the accurate prediction of their orbits

This program also seeks to characterize NEO's to the maximum extent possible, by measuring the sizes, shapes, and compositions of any newly discovered objects. Although this objective is of lower priority than that of discovery and orbit determination, it is considered very important from the point of view of helping to determine possible objectives of future space flight missions that NASA or other non-U.S. space agencies may sponsor.

2. Programmatic Considerations

Presently about \$3.5M is budgeted for this program, of which approximately \$0.5M is dedicated to program office support at NASA's Jet Propulsion Laboratory. Approximately 15 investigations are currently supported with the remaining funds. Owing to the expiration of some of the current awards, approximately \$600K will be open for competition through this ROSS-99 NRA. .

As a departure from past nomenclature for this program element, and in accordance with Section C.3 of Appendix C, all proposals for this NEO Observations program are now considered "new" regardless of past funding history, i.e., the old term of "Renewal (Full) Proposal" is no longer used. However, proposals for NEO observations that are a logical follow-on to work that has been selected and funded through previous Planetary Astronomy NRA's (where all previous NEO work would have been submitted) 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.5.3).

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Near Earth Object (NEO) Observations program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189.

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.3.11 Planetary Suborbital Research

1. Scope of Program

This Planetary Suborbital Research program element solicits proposals for basic supporting research and technology to study properties of solar system objects. This program solicits science investigations, the completion of which involves the flight of instruments as payloads either (i) on suborbital sounding rockets; (ii) on stratospheric balloons; or (iii) on Shuttle-based platforms or the Space Station. The latter type of program will be evaluated on a contingency basis, with no expectation of flight. This NRA is for new development efforts, as well as for ongoing programs. In all cases, proposed investigations must include appropriate plans and resources for the reduction and analysis of the data that are expected to be acquired.

From time to time opportunities to fly experiments as secondary attached payloads on expendable launch vehicles or on reusable platforms such as Hitchhiker or Spartan become available. Opportunities of this type are unpredictable and usually have significant cost uncertainties. Therefore, these types of flight opportunities are solicited under this NRA on a contingency basis only, with no expectation of funding or flight. Submittal through this NRA allows payloads of this type to be peer reviewed and to provide a ready list of scientifically and technically excellent payloads that could be flown if the opportunity and funding arise. If proposing this type of payload, the proposer should identify the type of platform that would be suitable for the proposed experiment.

Current plans call for opportunities to propose Planetary Suborbital Research investigations at least once every three years. However, proposers may specify shorter periods of performance if the full three-year period is not required to complete their intended program. Proposers are encouraged, but not required, to define a program that can be accomplished within a three-year period. It is recognized that the proposed investigation may evolve with time. Therefore, emphasis should be placed on describing the first year's effort, but with as much detail as possible regarding planned second and third year activities, including the planned flight phase and data analysis. Similarly, a detailed budget supporting the first-year's work is required, together with a reliable estimate for succeeding years. For proposals requesting support beyond three years, key projected activities occurring after the initial three-year interval should be identified. Such programs will be subject to full competitive review at the end of the three-year period.

Student participation in this Planetary Suborbital program is strongly encouraged, especially if it can be concluded within the nominal tenure of graduate training. Therefore, a brief description of the educational goals and training of such personnel should be included in the proposal. Note that such student participation is not to be confused with the Education and Outreach Program described in Section A.5.1. A brief description of the plans for the reduction, analysis, and archiving of data should also be included in the proposal.

2. Programmatic Information

The total funding available for this program is expected to be approximately \$600K per year, beginning in FY 2000. At present, the program supports one sounding rocket investigation, two Hitchhiker payloads, and one mid-deck investigation on the Space Shuttle. The number of groups that can be supported to fly sounding rockets (and other forms of flight opportunity) is limited and heavily dependent on the funds available to this program. NASA does not carry reserves to accommodate any cost overrun incurred by a particular investigation. Such a situation may entail either descopeing an initially proposed investigation, or delaying or canceling a particular launch date opportunity.

Proposals submitted in response to this NRA may include budgets for up to three years. These budgets are expected to cover complete suborbital investigations, including payload development and construction, instrument calibration, launch phase, and data analysis. The proposals selected will be funded on a yearly basis. Yearly funding allotments to complete a period of performance after the first year require an Annual Progress Report, which should include a summary sufficient to demonstrate that satisfactory progress has been made, and an updated budget.

NOTE: Appendix C of the ROSS-99 NRA contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

Owing to the larger scope and complexity of Planetary Suborbital proposals, the page limit for the *Science/Technical/Management Section* given in Section C.5.2 of Appendix C is revised to 20 pages instead of 15 pages.

The schedules for submission of the Notice of Intent (NOI) and the proposal for this program element are:

NOI Due Date	April 9, 1999
Proposal Due Date	June 8, 1999

These dates should be considered as an amendment to Table 1 of the Summary 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) 486-2137 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 NASA Research Announcement
Planetary Suborbital Research Program
The Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Phone number for commercial delivery: (281) 486-2189

Additional information may be obtained from the Discipline Scientist:

Dr. Jay T. Bergstralh
Planetary Atmospheres Program
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0313
E-mail: jay.bergstralh@hq.nasa.gov

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 sections starting with A.4 of Appendix A of this ROSS-99 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://umbra.nascom.nasa.gov/spd/secr/> >.

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 sections A.4 of this Appendix A.

(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.

(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. A SECTP selection has just been completed as advertised through the ROSS-98 NRA, and the next opportunity to propose is not anticipated until ROSS-2001; 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. However, the GI program for the Advanced Composition Explorer (ACE) that was offered in ROSS-98 is not repeated in this current ROSS-99, and at the time of the release of ROSS-99, the GI program for SEC interdisciplinary investigations described in Section A.4.8 is in abeyance pending the identification of appropriate funds.

(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.

Proposals for instrument and technique development are welcome, but must demonstrate that the proposed development is important to the solution of some important science question.

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 major 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 (i.e., all those beginning with A.4) 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

1. Scope of Program

The SECTP is a continuation of the previously funded Space Physics Theory Program (SPTP) except for galactic cosmic rays investigations that, beginning with the 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 is a triennium program, that is, it solicits proposals only every three years.

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 A. 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.

2. Programmatic Information

Selections for the SECTP are nominally for a three-year period of performance with annual funding allotments contingent upon the submission of a satisfactory progress reports and available funding. The most SECTP selections were carried out under the auspices of the ROSS-98 NRA, and funding for the selected investigations will start in Fiscal Year 1999. The total budget for this program element is about \$3.5 M. Since no increase is anticipated for the SECTP for rest of the triennium, the next selection opportunity is expected to be advertised in ROSS-2001. Therefore, proposals for this program element are not solicited through this current ROSS-99.

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: david.evans@hq.nasa.gov

A.4.2 Heliospheric Physics

1. Scope of Program

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 in this ROSS-99 NRA. Questions concerning the program element may be addressed to the discipline Scientist:

Dr. James C. Ling
Research Program Management Division
Code SR
NASA Headquarters
Office of Space Science
Washington DC 20546-0001
Telephone: (202) 358-0897
E-mail: jl原因@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, in-depth 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.

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.

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.

2. Programmatic Information

Total funding for the existing ITM program is nominally \$4M per year. Of the 50 grants currently being funded, approximately 40% will expire in FY 1999.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate

and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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 research investigations seeking to resolve science questions concerning 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 that give 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. Investigations seeking to resolve science questions concerning comparative magnetospheres and plasma-solar system body interactions are also appropriate.

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.

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.

2. Programmatic Information

Total funding in this program element has been about \$4M per year. Of the approximately 60 investigations currently being funded, about one third will expire in FY 1999.

In past years the Magnetospheric Physics program has permitted grants to be made separately to the Principal and Co-Investigators of the same investigation, but at different institutions, in order to avoid the overhead costs associated with subcontracts. However, beginning with investigations accepted as a result of this competition through ROSS-99 (FY 2000 funding), this practice will no longer be done except in those cases where the Co-Investigator is affiliated with a U.S. Government Laboratory (see the subsection entitled "*Budget Summary and Details* in Section 5.3 of Appendix C).

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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. Deliver hard copies of the proposals delivered to:

ROSS-99 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 david.evans@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 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://hessi.ssl.berkeley.edu/>>).

Note that it is anticipated that preparations for other future solar missions, such as the Solar Terrestrial Relations Observatory (STEREO), will be addressed in separate program announcements; therefore, proposals dealing with these missions are not appropriate for this ROSS-99 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 major 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, namely,

- Development of Instrument Concepts,
- 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.

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. It is emphasized that a proposal for a Solar Physics suborbital program must be for a complete science investigation, including data analysis and publication of results, even if these activities are projected to be done beyond the maximum three year period of performance. In a case like this, a follow-on proposal must be submitted for full peer review that documents the progress made in developing if not also flying the payload, and that projects the steps necessary for data acquisition and reduction, and the publication of results.

2. Programmatic Information

The Solar Physics SR&T program has 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 1999 of \$6.2 M supported approximately 75 grants, of which about 25 are expiring.

The Solar Physics Suborbital program has approximately \$1.5 M available for selections made through this ROSS-99 NRA for three to five investigations of up to three years duration each beginning in FY 2000.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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 Magnetospheric, Ionospheric, Thermospheric, and Mesospheric (MITM) Physics 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 (SEC) science theme of the NASA Office of Space Science.

The MITM Suborbital 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. The MITM Suborbital program also supports science investigations involving balloon and rocket payloads, Shuttle-based investigations, secondary payloads, and/or flights of opportunity. Selection is based on science merit, cost-effectiveness, and overall programmatic balance. Proposers may submit budgets for up to three years; these are expected to cover a complete suborbital investigation, including payload construction, launch phase, and data analysis.

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 Suborbital program are strongly urged to discuss prospective investigations with operations personnel at the 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.

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. The only currently scheduled campaigns are for PFRR during winter 1998-99 and winter 2000-2001.

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 Campaign Summary proposal should address 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; and any other information that defines the overall scope of the proposed campaign.
- 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, 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 *Cover Sheet* of the primary 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 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 Suborbital 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 is nominally about \$4M per year; annual funding levels have averaged \$250K per investigation and \$100K per individual investigator. Of the 16 investigations currently being funded, seven will end in FY 1999.

Owing to the larger scope and personnel involvement in MITM proposals, the page limit for the *Science/Technical/Management Section* given in Section C.5.2 of Appendix C is revised to 20 pages instead of 15 pages.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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 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-99 NASA Research Announcement
MITM Suborbital Program
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

This Program Element was offered in the ROSS-98 NRA as a one-time only opportunity. It is not repeated for this current ROSS-99 NRA. Starting with ROSS-99, proposals for the analysis of ACE data should be submitted to the Sun-Earth Connection Guest Investigator Program (see Section A.4.8).

A.4.8 Sun-Earth Connection Guest Investigator Program

NOTE: At the time of release of this ROSS-99 NRA, this program element is not expected to be open for the submission of new proposals. However, if resources do become available for the support of new proposals in the time frame during which this ROSS-99 NRA is open, an E-mail notice will be distributed not less than three months prior to the designated proposal due date.

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 on-going Sun-Earth Connection (SEC) Guest Investigator Program (GIP) is offered for investigations that extensively utilize the data sets from the operating SEC missions. Guidelines for these interdisciplinary objectives are taken from the SEC Senior Review that took place in mid 1997. 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.

The objectives of this SEC GIP are: (i) to understand the solar interior and the solar atmosphere, including the evolution of mass and energy ejected from the solar atmosphere; (ii) to understand the propagation of disturbances in the three-dimensional as well as the distant heliosphere; and (iii) 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, which is especially critical for understanding the complex problems of the upcoming solar maximum period. Nevertheless, all problems at all scales within the SEC realm are to be addressed by the solicited investigations, not exclusively global, multiple spacecraft efforts. The SEC GI Program is 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 current solicitation for the SEC GIP is intended to analyze data from specifically the following missions:

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

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 fleet of SEC missions and their accommodations 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) 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://plasma2.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 component of the SEC GIP program supports research relating to the analysis of data from the Heliospheric Missions (that is, Advanced Composition Explorer (ACE), Pioneer 10 and 11, the Voyager Interstellar Mission, Ulysses, IMP-8, and the Solar Anomalous, and Magnetospheric Particle Explorer (SAMPEX)). A one-time only Heliospheric Mission Guest Investigator Program and Advanced Composition Explorer Guest Investigator Program underwent comprehensive review in 1997 and 1998, respectively resulting in three-year awards that subscribed the available budget for this activity through Fiscal Year 2000 for the former and Fiscal Year 2001 for the latter. Proposals using data from these Heliospheric Missions should now be submitted to this ROSS-99 program.. 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

- 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.lmsal.com/SXT/homepage.html>>.

- 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.
 - GI's selected for the coronal experiments 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. Therefore, approved GI's selected for these objectives 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 of 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 GI proposers 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 clarify the following two critical questions:

(i) Are the proposed observations feasible using SOHO instruments, and, if so, can they be carried out with a reasonable amount of effort and time?

(ii) 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 proposers are referred to the December 1995 issue of *Solar Physics*, or the detailed SOHO information found at URL <<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.lmsal.com/TRACE/welcome.html>>.

- High Energy Solar Spectroscopic Imager (HESSI). Proposals are invited as part of the SEC GIP for HESSI scientific research--data analysis and theory--that heavily utilize the publicly open database (all data from HESSI, regardless of age). HESSI is scheduled to be launched in July 2000; hence, SEC GIP proposals selected for HESSI would not be expected to require full funding in the first year (prior to launch). The HESSI PI may not receive funding from or propose as a PI to this Guest Investigator program. HESSI 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 HESSI with other SEC mission data are especially pertinent. Information on HESSI may be found at URL <<http://hessi.ssl.berkeley.edu/>>.

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) 358-0911
Facsimile: (202) 358-3097
E-mail: william.wagner@hq.nasa.gov

3. Programmatic Information

NOTE: At the time of release of this ROSS-99 NRA, this program element is not expected to be open for the submission of new proposals. However, if resources do become available for the support of new proposals in the time frame during which this ROSS-99 NRA is open, an E-mail notice will be distributed not less than three months prior to the designated proposal due date. In that case, the following instructions will apply for the submission of proposals:

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 proposed research is distinct from existing efforts for which they are being funded.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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-99 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.4.9 Energetics and Dynamics of the Mesosphere and Lower Thermosphere: TIMED/CEDAR Collaborative Studies

1. Scope of Program

- **Introduction**

Understanding the Earth's upper atmosphere is the goal of two complementary programs that are poised to take advantage of joint measurement in the 2000-2001 timeframe. These are the NASA Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) mission and the NSF Coupling, Energetics and Dynamics in Atmospheric Regions (CEDAR) program.

The TIMED mission, which is scheduled for launch in May 2000, was designed to study the region of the atmosphere between 60 and 180 km altitude. This region constitutes the primary interface between the lower terrestrial atmosphere and the space environment. Although much has been learned from ground-based studies about the processes that control this region, relatively little is known about its global characteristics because atmospheric densities in the region are too great to allow long-term in situ satellite reconnaissance and because the geographical distribution of ground-based observatories is limited.

It was to fill this gap in knowledge that the TIMED mission was designed primarily to determine the temperature, density, and wind structure of the mesosphere/lower thermosphere/ionosphere (MLTI), and to determine the relative importance of the various sources and sinks of energy for the thermal structure of the MLTI.

TIMED has many goals in common with the NSF CEDAR program, which is designed to characterize and understand the atmosphere above 60 km with emphasis on the energetic and dynamic processes determining the basic composition and structure of the atmosphere. Particular attention is given to how these processes are coupled and to the mechanisms that couple different atmospheric regions. Phase III of the CEDAR program has begun and is expected to extend through the next decade. The scientific agenda of CEDAR Phase III has four science initiatives: coupling to lower altitudes, solar-terrestrial interactions, polar aeronomy, and long-term variations, all of which have close ties with TIMED objectives.

The beginning of the new century will be a time of intense activity for both of these programs. The modes of implementation of the TIMED and CEDAR programs, which feature, respectively, space-borne and ground-based instrumentation, are inherently synergistic. Therefore, NASA and NSF wish to take the best possible advantage of the complementary nature of these two programs through the support of correlative studies on the Energetics and Dynamics of the Mesosphere and Lower Thermosphere (EDMLT), which are solicited in this NASA Research Announcement (NRA).

- Thermosphere Ionosphere Mesosphere Energetic and Dynamics (TIMED) Mission

The main scientific objectives of NASA's TIMED mission are (1) to determine the temperature, density, and wind structure in the Mesosphere, Lower Thermosphere, and Ionosphere (MLTI) region (60-180 km), including the seasonal and latitudinal variations ("basic structure"); and (2) to determine the relative importance of the various radiative, chemical, electro-dynamical, and dynamical sources and sinks of energy for the thermal structure of the MLTI region ("energetics"). TIMED has, however, always been a tightly cost-capped mission, and it has been recognized from the beginning that this mission could only make a first step towards fulfilling these overall goals. Nevertheless, this mission as currently configured should provide the core subset of measurements that define, at least to first order, the basic state of the MLTI, but only the major parameters will be measured. Reduced to the most fundamental level, these parameters are the energy input, the energy output, and the major consequences of this energy exchange, namely temperature, winds, and density/composition. Moreover, only the most important physical component of each of these parameters forms the core measurement subset. Finally, in order to ensure that the evolution in physical processes between low and high altitude is addressed, the core measurement subset provides those observations throughout the entire altitude range from 60 to 180 km.

In order to fulfill its goal of providing complete geographic and seasonal coverage of the MLTI, TIMED is scheduled for a two year prime mission. The satellite will be launched into a 74.4° inclination, 625 km circular orbit, thus allowing repetitive observations at specific local times on a regular basis. The following set of investigations has been selected to carry out the TIMED mission.

TIMED Experimental Investigations

GUVI Global Ultraviolet Imager

- Dr. Andrew Christensen/Aerospace Corporation

-- A spatial scanning UV spectrograph designed to measure the composition and density above ~120 km, and auroral energy inputs.

SABER Sounding of the Atmosphere Using Broadband Emission Radiometry

- Dr. James Russell, III/Hampton University

-- A multi channel radiometer designed to characterize infrared radiation, allowing calculation of cooling rates and determination of composition and temperature profiles in the lower altitude portion of the MLTI.

SEE Solar EUV and XUV Spectral Irradiance Experiment for the TIMED Mission

- Dr. Thomas Woods/University of Colorado

-- A suite of photometers and spectrometer designed to measure the solar X-ray, ultraviolet and far ultraviolet input to the MLTI.

TIDI A TIMED Doppler Interferometer
- Dr. Timothy Killeen/University of Michigan
-- A Fabry-Perot Interferometer designed to measure the wind and temperature profiles.

TIMED Interdisciplinary Scientist Investigations

Models of Chemical Dynamical Radiative Interactions in the Mesosphere and Lower Thermosphere

- Dr. Anne Smith/National Center for Atmospheric Research.

Tides, Planetary Waves, and Eddy forcing of the Mean MLT Circulation

- Dr. Jeffrey Forbes/University of Colorado.

A Theoretical and Observational Study of Large- and Small-scale Dynamics in the Mesosphere and Lower Thermosphere in Support of TIMED

- Dr. David Fritts/North West Research Associates.

Solar and Magnetospheric Inputs to the MLTI Region

- Dr. Janet Kozyra/University of Michigan

Dynamics of the Mesosphere and Lower Thermosphere: Empirical and Theoretical Models

- Dr. Hans Mayr/NASA Goddard Space Flight Center.

Energy Transfer in the Thermosphere and Mesosphere

- Dr. Stanley Solomon/University of Colorado.

The Interdisciplinary Scientists are providing theoretical and modeling support with specific goals of integrating data from multiple TIMED instruments and relating the expected results from the TIMED mission to phenomena and processes in adjacent regions of the Earth's atmosphere.

More detailed information on the TIMED instruments and their measurement capabilities and the research interests of TIMED Interdisciplinary can be found at the Web site <http://www.TIMED.jhuapl.edu>.

• Coupling, Energetics and Dynamics of Atmospheric Regions (CEDAR) Program

The NSF CEDAR program has as its objective to explain how energy is transferred between atmospheric regions by combining a comprehensive measurement program with theoretical and empirical modeling efforts. Initiated in 1987, CEDAR has been guided by a three-phase implementation plan. Phase I entailed a coordinated approach, whereby existing instruments and facilities were used to address topics beyond the scope of single-instrument research. Automation of instruments and upgrades to improve speed and sensitivity were accomplished in Phase II, leading to an expansion of aeronomy research

and broadening of the scientific research scope. Phase III, which has just recently begun, focuses on scientific studies in four areas: coupling with lower altitudes, solar-terrestrial interactions, polar aeronomy, and long-term variations.

CEDAR science depends critically on accurate and reliable observations made by state-of-the-art instrumentation. The CEDAR community has made significant advances in the development of Class I facilities, which consist of optical and radar instrument clusters collectively capable of multi-parameter observations spanning the atmosphere from 60 to 1000 km altitude or more. The most advanced of these clusters are the four incoherent scatter radar sites that are managed by the NSF Upper Atmospheric Facilities (UAF) Program, as follows.

<u>SITE</u>	<u>PRINCIPAL INVESTIGATOR/INSTITUTION</u>
Jicamarca, Peru	Don Farley/Cornell University
Arecibo, Puerto Rico	Paul Goldsmith/Cornell University
Millstone Hill, Massachusetts	John Foster/ Massachusetts Institute of Technology
Sondrestrom, Greenland	Jeff Thayer/ SRI International

In addition to these large facilities, CEDAR science is facilitated by an extensive, globally distributed array of smaller optical and radio wave instruments that provide comprehensive data on atmospheric properties. All data acquired by CEDAR instrumentation are archived in a data base at the National Center for Atmospheric Research (NCAR). Information about CEDAR instrumentation and the data base is available through the CEDAR Web site at <http://cedarweb.hao.ucar.edu/index.html>.

- Research Opportunity

NASA and NSF are jointly soliciting proposals for investigations of the mesosphere and lower thermosphere. The understanding of this region of the atmosphere is a primary focus of both the CEDAR and TIMED programs, and NASA and NSF wish to take the best possible advantage of the complementary nature of the two programs through the support of correlative studies that use the complementary resources available to both programs in addressing their common science goals. To this purpose, portions of the CEDAR and TIMED Mission Operations and Data Analysis budgets have been dedicated to the support of collaborative studies.

Prospective Collaborative Investigators (CI's) will be expected to demonstrate the importance of their proposed efforts to the science goals of both the TIMED and CEDAR programs. Funding for this effort is intended to support scientific studies that may require activities such as the analysis and coordination of data from satellite and ground-based instruments, data collection and assimilation activities, and interaction with the modeling community. Although proposals for the support of single-instrument data sites are not excluded, proposals that provide for the coordination of a number of investigators and data sets in the attack on a common scientific goal are especially desirable. The establishment of new instrumentation is out of scope for this program.

- Data Policy

The TIMED program data policy calls for complete and immediate public access to all of the TIMED mission data. Commensurately prompt public access to CI data is also important for effective collaborative efforts; therefore, the speed and appropriateness of the data distribution plans will be an important element in the evaluation of proposal merit. Therefore, those CI's proposing to provide data in support of CEDAR/TIMED science must consider the following guidelines relating to data access and distribution:

- CI's have the option of hosting a Web site to distribute their data files or delivering the files as soon as possible to the CEDAR database. Proposals should describe plans for implementing one or both of these procedures and indicate the expected time required for data delivery.
- CI data files should be produced in NetCDF format via the Web or delivered to CEDAR in a format compatible with the CEDAR database. Other data formats will be acceptable provided the proposals make a convincing case that the data can be easily accessed by other users.
- CI proposals should identify the type and quantity of data that will be contributed as part of the CEDAR/TIMED collaborative project. Proposals should describe whether the data will be obtained routinely in a standard data-taking mode, or only during selective campaigns or satellite overpasses necessitating advanced planning of operating modes and instrument configurations.
- Data providers will be expected to provide a text description of the contents, version and quality of the data in each type of data file they produce. This description (called a Data Product Specification) will be under configuration control.
- Data providers will send to the TIMED Mission Data Center a notification of the availability of each data file. This Product Availability Notice is a short fixed format text file describing each data file, including the file's URL. This information will be included in the mission data catalog that allows data users to identify and search mission data products.
- CI's will also be expected to provide information about planned and actual data collection activities in the form of text timeline files.
- CI's who also host Web sites containing the data are expected to provide reliable web access to the data for the life of the TIMED mission with minimal site down-time. These CI's will also support the bulk transfer of all data files for final archiving. These transfers will occur one year after launch, at the end of mission operations, and four months before mission close-out. In addition, these sites should provide site access statistics and share a common user registration database.
- All CI's will be expected to participate in pre-launch data system testing in late 1999 and early 2000, which will involve Web distribution of sample data file.

More detailed information about CI interface requirements is available at the TIMED Web site <http://www.timed.jhuapl.edu>.

It is anticipated that a number of prospective CI's may want to make use of data from one or more of the incoherent scatter radar facilities listed above. CI's should not make individual arrangements for facility use or to include prospective facility costs within

their own budgets. In order to ensure that data from these four incoherent scatter radar facilities are available, however, CI's should contact the PI's of these facilities to discuss their data requirements. Facility PI's will not be able to make firm commitments about the availability of the desired measurements but will advise proposers about the plausibility and reasonableness of the requested data. After selection of proposals, each of the facilities will be provided funding to ensure that an appropriate portion of the required measurements can be made. To aid in the allocation of these resources, proposals must address the following questions:

- How much archived facility data will be used? Can these data be taken from the NCAR CEDAR data base or is additional processing required?
- How many new experiments need to be performed? What are the observational restrictions on the times of these experiments? What operating modes are needed?
- How much data processing is required before the data are in a useable format?
- How much support will be needed from facility staff in conducting the experiments and processing the data?

CI's of EDMLT proposals need not team with members of facility staff in order to ensure access to facility data, although facility staff members may be included as scientific collaborators on a proposed project. Facility PI's and staff members will have no preferred access to facility data or usage and, if they choose to propose as a CI or a member of a CI team, they must provide the information indicated above in the same way as other proposers.

2. Programmatic Considerations

• Investigator Eligibility

- TIMED Principal Investigators (PI's) are not eligible to receive funds from the EDMLT program or to serve as PI's or Co-I's on proposals submitted in response to this NRA.
- UAF staff may be PI's on proposals to this NRA.
- UAF PI's may not be PI's on EDMLT proposals but may be Co-Investigators.
- NSF will not consider funding proposals submitted by institutions that are not traditionally supported by NSF. However, such proposals may be submitted for funding by NASA and, therefore, need not include the NSF forms discussed below.
- Investigators working for non-U.S. institutions are not eligible for funding from either NASA or NSF.

- Funding and Budget Considerations

Successful proposals will be funded by either NSF or NASA, at the Agencies' discretion. Proposers may request funding for tasks lasting up to two years. Funding provided for efforts proposed in response to this program element is intended to support activities that take place during the prime TIMED data-taking period, which is expected to be during the years 2000 and 2001. Proposed budgets are expected to take into account the fact that the TIMED program may begin phasing down in FY 2002. However, if TIMED is approved for an extended mission, then an additional EDMLT solicitation for collaborative efforts for the years 2002 and 2003 may be issued.

The total current joint NASA/NSF funding available for support of this effort will be:

	<u>NASA</u>	<u>NSF</u>	<u>Total</u>
FY 2000	\$1.0M	\$0.5M	\$1.5 M
FY 2001	\$1.0M	\$0.5M	\$1.5 M

It is anticipated that there will be a need to set aside a portion of this funding to offset expenses at supporting facilities, and it is expected that on the order of 10 individual investigations will be supportable from the total remaining funds.

- Proposal Evaluations and Review Criteria

Proposals will be evaluated principally for intellectual merit by peer scientists, by mail and at a joint NASA/NSF review panel meeting. Because the EDMLT Program is a joint NASA/NSF effort, the following augmentations and supplements to Section C.1.4 of Appendix C of the parent NRA 99-OSS-01 are necessary. In case of conflict, the material presented here takes precedence.

- (i) Evaluation factors

(1) The evaluation criteria shall be as in Appendix B, Section (i), with the explicit understanding that "NASA's objectives" referred to in Appendix B are the objectives of the EDMLT Program.

(2) Evaluation of intrinsic merit includes consideration of the following factors listed in approximate order of decreasing importance:

- How important is the proposed activity to advancing knowledge and understanding within its own field and across different fields?
- For investigator proposing to provide data, to what extent does the data distribution plan satisfy the guidelines in Section 1 above?
- How well qualified is the proposer (individual or team) to conduct the project?
- To what extent does the proposed activity suggest and explore creative and original concepts?
- How well conceived and organized is the proposed activity?
- Is there sufficient access to resources?

(3) Evaluation of the cost of a proposed effort shall include the realism and reasonableness of the proposed cost, and the comparison of that proposed cost to available funds.

- Additional Guidance for Proposal Preparation and Contents

Since either NASA or NSF may fund any proposal (with the exceptions noted at the beginning of this Section 2), proposers are requested to prepare a single proposal that may be used by either Agency. Therefore, each proposal shall include all forms, starting with the cover pages, as required by both NSF (see the *NSF Grant Proposal Guide*, NSF publication 99-2) and for NASA (see section C.5.3 of Appendix C this NRA 99-OSS-01). Note that the Web site for the submission of the NASA Cover Page will additionally ask for the following information:

- Identification of which TIMED instrument data sets the proposer expects to use;
- Identification of which, if any, UAF facility data sets will be required; and
- A brief description of the types of data to be provided by proposer, including comments on expected data quality and data distribution methods.

- Prior Support

A description of accomplishments achieved under any prior NSF support must be included following the Science Plan.

- Certification Forms. The institutional signatures on both the NASA and NSF Cover Sheet forms certify the compliance of that institution to the required certifications; see NSF 99-2 and Section C.5.3 of NRA 99-OSS-01 for further details.

- Submission Dates and Locations

Notice of Intent due date	April 7, 1999.
Proposal due date:	June 3, 1999.
Number of proposals:	Signed original plus 15 copies

Notices of Intent and NASA Proposal Cover pages should be submitted through the World Wide Web at <http://props.oss.hq.nasa.gov/>. Proposers without access to the WWW or who experience difficulty, may contact Ms. Debra Tripp (e-mail: deb.tripp@hq.nasa.gov) for assistance.

Hard copies of proposals are to be delivered to:

Mesosphere and Lower Thermosphere Studies
Jorge Scientific Corporation
400 Virginia Avenue, SW
Washington DC 20023
Phone number for commercial delivery: (202) 554-2775

- Further Information

Further information about this EDMLT program can be obtained from:

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

Dr. Sunanda Basu
Program Director
Aeronomy
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
E-mail: sbasu@nsf.gov
Telephone: (703) 306-1529

and

Dr. Robert Robinson
Program Director
Upper Atmospheric Facilities
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
E-mail: rmrobins@nsf.gov
Telephone: (703) 306-1531

A.5.1 Education/Public Outreach (E/PO) Program

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 K-14 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 of these documents may be obtained either by selecting *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.

In accord with these established OSS policies, proposers to any OSS 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 research award funded through any previous OSS NRA is encouraged to propose an E/PO supplement to their award (see details in Section 3 below). The following guidelines apply to all proposed E/PO activities:

- An E/PO activity will be funded only in conjunction with an award for a “parent” research proposal;
- The proposed E/PO activity is expected to have a general intellectual linkage to the science objectives of its “parent” proposal and/or the science expertise of its PI;
- The period of performance of the E/PO activity may not exceed that of its “parent” research award;
- Up to \$10K per year may be proposed for an E/PO program, although larger budgets may be considered if funds permit for a few exceptionally meritorious activities, and for “Institutional” E/PO proposals (see Section 3); and
- NASA requests (but does not require) that the institutional overhead for an E/PO budget be waived by the submitting organization, since in many cases such activities will be of direct value to local educational and/or public science institutions and the budget available for this OSS E/PO program is extremely restricted.

E/PO proposals will be funded using funds separate from those for the research grants funded under this NRA, and E/PO funding is considered as an add-on over and above any funding guidelines for research proposals that may be given elsewhere in this NRA. E/PO proposals will be evaluated (see criteria below) by appropriately qualified scientific, education, and outreach personnel, and the substance of these reviews will be

conveyed to the proposers as part of their debriefings. The OSS Selecting Official will take into account proposed E/PO tasks and their review ratings when deciding on final selections and funding levels and as an aid in discriminating between research proposals having otherwise comparable merits.

2. Evaluation Criteria

There are two classes of evaluation criteria against which proposed OSS E/PO activities will be evaluated. The general criteria to be applied to the evaluation of all proposals, which reflect requirements necessary for further consideration of an E/PO proposal, are:

- The quality, scope, and realism of the proposed E/PO program including the adequacy, appropriateness, and realism of the proposed budget;
- The capability and commitment of the proposer and the proposer's team, and the direct involvement of one or more science team members in overseeing and carrying out the proposed E/PO program;
- The establishment or continuation of effective 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; and
- The appropriateness of plans for evaluating the effectiveness and impact of the proposed education/outreach activity.

To ensure that the goals and objectives of the OSS E/PO strategy are realized in practice, proposals will also be evaluated using one or more of the following specific criteria. Because of the modest financial scope of this program, it is recognized that not all proposals can (or even should) address all of these specific factors. Therefore, only the applicable subset will be considered in evaluating each individual proposal. An educationally sound, well-posed and focused effort that will clearly be effective in reaching its intended target audience is preferable to an unrealistically broad effort. These specific criteria are:

- For proposals dealing directly with or strongly affecting the formal education system (e.g., through teacher workshops or student programs carried out at informal education institutions such as science museums and planetariums), the degree to which the proposed E/PO effort is aligned with and linked to nationally recognized and endorsed education reform efforts and/or reform efforts at the state or local levels;
- The degree to which the proposed E/PO effort contributes to the training, involvement, and broad understanding of underserved and/or underutilized groups in science and technology; and/or
- The potential for the proposed E/PO activity to expand its scope by having an impact beyond the direct beneficiaries, reaching relatively large audiences, being suitable for replication or broad dissemination, or drawing on resources beyond those directly requested in the proposal.

Although creativity and innovation are certainly encouraged, note that neither of these sets of criteria focuses on the originality of the proposed effort. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and that the PI and/or appropriate research team members will be actively involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been planned and will be executed; and that the proposed investment of resources will make a significant contribution towards meeting stated plans and objectives. To aid proposers in the preparation of their proposals, as well as to ensure that reviews are carried out on a consistent basis aligned with the OSS Education Strategy and Implementation Plan, an *Explanatory Guide* to E/PO evaluation criteria has been prepared and may be found by linking through *Education and Public Outreach* at the Web site <<http://www.hq.nasa.gov/office/oss/>>.

3. Special Case E/PO Proposals

There are three special cases for the submission of E/PO proposals that may be considered by interested participants in OSS programs:

3.1 Submission of the Same E/PO Proposal to Multiple Program Elements within a Single NRA

OSS recognizes that some proposers may submit research proposals to more than one program element offered in a single NRA, or may submit more than one research proposal to the same program element of a single NRA. In either case, it is permissible to submit the same E/PO proposal with all such research proposals subject to three conditions: (i) that OSS will review such an E/PO proposal only the first time it is submitted; (ii) that this one evaluation will carry through to all further submissions of that E/PO proposal for that one NRA; and (iii) that such an E/PO proposal will be funded only once. The Web page that is used for the submission of the E/PO proposal (see Section 5 below) provides for entering information to indicate to OSS that an E/PO proposal has been submitted in conjunction with another research proposal for a given NRA. Note that in such a case, the E/PO proposal must be resubmitted in the identical form as it was the first time; OSS will not separately evaluate E/PO proposals that have only minor changes between such multiple submissions. Substantially different E/PO proposals will, of course, be considered individually.

3.2 “Institutional” E/PO Proposals

Based on recent experience, OSS recognizes that multiple proposers from the same institution who are responding to the same NRA (or single program element within a multiple program NRA) may wish to submit a common, collaborative “Institutional” E/PO proposal. Such proposals should be of larger scope and would be expected to have a larger impact than that possible under the parentage of a single research proposal.

Therefore, NASA OSS allows the submission of a common Institutional E/PO proposal involving an arbitrary number of proposers from that one institution subject to the following conditions:

- The identical E/PO proposal must be submitted in conjunction with every “parent” research proposal submitted from that institution for a single given program element. The Web page that is used for the submission of the E/PO proposal (see Section 5 below) provides for entering information to indicate to OSS that the E/PO proposal is an Institutional Proposal. It must be clearly marked as an Institutional proposal, identify all the separate research proposals associated with it, identify a team leader for the overall E/PO effort (who may be someone from that institution other than one of the proposing Principal Investigators), and identify all participating personnel.
- Such an Institutional proposal will be reviewed only once by NASA, and a decision whether to fund that proposal (or parts of it--see below) will be made on the basis of that one review.
- The maximum funding that will be allowed for such an Institutional E/PO proposal is \$7.5K per year for each one of the parent research proposals with which the umbrella E/PO effort is associated.
- Because not all the parent research proposals associated with a particular Institutional E/PO effort may be accepted, the Institutional proposal must clearly identify how the different elements of the E/PO proposal are related to each other, discuss the consequences of a partial selection (and concomitant funding limitation), and clearly demonstrate the continued viability (including arrangements for leadership of the overall effort) of the proposed program should a partial selection be offered. The page limit for an Institutional E/PO proposal is expanded to five pages (one extra page from that indicated in Section 5 below) to allow discussion of these issues.

3.3 E/PO Proposal as a Supplement to an Existing, Multiple Year OSS NRA Award

The PI of an existing multiple year award selected through any OSS NRA (including this one) having at least one year remaining in its period of performance may submit an E/PO proposal as a supplement to that parent research award. The period of performance for such a supplemental E/PO activity is limited to the balance of the period of performance of the research award. Such a supplemental E/PO proposal should be prepared as a stand-alone package following the format and content guidelines given in Section 5 and submitted in each of two ways:

- (i) as two hard copies submitted with the Progress Report required for the annual funding allotment needed to continue the parent award; and
- (ii) as an electronic submission to the Web site identified in Section 5 (note: for this option, the Web site will request the information needed to coordinate the E/PO supplement with its parent research award, in particular, the grant or contract number and title of the “parent” award, the names of the NASA science program and Discipline Scientist under which that award was first made; and the anniversary date of the parent award).

Such E/PO supplement proposals will be reviewed using the evaluation criteria described above, and, if accepted, the E/PO funding is restricted to start on the anniversary date of the parent award.

4. Assistance for the Preparation of E/PO Proposals

NASA OSS has established a nation-wide infrastructure of space science education/outreach groups whose purpose is to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. Of particular interest to proposers to this NRA are two elements of this system (which are also described in more detail in the OSS education/outreach implementation plan referred to in Section 1 above):

- Four OSS science theme-oriented E/PO “Forums” to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science missions and research programs, and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
- Five regional E/PO “Broker/Facilitators” 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 suitable for regional and/or national dissemination

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate alliances. Proposers should be careful to note that these Forums and Broker/Facilitators have been established to provide help, but the responsibility for actually developing the E/PO program and writing the proposal is that of the proposer. 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/>>.

5. Preparation and Submission of an E/PO Proposal

In order to be considered for evaluation, E/PO proposals must adhere to the following formats and also must be submitted both electronically and in hard copy as described below.

- An E/PO proposal is to consist of a contiguous body and budget:
 - The body of the E/PO proposal is limited to four pages ($\leq 17,000$ characters, including spaces, using the fonts and page layouts specified elsewhere in this NRA) and must include the following parts: a brief abstract of the proposed activity (not to exceed 800 characters); an expanded description of the E/PO objectives and planned activities; a description of the intended involvement of the Principal Investigator and/or key science team members in the proposed E/PO effort; a description of any educational personnel who are involved in the effort, including proposed partnership institutions (together with specific indicators of commitment on the part of partners where appropriate); a description of how the effort will be managed; and a brief explanation of the requested E/PO budget. Note that the PI or one of the science team members of the parent research proposal must have the prime responsibility for overseeing the implementation of the proposed E/PO activity. The responsible individual should be clearly identified in the body of the E/PO proposal.
 - The period of performance of an E/PO activity may not exceed that of the parent proposal. The E/PO budget must be summarized for its intended total period of performance, as well as for each individual year thereof, using the format entitled *Budget Summary for Optional Education/Public Outreach Proposal* given at the end of this program element (therefore, an E/PO effort proposed for a three year period of performance will require four budget sheets). In addition, this E/PO budget must be integrated line-for-line into the *Budget Summary* for the entire parent research proposal discussed in Section C.5 and given in Section C.6 of Appendix C of this NRA.
- An E/PO proposal (both body and budget) must be submitted by each of two separate ways:
 - As an electronic submission (for the evaluation process) by uploading it, including its *Budget Summary* sheets, to the secure Web site <<http://cass.jsc.nasa.gov/panel/>>, which provides instructions for this activity using a wide variety of formats. In accordance with the size limits specified above, the peer evaluations will consider only the first 800 characters submitted for the E/PO abstract and 17,000 characters for its body. Proposers without Web access or who experience difficulty in using this site may request assistance from the Lunar and Planetary Institute by E-mail at <panel@lpi.jsc.nasa.gov> or by phone at (281) 486-2137; and

- As part of the total hard-copy version of the research proposal (see the ordered list of component parts for proposals elsewhere in this NRA); also note that the *Cover Page* for the research proposal must indicate that an E/PO proposal is included by checking the appropriate notification on the form provided on the Web site for its submission.

6. Reporting Activities for Approved E/PO Proposals

In order to assist OSS in obtaining a coherent picture of the entire portfolio of E/PO efforts supported across all OSS programs, the appropriate OSS Education Forum (see Section 4 above) will contact proposers whose NRA E/PO components are selected to obtain summary information concerning the nature of and intended audience for their selected E/PO effort. In addition, a brief E/PO progress report will be required in conjunction with the annual progress report required for the continuation of the parent research award. A more complete report will also be required at the completion of the E/PO activity. The Education Forums will supply a simple template for preparation of such reports.

7. Additional Information

Questions about this E/PO program may be directed to:

Dr. David Bohlin
Code SR
Office of Space Science
National Aeronautics and Space Administration
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. 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. This program, which selects proposals yearly, provides awards of up to \$40K to foster the development of innovative approaches to space science education and outreach by space scientists and their educator partners. The annual solicitation for the IDEAS program is typically released in July with proposals due in October. The annual request for proposals is posted at <<http://opposite.stsci.edu/pubinfo/edugroup/ideas.html>>. Inquiries may be addressed by E-mail to <IDEAS@stsci.edu> or by postal mail to:

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

BUDGET SUMMARY

for

OPTIONAL EDUCATION/PUBLIC OUTREACH PROPOSAL

(Note: To be integrated with that for the "parent" Research Proposal)

For (check one):

___ **Total Period of Performance from (M/D/Y)** _____ **to** _____
/or/
___ **Year** ___ **of** ___ **from (M/D/Y)** _____ **to** _____

1. Direct Labor (salaries, wages, and fringe benefits) _____
2. Other Direct Costs:
 - a. Subcontracts _____
 - b. Consultants _____
 - c. Equipment _____
 - d. Supplies _____
 - e. Travel _____
 - f. Other _____
3. Facilities and Administrative Costs _____
4. Other Applicable Costs: _____
5. SUBTOTAL--Estimated Costs _____
6. Less Proposed Cost Sharing (if any) _____
7. Carryover Funds (if any)
 - a. Anticipated amount : _____
 - b. Amount used to reduce budget _____
8. Total E/PO Estimated Costs _____

A.5.2 Applied Information Systems Research Program

1. Scope of Program

The Applied Information Systems Research (AISR) program conducts information systems research to apply new developments in computer science and information technology to improve and enhance ongoing support for OSS science programs. The specific goals of the AISR program are to:

- Increase the scientific return on research within all OSS science themes by making advanced tools and capabilities available for the acquisition and utilization of science data and information;
- Exploit advances in computer science and information technology for the benefit of space science; 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 to apply state-of-the-art computer science and information technology to improve the understanding and effectiveness of OSS scientific research endeavors. The period of performance for solicited proposals may be from one to three years. Note that the AISR program now includes investigations previously supported under the Astrophysics Data Program Type 2 opportunity for applied research for tools for data analysis and/or data management, as well as data restoration efforts supported separately within a number of space science research discipline programs. Background information on the AISRP and abstracts for current investigations being conducted can be found on the World Wide Web at <http://www.hq.nasa.gov/office/oss/computer/aisr/aisr.html>.

2. Areas of Interest

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

- Science data analysis and visualization;
- Simulations, computational methods, and modeling in support of extracting science from NASA data sets;
- Science mining and exploration, including software technology, adaptive techniques, data compression, etc.
- Science planning and operations, including innovative concepts and ideas beyond current methods and processes for spacecraft/science operations;;
- Science data management, storage, and distribution; and
- Science data product generation for the benefit of a broader community of scientists.

Proposers are encouraged to propose original, innovative applications of information technology that will be more broadly applicable across multiple science disciplines and/or projects. Proposals that foster and facilitate interdisciplinary research, including tools that link multiple data sets and software to bring to bear on a science problem or problems will be given priority consideration.

3. Guidelines for Proposals

Proposals are expected to present a clear and concise description of:

- Specific objectives for the investigation, products to be developed, and work plan for accomplishing the proposed tasks; and
- Compelling justification for the endeavor and how it extends the forefront of capabilities, and its relevance and importance for space science research.

Note that the AISR program is intended to provide tools needed to conduct the space science research disciplines and not for that research itself. So there is not an emphasis on a project having a particular science goal, but the proposal should clearly demonstrate how it supports the needs of science community. Prospective submitters should also be aware that considerable tools and capabilities have been provided by previously selected participants in this program, as well as through other sources. Proposals should demonstrate how the proposed effort clearly extends the frontiers of capabilities in a fundamental and important manner rather than repeating or maintaining current capabilities. If a proposal is itself based on a previously funded effort, the proposal should identify that work, clearly summarize significant results from it, and demonstrate how the current effort is unique and/or extends the capability.

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://ssds.nasa.gov/>>.

4. Programmatic Information

Total funding for the existing AISRP is nominally \$4M per year. Of the nearly 50 investigations currently funded, approximately 40% will expire in FY 1999.

NOTE: Appendix C contains critical information necessary for the preparation and submission of proposals submitted in response to this NRA. In particular, Section C.5.3 contains detailed standards concerning the format, page limits, and contents of a proposal. The submission of a proposal not in compliance with these standards may complicate and/or hinder its efficient and complete evaluation. Therefore, deficiencies in format and/or omission of key information may result in a proposal being found unacceptable for evaluation, or if evaluated, being adversely affected during the evaluation process.

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) 486-2136 for assistance. Hard copies of the proposals are to be delivered to:

ROSS-99 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:

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

This Program Element was offered in the ROSS-98 NRA as a one-time only opportunity. It is not repeated for this current ROSS-99 NRA.