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National Aeronautics and
Space Administration

Research Announcement

Research Opportunities
in
Space Life Sciences

Biomedical Research and Countermeasures

A Research Announcement for the
Life Sciences Division

Letters of Intent Due:
Proposals Due:

October 15, 1999
December 1, 1999

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NASA Research Announcement

Research Opportunities in Space Life Sciences

Biomedical Research and Countermeasures

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals for new research in Biomedical Research and Countermeasures (BR&C). This Announcement solicits research proposals that support the opening of the space frontier by exploring, using, and enabling the development of space, and by expanding human experience in space. The research supported by the Life Sciences Division will increase knowledge of nature's processes using the space environment, aid in the exploration of the Solar System, support the achievement of routine space travel, and enrich life on Earth through the use of space technology and the application of biomedical knowledge. This research supports NASA's mission and the Human Exploration and Development of Space (HEDS) Strategic Plan. The HEDS Enterprise also seeks to "share HEDS knowledge, technologies, and assets that promise to enhance the quality of life on Earth."

The Life Sciences Division programs represent an opportunity for NASA to enhance and broaden the public knowledge, understanding, and appreciation of biological and biomedical research, and the value of this research in the space environment. Individuals participating in NASA's Life Sciences Division programs have a responsibility to foster the development of a scientifically informed public. Therefore, all participants in this NRA are strongly encouraged to promote general scientific literacy and public understanding of life sciences, the space environment, and the Space Life Sciences programs through formal and informal education opportunities. Where appropriate, supported investigators will be required to produce, in collaboration with NASA, a plan for communicating their work to the public.

The Life Sciences Division supports innovative, competitive, and multidisciplinary ground-based scientific research and technology development; flight experiments using space platforms such as the Space Shuttle and the early phase of the International Space Station (ISS) will also be supported. Ground-based research leading to the development of mature experiments for flight are particularly encouraged. Proposals for flight experiments are very competitive and should be based on solid ground-based research findings. In the BR&C Program, proposals for research leading to better medical care of crews and reducing health risks will be favored.

Proposers are encouraged to review the research already funded by these programs by looking at the descriptions of the program tasks at:

http://peer1.idi.usra.edu/peer_review/taskbook/taskbook.html

Proposals for research already being funded in the program will be of lower priority.

Details relevant to the Program are included in the attached appendices and the associated document, *Space Life Sciences Flight Experiments Information Package* available at:

http://peer1.idi.usra.edu/peer_review/nra/99_heds_03_feip.html

- Appendix A provides a detailed description of the research areas solicited by this Announcement.

- Appendix B contains detailed instructions for this specific NRA and includes the relevant application forms.
- Appendix C contains general instructions applicable to the preparation of proposals in response to NASA Research Announcements.
- The *Space Life Sciences Flight Experiments Information Package* describes the evaluation process for space flight experiments, and the capabilities of the flight research facilities that may be available to investigators.
- The *Space Life Sciences Ground Facilities Information Package* describes the capabilities of ground-based facilities available to investigators, and procedures for their use.

Proposals submitted in response to this Announcement must address the research emphases defined in this Announcement. Those that do not will be returned to the proposer. Other Announcements calling for focused research or utilization of unique resources may be issued throughout the year. Unsolicited proposals received at other times during the year will be held until the next annual review period if the proposed research is relevant to the programs described in this Announcement. However, NASA reserves the right to act in the best interest of the federal government in the matter of proposal acceptance and evaluation.

Ground-based proposals will be funded in one-year increments for activities lasting up to three years. The funding duration will be dependent on proposal requirements, review panel recommendations, and continuing progress of the activity. Flight experiment activities will also be funded in one-year increments, the duration of these activities will be dependent upon the availability of flight opportunities, but will typically last at least three years. Flight experiments are reviewed biannually for scientific currentness, technical progress, and implementation feasibility. All proposals will be evaluated for overall scientific and technical merit by independent peer-review panels. Relevance to NASA's programmatic needs and goals, and the feasibility of flight proposals will be evaluated separately by NASA. The government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made, and the receipt of proposals that the government determines are acceptable for award under this NRA. It is anticipated that a typical award will average \$150,000 (total annual costs). The total annual cost for ground research may not exceed \$350,000. NASA does not provide separate funding for direct and indirect costs; thus, the amount of the award requested is the total of all costs submitted in the proposed budget.

Participation in this Announcement is open to all categories of organizations, industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Under certain circumstances, NASA will review proposals from non-U.S. institutions, **but will not** fund non-U.S. institutions (see Appendix A, Section VI Announcement for details).

A letter of intent to propose is requested by October 15, 1999 (see Instructions, Appendix B of this Announcement). Letters of intent should be submitted via the World Wide Web (www) at:

http://peer1.idi.usra.edu/expro/loi/99_HEDS_03_loi.cfn

If you do not have access to the www, you may submit a letter of intent via email to:

loi@hq.nasa.gov

The subject heading of the e-mail message should read "Letter of Intent-NRA 99-HEDS-03." If you do not have access to e-mail, you may submit a letter of intent by U.S. Postal Service or commercial delivery to the address listed below for proposal submission.

Proposals may not be submitted electronically. Proposals must be received by December 1, 1999 by 4:30 PM Eastern Time. Proposals and letters of intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

Information Dynamics, Inc.
SUBJECT: NASA Life Sciences Research Proposal
300 D Street, SW
Suite 801
Washington, DC 20024

Proposals and letters of intent that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 AM and 4:30 PM. The telephone number, 202-479-2609, may be used when required for reference by delivery services. Information Dynamics, Inc. (IDI) cannot receive deliveries on Saturdays, Sundays, or federal holidays. Upon receiving a proposal, IDI will send a postcard to the proposer confirming its arrival.

In order to be accepted as a complete submission, proposals **must include** completed copies of the appropriate forms described in Appendix B. Form C is only required for flight experiment proposals. Special instructions apply to proposals by institutions which are not entities of the United States (see Appendix A, Section VI of this Announcement).

The following items apply only to this Announcement:

Solicitation Announcement Identifier:	NRA 99-HEDS-03
Number of Copies Required:	Original + 25 copies
Letters of Intent Due:	October 15, 1999
Proposals Due:	December 1, 1999
Selection Announcement:	May 2000
Funding Begins:	June 2000
Selecting Official:	Director Life Sciences Division Office of Life and Microgravity Sciences and Applications

Additional information is available from the appropriate Science Program or Element Coordinator, as indicated below, at the following address:

[name of coordinator]
 UL/Life Sciences Division
 NASA Headquarters
 Washington, DC 20546-0001
 Telephone: (202) 358-2530
 Fax: (202) 358-4168

Program or Element	Coordinator	E-Mail
Biomedical Research and Countermeasures	David L. Tomko, Ph.D.	dtomko@hq.nasa.gov
Environmental Health	Bette Siegel, Ph.D.	bsiegel@hq.nasa.gov
Behavior and Performance	David L. Tomko, Ph.D.	dtomko@hq.nasa.gov
Space Radiation Health	David L. Tomko, Ph.D.	dtomko@hq.nasa.gov
Clinical Research in Support of Space Missions	Victor Schneider, M.D.	vschneider@hq.nasa.gov
Flight Experiments	Peter R. Ahlf	peter.ahlf@hq.nasa.gov

This Announcement will be updated and issued annually and is the primary means of obtaining research proposals from the BR&C life sciences community. This Announcement is restricted to the programs named above and described in detail in Appendix A. Potential proposers should read with care the program descriptions that are of interest, and focus their proposals on the specific research emphases defined in this Announcement.

Your interest and cooperation in participating in this effort is appreciated.

Original Signed by

Arnauld E. Nicogossian, M.D.
 Associate Administrator for
 Life and Microgravity Sciences and Applications

Biomedical Research and Countermeasures

I. Introduction

The major goals of NASA's Life Sciences Division, located within the Office of Life and Microgravity Sciences and Applications, are to:

- Effectively use gravity and microgravity and the other characteristics of the space environment to enhance our understanding of fundamental biological processes.
- Develop the scientific and technological foundations for a safe and productive human presence in space for extended periods and in preparation for exploration.
- Apply this knowledge and technology to improve our nation's competitiveness, education, and quality of life on Earth.

To accomplish these goals, the Life Sciences Division supports activities in three distinct but related programs: Gravitational Biology and Ecology (GB&E), Biomedical Research and Countermeasures (BR&C), and Advanced Human Support Technology (AHST). This Announcement is concerned with the BR&C Program. This program contains several elements which range from environmental, and psychosocial sciences to applied gravitational research related to the development of countermeasures that mitigate the detrimental effects of space flight on humans, protect humans from the harsh environment of space, and enable safe, efficient, and productive use of space laboratories (see Figure 1). In addition, the Division supports the utilization of specialized NASA ground-based facilities and the development of special technologies required in the pursuit of its research goals. Proposers can access NASA specialized ground-based facilities for their research. Please refer to the *Space Life Sciences Ground Facilities Information Package* for instructions on how to incorporate the use of these facilities into a proposal.

This Appendix defines the research program elements encompassed by this Announcement, describes the specific areas of ground-based and flight research that proposals should address, and describes the specific emphases that are acceptable for submission in response to this Announcement. It is important that the prospective investigator read the relevant section(s) carefully, as many of the programmatic emphases are different from those appearing in previous Division Announcements. In addition, this Appendix includes guidelines for preparing and submitting proposals, and defines the administrative policies governing the program and proposers.

Figure 1: Relationship of the Biomedical Research and Countermeasures Program to the NASA/HEDS Strategic Plan

must be downloaded separately from

http://peer1.idi.usra.edu/peer_review/nra/99_HEDS_03.html

II. Biomedical Research and Countermeasures Program Emphases

Program Description

The BR&C Program directly supports NASA's missions in the Human Exploration and Development of Space (HEDS) Enterprise (see Figure 1). It also responds directly to the requirements established by the Medical Policy Board, which deal with the safety of human space travel (see *Medical Policies and Requirements Document*, Bibliographic Reference #7 of this Appendix).

The goals of this program are to:

- develop an understanding of the physiological mechanisms that are responsible for space flight-related biomedical and behavioral changes in humans in support of countermeasure development;
- develop countermeasures that allow humans to live and work in microgravity for long durations, minimize the risks in readapting to gravity, and optimize crew safety, well-being, and performance;
- identify, characterize, and mitigate (preventing and reducing) health, environmental, and other operational human medical risks associated with space exploration.

NASA is committed to maintaining a strong, openly competitive, peer reviewed program. Opportunities for investigators include individual investigator awards, center awards, various interagency activities, and participation in focussed discipline team research. Investigators are encouraged to apply through whichever of these mechanisms they deem to be most suitable to enable them to conduct research in support of NASA's Biomedical Research and Countermeasures Program. As noted in Section IV of this appendix, programmatic balance is maintained by the selecting official for the program, the Director of the Life Sciences Division at NASA Headquarters. Additional research funds are awarded through peer-reviewed research solicited under other venues (for example, that of the National Space Biomedical Research Institute (NSBRI)).

In the development of procedures and devices that can mitigate the deleterious effects on humans engaged in space flight, a scale of countermeasure readiness has been developed. The Countermeasure Readiness Level (CRL) describes the level of scientific maturity of applied research from the development of an hypothesis to validated procedure ready for operational implementation (Figure 2). This scale is a metric that is used in the development of a procedure for use in space where there is significant scientific research necessary to develop the required knowledge base. By utilizing this metric it is possible to describe the current program content and to determine and direct progress toward providing countermeasure deliverables. These readiness scaling categories and processes also provide a framework by which the NASA activities can be described and implemented.

**Figure 2: Countermeasure Readiness Levels
must be downloaded separately from**

http://peer1.idi.usra.edu/peer_review/nra/99_HEDS_03.html

This NASA Research Announcement focuses on the lower CRL categories that will continue to add the fundamental and basic knowledge necessary as the basis and foundation of applied solutions that are addressed by the higher level CRL levels. As the NSBRI is focused on providing the actual countermeasures with high CRL levels, their research emphases will focus on activities in these areas. However, as they will be implementing their program within a structured Critical Path Research and Technology plan, there will possibly be requirements for research within a lower CRL category when that is required to move forward in a particular countermeasure area.

The Human Space Life Sciences Programs Office at the Johnson Space Center is responsible for the evaluation and validation of countermeasures (items 7 and 8 on the CRL Figure 2). Proposals for countermeasure evaluation and validation should not be submitted to this Announcement. A separate announcement will be issued at a later date for this purpose.

The ability of NASA to provide applied solutions to physiological problems in human space flight has and will continue to be a major function of the Biomedical Research and Countermeasures Program. The addition of the focused mission of the NSBRI provides a new and essential element to ensure that the transfer of knowledge to operational solutions can and will occur. Those investigators desiring to propose against this Announcement should be aware of the approach the Biomedical Research and Countermeasures Program uses and should develop their proposals accordingly.

Types of Proposals

NASA is soliciting two types of proposals: 1) Ground-based research and 2) Flight experiments.

1. Proposals For Ground-Based Research

Research proposals should explore physiological and molecular mechanisms of space flight-related changes in order to: 1) facilitate the development of integrative countermeasures to prevent or minimize undesirable responses to microgravity, or 2) enhance recovery and physiological re-adaptation following space flight. Proposals for multidisciplinary integrated approaches studying responses of several physiological systems to simulate the various effects of spaceflight using appropriate animal or human subjects are especially encouraged.

2. Proposals For Flight Experiments

Flight experiment opportunities during the assembly phase of ISS (pre-2004) will be extremely limited.

A full spectrum of non-human biological specimens will be available for biomedical research on ISS only after assembly is complete (2004). Prior to assembly completion, research using a limited number of biological specimens will be possible on ISS. Additional opportunities for short-duration experiments may arise on some Space Shuttle flights. While proposals in any of the research areas described above are appropriate, they must comply with the operational and hardware constraints and requirements associated with the current space flight program. Proposers of flight experiments need to consult the *Space Life Sciences Flight Experiments Information Package* for this information. Also, please see Section III of this Appendix, Flight Opportunities and Constraints, for additional information.

Elements and Emphases for FY 2000

The emphasis of the current ground-based component of this program is to develop insights into physiologic changes that are likely to occur as a consequence of extended periods of flight. The BR&C Program supports basic and applied research. Researchers may use hypogravity simulation models (e.g., bed rest, tail suspension, etc.) or hypergravity produced by centrifugation. Experiments may use human subjects or animal models. The program is composed of five research elements, each focused on the development and ultimate use of countermeasures to the effects of space flight: 1) Physiology, 2) Behavior and Performance, 3) Environmental Health, 4) Clinical Research in Support of Space Missions , and 5) Radiation Health.

Mechanistic research is solicited that supports the development of Biomedical Countermeasures to the effects of space flight. A countermeasure is any means or procedural strategy that prevents, reduces, eliminates, or ameliorates negative effects of space flight on astronauts. It should be noted that the astronaut corps is diverse, comprising men and women 30-60 years of age and of various ethnic backgrounds. Countermeasures must be robust enough to be efficacious across this population, and be tailored for individual specificity. **This program encourages integrated approaches that study interactions that occur between different physiological systems in the design and application of potential countermeasures. Defining the effects of experimental interventions on non-target systems is deemed to be of particular importance.** Research is also sought to support the solution of operational and clinical problems. This section describes the elements and research emphases within the BR&C Program for FY 2000. High priority in FY 2000 will be given in particular to proposals for research in the areas of Behavior and Performance, Rehabilitation, and Nutrition. For the next three years, low priority will be given to flight research proposals that require complex, experiment-unique equipment or have intensive resource requirements (crew time, power, up-mass, etc.). However, research requesting only pre- and post-flight experiments will be entertained.

1. Physiology

Proposals are requested for experiments to evaluate the effects of stressors (e.g., workload, isolation, sleep loss, etc.) on physiological function. Studies that use integrated approaches are particularly encouraged.

2. Behavior And Performance

The Behavior and Performance element of the program addresses issues of 1) Perception and Cognition, 2) Human Physical Performance, 3) Personal, Interpersonal, and Group Dynamics (coping, response to stress, etc.), 4) Habitability, and 5) Sleep and Circadian Rhythms. Physiological studies should be directed toward understanding the effects of responses to space flight (such as immune changes, stress, etc.) on behavior and performance measures.

This element supports experiments designed to understand the mechanisms by which microgravity, confinement, cumulative sleep loss, mission design and events, spacecraft environment, and noise and light affect the behavior and performance of crews and dependent support. It also addresses psychosocial, gender, and cross-cultural aspects of human missions in space. Studies of relationships between individuals and individuals in groups are also addressed. Existing databases and ground simulations in extreme and isolated analogs and test beds may be used to extrapolate to responses that might be expected in long-duration space flight. Behavior and performance research priorities for ground-based studies include:

a. Psychological Research

Research is solicited on: the development of predictive tools for the assessment of psychological well-being, and the development of procedures or tools to support psychological well-being; cognitive processing, mood and emotion, especially as those are affected by multicultural and gender variables in long-duration space missions; development of tools and procedures to enhance the formation of healthy cultures in small groups on space missions; and the sense of presence and after-effects in virtual environments.

b. Psychiatric Issues

Research is required to detect and treat behavioral disorders that might occur in locations remote from usual health care facilities, e.g., during long-duration space flight.

For a broad, detailed listing of NASA Life Sciences Behavior and Performance research priorities, please reference the Countermeasures Task Force Report on Behavior and Performance online (http://peer1.idi.usra.edu/peer_review/prog/prog.html).

3. Environmental Health Research

Research within the Environmental Health element includes three interrelated disciplines, each dealing with a specific aspect of the spacecraft environment – Barophysiology, Microbiology, and Toxicology. The Environmental Health element has established the following goals: (1) to understand the effects of the spacecraft environments on humans and other organisms; (2) to develop standards and countermeasures, where necessary, to optimize crew health, safety, and productivity.

For FY 2000, proposals are particularly sought for ground studies to determine the effects of potential toxins found on the ISS on human health. Since the work and living environment of the space flight crew is one and the same, the individual may be exposed to these potential toxins for extended times as compared to limited work hours here on Earth. Additionally, proposed studies that 1) evaluate the added risk of several potential toxins with space radiation or 2) develop small and power efficient real time-monitoring devices of known space craft toxins would be encouraged.

Although very limited crew time and logistical support will be available for research studies during construction of the ISS, well-designed, focused flight proposals that could evaluate the potential health hazards of air or water contaminants found on the ISS are encouraged.

4. Clinical Research in Support of Space Missions (Medicine in Extreme Environments)

The Clinical Research in Support of Space Missions element of the program will focus on the development of medical knowledge and technologies required to maintain human health and performance in space and on return to earth. Medical knowledge must be expanded so that the practice of Space Medicine in the microgravity environment is evidence based. Medical and Surgical techniques, procedures, and systems are required to diagnose and treat illnesses and injuries that may occur in space and to provide for post flight rehabilitation. The Clinical Research in Support of Space Missions element of the program will support research required to improve, or answer specific questions about in-flight diagnosis, therapy, and post-flight rehabilitation. Emphasis will be placed on space flight research in view of the fact that few ground-based simulations are relevant.

a. Diagnosis

Space flight research is required to complete the understanding of the pathophysiology, diagnosis and therapeutic modalities required for implementation of the evidenced-based practice of Space Medicine. The development of non-invasive diagnostic tests as well as autonomous and semi-autonomous patient monitoring systems with low false positive alarm rates, is required.

Ground based research is required to develop critical diagnostic systems. High priority will be given to the development of noninvasive imaging systems that may be used to image bone, internal organs, and soft tissues.

Ground based research is also required to develop medical information systems that support the onboard medical provider.

b. Therapy

High priority will be given to proposals that investigate, in the space environment, mechanisms and changes that occur during space flight or immediately post flight in the therapeutic effectiveness of representative classes of medications. Proposals addressing the adverse drug interactions under these two operational conditions are also solicited. The research should be relevant to the astronaut population of men and women between 30 and 60 years of age. Space flight research is sought to address the therapeutic effectiveness of antibiotics given to fight infections which may occur in space flight.

Proposals are sought for ground-based research to enhance the “shelf-life” and effectiveness of pharmaceuticals, intravenous fluids, and blood replacement substances which are stored for extended periods of time.

Proposals are sought for ground-based research to enhance surgical capabilities in space. High priority will be given to proposals that investigate the application of fiber optic based and minimally invasive surgical techniques.

Proposals are sought in the field of medical education principally focused on the development and maintenance of medical capabilities for both physicians and non-physician crew medical officers. Priority will be given to those proposals, which address new training paradigms such as virtual reality. The proposals should take into account the necessity of integration with Medical Informatics systems.

Proposals that address the development of space flight treatment capabilities for acute medical and surgical emergencies will be given a priority, including, but not limited to:

- Wounds, Lacerations, and Burns
- Toxic exposures
- Decompression illness
- Dental, Ophthalmologic, Urologic, Gastrointestinal, and Gynecologic emergencies

c. Rehabilitation

Proposals are sought for ground-based research and development of effective rehabilitation techniques for space travelers, all of whom are deconditioned when they return to Earth. Priority will be given to proposals addressing deconditioning events associated with long duration space flight.

d. Pharmaceuticals and Blood Replacement Solutions

Proposals are sought for ground-based research to enhance the “shelf-life” and effectiveness of pharmaceuticals, intravenous fluids, and blood replacement substances which are stored for extended periods of time and would be required for clinical care of patients in extreme environments, i.e. low-weight, low-volume materials which would be used for common acute and chronic medical problems.

5. Radiation Health

The Radiation Health element of the program supports research in the areas of 1) Radiation Physics, 2) Shielding Materials, 3) Genetic Biological Predisposition, and 4) Bioengineering and Radiation Protection. For FY 2000, the primary area of emphasis for the Space Radiation Health element is the *reduction of radiation risk* based on development of mechanistic insights into the biological effects of radiation. Purely phenomenological approaches, e.g., testing of pharmacological substances with presumed radioprotective effects, are not acceptable. Instead, proposals are required to be hypothesis-driven and are expected to obtain their data in ground-based experimental radiobiology studies with proton and high-energy heavy ion beams in the energy range corresponding to space radiation¹.

Scientists working in rapidly developing areas of life sciences not necessarily associated with the study of radiation are particularly encouraged to consider the contributions that their field of study can make to Radiation Health, and to propose investigations relevant to the Space Radiation Health element.² Proposals are required to provide evidence for expertise in radiation, either by reference to the Principal Investigator's work or by the inclusion of active collaborators expert in radiation research. Hypotheses should be substantiated by presentation of preliminary data wherever feasible, at least by adequate references to the published literature. Experimental proposals should include a clear discussion of the relevant aspects of the required radiation dosimetry and an estimate of the statistical power of the expected results. The significance of the work for eventual risk reduction should be clearly explained in every proposal.

Proposals will be considered for studies:

- leading to significant advances in our understanding of genetic mechanisms of radiation damage and repair in cells and tissues, especially those aspects that are complementary to research in genomic instability currently jointly funded with the National Cancer

¹ NASA has signed agreements with Loma Linda University Medical Center related to the use of proton beams and with Brookhaven National Laboratory for the use of heavy ion beams at the Alternating Gradient Synchrotron (further details are provided in Section 5.0 of *Space Life Sciences Ground Facilities Information Package 1999*). **NASA negotiates beam delivery directly with these institutions, and investigators proposing to use these irradiation facilities should not include the cost of beam time in their budgets. However, investigators should include the cost of carrying out the experiments at the beam site, including travel.** Investigators are not required to use these facilities, however if exposures at other facilities are needed for proposed studies, proposers must obtain them at no cost to NASA. If exposures not available at Loma Linda or Brookhaven are needed for studies proposed in response to this NRA, proposers must indicate in their application how such exposures will be accomplished, provide evidence that the sources will be available for their use, and indicate how the dosimetry and other physical characteristics of the radiation fields will be measured.

² A detailed programmatic description, including brief tutorial appendices on relevant aspects of space radiation, is included in the NASA Strategic Program Plan for Space Radiation Research, available on the internet at:

http://www.hq.nasa.gov/office/olmsa/lifesci/Strategic_Plan.pdf

Institute. Proposals addressing genetic sensitivity to space radiation and genetic intervention to alter such sensitivity are particularly encouraged.

- leading to significant advances in our understanding of cancer risk, consequences of CNS damage, and acute and early damage due to solar particle events.
- based on basic mechanisms of molecular biology that are likely to result in development of biological countermeasures in humans that could lead to prevention or intervention (including genetic or pharmacological agents) against effects of radiation damage in space.
- linking biological mechanisms to significant improvements in accuracy of prediction of radiation risk for humans in space (especially carcinogenesis).

Experimental studies not directly using protons or heavy ions in the relevant energy range or not directly relevant to the interpretation of experiments already conducted with such radiation will not be funded. Research that can lead to future space flight investigations will be welcome. Such research should take into account the impact of gender, age, nutrition, stress, genetic predisposition, or sensitivity to other factors of importance in managing space radiation risks.

Ground-based proposals in other areas than enumerated above in the "Elements and Emphases for FY 2000" section but covered in the BR&C Program will be considered, however, selection for funding will be at a lower priority regardless of scientific merit score.

III. Flight Experiment Opportunities and Constraints

Two types of flight experiments are currently solicited: (1) pre-mission and post-mission studies involving data collection and analysis on crewmembers and other biological specimens prior to, and on return from space, and (2) on-orbit experiments that can be implemented on the space platforms of the Space Shuttle or the ISS. Individuals proposing flight experiments should refer to the *Space Life Sciences Flight Experiments Information Package*. This document describes the critical issues of import to *everyone* interested in proposing a flight experiment including unique aspects of the evaluation and selection process and detailed information regarding operational constraints and capabilities for flight experiments on the Space Shuttle and ISS.

All flight experiments must address one or more of the research programs and emphases defined in Section II above. Flight investigations must represent mature studies strongly anchored in previous ground-based research or previous flight research (see Section II of this Appendix). Ground-based research may, and usually must, represent one component of a flight experiment proposal. However, that research should be limited to activities that are essential to the final development of an experiment for flight and for the completion and publication of the scientific results of the experiment. Preparatory ground research designed to define a mature space flight experiment should be proposed separately and in its own right as part of the ground-based program. For this year only, due to limited flight opportunities in the near future, flight experiments using rodents are not being solicited. However, ground research proposals that include the development of a specific protocol for a future flight experiment are encouraged.

Opportunities for flight experiments continue to be extremely limited at this time. For the next five years, a majority of the capacity of the Space Shuttle fleet is dedicated to assembly and operation of the ISS. Therefore, opportunities for Shuttle-based experiments are limited. It

will be possible to conduct experiments onboard the ISS. However, ISS experiments will be severely constrained by limitations on resources such as mass, volume, power, re-supply of consumables, and crew time. Priority for initial use of some research hardware on the ISS will be for validation testing of the hardware operation and capabilities. Access to the crew for pre-mission and post-mission studies will be limited, particularly for the ISS crewmembers. Detailed limitations on Space Shuttle and ISS flight experiments are included in the *Space Life Sciences Flight Experiments Information Package*. Proposals requiring resources beyond the capabilities defined in this document should not be submitted in response to this Announcement.

Flight experiments selected as a result of this Announcement will enter a definition phase. The experiment will not be considered for an actual flight prior to successful completion of this phase. Selection of a flight experiment through this Announcement does not represent a guarantee for flight.

IV. Proposal Evaluation and Awards Selection Process

The following information is specific to this NRA and **supercedes** the information contained in Sections I and J of Appendix C, *Instructions for Responding to NASA Research Announcements*.

All proposals must comply with the general requirements of the Announcement. Upon receipt, proposals will be reviewed for compliance with the requirements of this Announcement. This includes:

1. Submission of complete proposals specified in this Announcement (see Instructions, Appendix B). Proposals must be responsive to the areas of program element emphasis described in this Announcement and include a project description that is not more than 20 pages in length (see Instructions, Appendix B).
2. Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects.(see Instructions, Appendix B).
3. Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not exceeding three years in duration.
4. Proposals that are revised versions of proposals previously submitted to NASA must be clearly marked as such and must contain an explanation of how the revised proposal has addressed criticisms from previous NASA review (see Instructions, Appendix B).
5. Submission of all other appropriate forms as required by this NASA Research Announcement (refer to Checklist for Proposers, Form H, Appendix B).

Note: At NASA's discretion, non-compliant proposals may be withdrawn from the review process and returned to the proposer without further review.

Compliant proposals submitted in response to this Announcement will undergo an intrinsic scientific or technical merit review. Proposals receiving a passing score in this review will then undergo additional review(s) as follows:

- Flight feasibility review (flight experiments only)
- Evaluation of NASA programmatic relevance and cost

A. Intrinsic Scientific or Technical Merit Review

The **first review tier** will be a merit review by a panel of scientific or technical experts. The number and diversity of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphases described in Section II of this Appendix. The merit review panel will assign *a score from 0-100* or a score of “not recommended for further consideration” based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel.

The score assigned by this panel *will not be affected by the cost of the proposed work nor will it reflect the programmatic relevance of the proposed work to NASA*. However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal’s budget and relevance to NASA.

The following will be used in determining the merit score:

- **Significance:** Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field? Is there a probable application to health on Earth?
- **Approach:** Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics?
- **Innovation:** Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?
- **Investigator:** Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the investigator’s productivity satisfactory?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?

B. Flight Feasibility Review

A **second review**, applicable only to flight experiment proposals, will be an evaluation of the flight feasibility of the proposed work on a space platform. This review is described in the *Space Life Sciences Flight Experiments Information Package*.

C. Evaluation of Programmatic Relevance and Cost

The **third review** will evaluate the programmatic relevance and cost of all proposed work. This review will be conducted by NASA program scientists and managers. Evaluation of the cost of a proposed effort includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds. Programmatic relevance will include an evaluation of how the proposed work may help achieve an appropriate balance of scientific and technical tasks required by critical research issues faced by the BR&C Program.

D. Development of Selection Recommendation

The information resulting from these three levels of review, as described above, will in turn be used to prepare a **selection recommendation** developed by NASA program scientists and managers for each of the program elements described in this Announcement. This recommendation will be based on:

1. The scientific or technical merit review score from the peer review panel.
2. The results of the flight feasibility review (if applicable).
3. The programmatic relevance and cost of each proposal.

This **selection recommendation** is the responsibility of the NASA program scientist. Selection for funding will be made by the Director of the Life Sciences Division.

V. Eligibility

All categories of institutions are eligible to submit proposals in response to this NRA. Principal Investigators may collaborate with universities, Federal Government laboratories, the private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior support by NASA of research or training in any institution or for any investigator is not a prerequisite to submission of a proposal or a competing factor in the selection process.

All categories of institutions are eligible to submit proposals in response to this NRA, but only approved proposals from U.S. institutions will be selected for funding.

VI. Foreign Proposals

Only ground-based proposals from U.S. entities, or from non-U.S. entities which include significant participation of U.S. entities, submitted in response to this NRA will be reviewed. Flight experiment proposals may be from US or international entities according to the following rules. This solicitation is coordinated with solicitations from the European Space Agency (ESA), and the space agencies of Canada (Canadian Space Agency, CSA), France (Centre National d'Études Spatiales, CNES), Germany (Deutsche Zentrum für Luft- und Raumfahrt, DLR), and Japan (National Space Development Agency of Japan, NASDA). Flight experiment proposals from entities of the member countries of ESA, Canada, and Japan must be submitted to their respective space agency, including those with U.S. researchers and co-investigators. Proposals for flight experiments from entities of countries **other than** the U.S. member countries of ESA, Canada or Japan will not be reviewed unless they involve substantive co-investigator collaboration from one of the above mentioned countries. U.S. co-investigators who are collaborating on such proposals must ensure that their scientific role is clearly delineated in the proposal, that their expertise is shown to make a substantial contribution, and that their funding requirements are included in the proposal. The solicitation, review, and selection process for flight experiments proposed through this coordinated effort is described in the *Space Life Sciences Flight Experiments Information Package*.

VII. Program Reporting

It is expected that results from funded research will be submitted to peer-reviewed journals as the work progresses. Only published papers that acknowledge NASA's support and identify the grant or contract will be counted as resulting from the research project and used to evaluate its productivity.

Annual Reporting Investigators will be expected to provide NASA with annual summary information. This information will consist primarily of:

- an abstract
- a bibliographic list
- copies of publications
- a statement of progress
- potential technological, economic or societal impacts

This information will be made available to the scientific community and will be used to assess the strength of the Division's programs. It will also serve as the basis for determining the degree of progress of the project.

Annual Task Book Reporting The NASA Life Sciences Division publishes a comprehensive annual document titled Life Sciences Program Tasks and Bibliography (or Life Sciences Task Book) which includes descriptions of all peer-reviewed activities funded by the division during the previous fiscal year. Since its inception in fiscal year 1995, the Task Book has served as an invaluable source of information for NASA Life Sciences as well as the scientific and technical communities.

Investigators are required to provide information for this publication on an annual basis. Please note that this requirement is in addition to the annual report which investigators are required to submit at the end of each funding cycle. Supplying the requested information for the Life Sciences Task Book does NOT fulfill the requirement for the annual report. Unlike the annual report, information requested for the Task Book must be for the government's fiscal year rather than the project funding cycle and brief.

The information requested for inclusion in the Task Book consists primarily of:

- an abstract
- a brief statement of progress during the fiscal year
- a brief statement of benefits of the research with respect to life on Earth
- a bibliographic list for the fiscal year
- a copy or reprint of each publication listed in the bibliography for the fiscal year

Note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting in journals and elsewhere.

Final Report A final report is required which shall include all peer-reviewed publications.

Flight Experiment Reports Investigators selected to carry out space flight experiments are expected to provide NASA with three reports:

1. A “quick-look” report of preliminary flight results that is due one month after the space flight takes place.
2. A final report containing all data and information on the flight study is due approximately one year after all required data/materials are provided by NASA to the investigator. At this time, all of the data must also be provided to NASA for placement in the Life Sciences Data Archive; data in this archive will be made available to the scientific and technical community.
3. Specific examples of how the results of their research have potential applications in the private or commercial sectors or which could be promulgated by application and have significant contributions to “quality of life” are required to be submitted to NASA with the final report, approximately one year after all required data/materials are provided by NASA to the investigator.

VIII. Bibliography

1. **Life Sciences Program Tasks and Bibliography (Task Books)** for FY 1995 through FY 1998 are available on-line at the following World Wide Web address:
http://peer1.idi.usra.edu/peer_review/taskbook/taskbook.html
2. **Space Life Sciences Flight Experiments Information Package**, this document is available on-line at the following World Wide Web address:
http://peer1.idi.usra.edu/peer_review/nra/99_heds_03_feip.html
3. **Space Life Sciences Ground Facilities Information Package**, this document is available on-line at the following World Wide Web address:
http://peer1.idi.usra.edu/peer_review/nra/99_heds_03_gfip.html
4. **SPACELINE**, an on-line bibliographic database, is available for searching for references to publications about space life sciences research. A cooperative venture between NASA's Life Sciences Division and the National Library of Medicine (NLM), SPACELINE is similar in structure to NLM's MEDLINE database. Individuals can perform their own searches with the new web-based interface. Additional information may be obtained from the SPACELINE Office. Phone: 301-295-2482;
email: **SPACELINE@usuhs.mil**
Web address 1: **<http://spaceline.usuhs.mil>**
Web address 2: **<http://igm.nlm.nih.gov>** (MEDLINE)
5. **The Space Life Sciences Data Archive (LSDA)** is an on-line database containing descriptions and results of completed NASA-sponsored flight experiments. Descriptions are included of experiments, missions, procedures, hardware, biospecimens collected, personnel, and documents. Biospecimens that are available for research purposes are described in detail. A limited number of experiments contain final reports and spreadsheet data suitable for downloading. Data from human subjects are unavailable online for reasons of privacy.

Internet access: **<http://lsda.jsc.nasa.gov>**
LSDA Help Desk: (281)483-7876
Email: lsda@semail.jsc.nasa.gov
6. **Center for Advanced Studies in the Space Life Sciences** contains a list of workshops and seminars sponsored by the Center. The proceedings and final reports of these workshops are also posted as they become available. Web address:
<http://www.mbl.edu/html/NASA/>

7. **Medical Policies and Requirements Document.** National Aeronautics and Space Administration, Medical Policy Board. Arnauld Nicogossian, Chairperson. NASA Headquarters. This document is currently in revision. Please contact Dr. Richard Williams (202-358-4410) for more information.
8. **A Strategy for Research in Space Biology and Medicine in the New Century.** National Academy of Science. National Research Council Committee on Space Biology and Medicine. Mary J. Osborn, Committee Chairperson. 1998. Washington D.C.: National Academy Press. Web address: <http://www.nas.edu/ssb/csbm1.html>
9. **NASA Strategic Program Plan for Space Radiation Research**, available on the internet at: http://www.hq.nasa.gov/office/olmsa/lifesci/Strategic_Plan.pdf
10. **The NASA Strategic Program Plan for Space Radiation Research**, available on the internet at: http://www.hq.nasa.gov/office/olmsa/lifesci/Strategic_Plan.pdf
11. **Space Physiology and Medicine, 3rd ed.** A. Nicogossian, C. Huntoon, and S. Pool. (Eds.). 1994. Philadelphia, PA: Lea & Febiger.
12. **Cell & Molecular Biology Research in Space.** *The FASEB Journal*, Vol. 13, Supplement, 1999.
13. **Guidance on Radiation Received in Space Activities.** July 31, 1989. NCRP Report 98. Bethesda, MD: National Council on Radiation Protection and Measurements.
14. **Workshop on Space Flight Validation of Radiation Risk.** January 24-26, 1996. Universities Space Research Association, 3600 Bay Area Boulevard, Houston, TX 77058
15. **Shielding Strategies for Human Space Exploration.** J. W. Wilson, J. Miller, A. Konradi and F. A. Cucinotta, Editors. NASA CP-3360, December 1997, pp. 456. Also available from the NASA Langley Technical Reports Server at: <http://techreports.larc.nasa.gov/ltrs/ltrs.html>
16. **Acceptability of Risk From Radiation - Application to Human Space Flight.** April 30, 1997. Symposium Proceedings No. 3. Bethesda, MD: National Council on Radiation Protection and Measurements.
17. **Modeling Human Risk: Cell & Molecular Biology in Context.** June, 1997. Ernest Orlando Lawrence Berkeley National Laboratory Report LBNL-40278. Berkeley, CA
18. **Radiation Hazards to Crews of Interplanetary Missions: Biological Issues and Research Strategies.** 1996. Washington, DC. Task Group on the Biological Effects of Space Radiation. Space Studies Board Commission on Physical Sciences, Mathematics and Applications, National Research Council. National Academy Press.
19. **Task Force on Countermeasures.** This report incorporates the output of the Countermeasures Task Force, the Vestibular Countermeasures Task Group, and the Behavior and Performance Working Group into a unified document. Available at: http://peer1.idi.usra.edu/peer_review/prog/countermeasures/countermeasures.html or (202) 358-4180.

20. **International Workshop on Cardiovascular Research in Space.** *Medicine and Science in Sports and Exercise*, Volume 28, Number 10 Supplement, 1996.
21. **Muscle Research in Space: International Workshop.** *International Journal of Sports Medicine*, Volume 18, Supplement 4, S257-S331, 1997.
22. **Space Neuroscience Research.** *Brain Research Reviews*, Volume 28, Numbers 1/2, Special Issue, 1998.
23. **International Workshop on bone Research in Space.** *Bone, Official Journal of the International Bone and Mineral Society*, Volume 22, Number 5 (Supplement), 1999.

**Obtaining cited papers:*

Many of the documents may be ordered through your library or through the National Technical Information Service (NTIS). Documents available through NTIS are accompanied by their NTIS order number and price. To order a document through NTIS, call 1-800-553-6847. If you are unable to locate a document through this means, please contact Information Dynamics, Inc. at (202) 358-4180.

APPENDIX B
NRA 99-HEDS-03

**Instructions for Letter of Intent and Proposal Preparation
and Submission, including
Required Application Forms**

This section contains the general instructions for letters of intent and proposal preparation and submission, including the specific forms required for proposal submission in response to agency solicitations in Space Life Sciences in 1999. This section is specific to this NRA and supercedes the information contained in Appendix C. The forms at the end of this section include the following:

Form A	Solicited Proposal Application
Form B	Proposal Abstract
Form C	Space Flight Experiment Requirements Summary (required for Flight Experiments only)
Form D	Biographical Sketch
Form E	Other Support
Form F	Detailed Budget, First Year
Form G	Detailed Budget, Entire Project Period
Form H	Checklist for Proposers

Instructions for Letter of Intent Submission

To facilitate proposal processing, potential Principal Investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a letter of intent to propose. As stated previously (see Research Announcement, Pages 2 and 3) the letter of intent, which is not binding, should be submitted electronically by October 15, 1999. If you do not have access to electronic submission, you may submit an letter of intent by U.S. Postal Service or commercial delivery in the same manner as proposals.

As detailed on the electronic letter of intent submission form, the letter of intent should contain:

- A descriptive title of the research or technical proposal
- The names, addresses, and telephone numbers of a single Principal Investigator and all Co-Investigators
- The major participating institutions
- A brief summary describing the proposed research and clearly indicating the program element(s) defined in this Announcement that is/are most relevant to the proposal
- The proposal type: ground-based versus flight research
- Up to six (6) key words that best describe the research area of the pending proposal

Instructions for Proposal Preparation

An original signed proposal, plus twenty-five (25) complete copies of that proposal and one 3.5-inch computer disk, **must be received by December 1, 1999**. Proposals are to be mailed to the address indicated, and in the manner described, in the Research Announcement on Page 3 of this document.

All proposals must include each of the forms provided in this Appendix as part of the complete submission, with the exception of Form C, which is submitted only with flight experiments, and Forms F and G, which are not required for some non-U.S. proposals (see the form-specific instructions included in this Appendix). The name of the Principal Investigator should appear in the upper right hand corner of each page of the proposal, except on the forms in this Appendix where special places are provided for this information. Note that the proposal must specify the period of performance for the work described; periods of performance may be for any duration up to three (3) years but should be suitable for the project proposed.

The proposal must include the following material, in this order:

- (1) Cover Page: Solicited Proposal Application (Form A), including certification of compliance with U.S. code (if applicable)*
- (2) Proposal Abstract (Form B)
- (3) Proposal Title Page, with Notice on Restriction on Use and Disclosure of Proposal Information, if any
- (4) Project Description (20 page maximum length; the project description should be complete and able to stand alone; if longer than 20 pages, the proposal will not be reviewed)
- (5) Space Flight Experiment Requirements Summary (to be submitted with flight experiments only) (Form C)
- (6) Management Approach
- (7) Letter of Assurance of Foreign Support (to be submitted with proposals by non-U.S. entities)
- (8) Biographical Sketch (Form D)
- (9) Other Support (Form E)
- (10) Facilities and Equipment
- (11) Special Matters (specific information on animal or human subjects protocol approval required, if applicable)*
- (12) Detailed Budget, 12 Month (Form F)
- (13) Detailed Budget, Entire Project Period (Form G)
- (14) Supporting Budgetary Information
- (15) Checklist for Proposers (Form H)
- (16) Appendices, if any (reviewers are not required to consider information presented in appendices).

- (17) Computer diskette (3.5 inch, Macintosh or PC format) containing an electronic copy of the principal investigator's name, address, telephone and fax numbers, e-mail address, and the complete project title and abstract as provided on Form B

* One signed original required

(1) Cover Page: Solicited Proposal Application (Form A)

All of the information requested on Form A must be provided, and one original signature version of this form should be submitted. This form meets the requirements of the transmittal memo described in Appendix C, Section C (1).

For Item (7) on this form, new means that a proposal for this project has not been submitted to NASA from 1996 to 1998, renewal means that this proposal is for the continuation of a currently funded task beyond the term of the funded proposal, and revised means that this proposal represents a revision of a proposal submitted to NASA and reviewed from 1996 to 1998, but not funded. A proposal previously submitted but not funded should be termed revised even if the original Principal Investigator has changed for 1999. Renewal and revised applications should contain special material described in the Project Description section below.

(2) Proposal Abstract (Form B)

The information requested on this form is essential to the review of the proposal. It determines how the application will be evaluated and which program manager(s) will receive the final review materials for possible inclusion in one of the research programs of the Life Sciences Division.

(3) Proposal Title Page

The title page should contain the project title, name and address of the submitting institution, the name, address, and telephone number of the Principal Investigator, and the names and institutions of any co-investigators. It is NASA policy to use information contained in proposals for evaluation purposes only. While this policy does not require that the proposal bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the Title Page of the proposal and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals will be protected to the extent permitted by law, however NASA assumes no liability for use and disclosure of information not made subject to the notice.

NOTICE

Restriction on Use and Disclosure of Proposal Information

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

(4) Project Description

The length of the Project Description section of the proposal should not exceed 20 pages using regular (12 point) type. If longer than 20 pages, the proposal will not be reviewed. The proposal should contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with the resources requested and with their own resources. In addition, the proposal should clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement. The project description should be consistent with the type of proposal that is being submitted (ground-based research investigation or space flight experiment).

Renewal applications (for competing renewal of currently funded activity). Results of the associated NASA supported research must be presented as part of the project description

Revised applications (revisions of 1996, 1997, or 1998 submissions) must include, appropriate notation in the project description. Applicants must highlight the changes they have made in their research plan by appropriate bracketing, indenting, or changing of typography. Clearly present any work done since the prior version was submitted. Note that revised applications that do not address the criticisms in the previous critique will be considered unresponsive and will be returned without review.

(5) Space Flight Experiment Requirements Summary (if applicable, Form C)

All applicants proposing space flight research must complete Form C. The information on this form is essential for the flight feasibility review of the proposed study. Before filling out this form, applicants must read the *Space Life Sciences Flight Experiments Information Package* carefully and make certain that they understand the constraints associated with flight experiments. Keep in mind that the primary audience for this form are the international technical experts whose expertise may not include your specific area of research.

(6) Management Approach

Each proposal must specify a single Principal Investigator who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. In proposals that designate several senior professionals as key participants in the research project, the management approach section should define the roles and responsibilities of each participant, and note the proportion of each individual's time to be devoted to the proposed research activity. The proposal must clearly and unambiguously state whether these key personnel have reviewed the proposal and endorsed their participation.

(7) Letter of Assurance of Foreign Support

Proposals from non-U.S. entities that meet the criteria specified in Appendix A, Section VI must include a written endorsement from the respective agency or funding/sponsoring institution. In addition to sending the application to the designated address, one copy of the proposal, along with the letter of endorsement from the sponsoring non-U.S. government agency or funding sponsoring institution must be forwarded to:

National Aeronautics and Space Administration
Code I
Office of External Relations
(NRA number)
Washington, DC 20546-0001
USA

(8) Biographical Sketch (Form D)

The Principal Investigator is responsible for direct supervision of the work and must participate in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the Principal Investigator that includes his or her current position title and educational background, a list of principal publications, and a description of any exceptional qualifications must be included. Use Form D to describe the research and professional experience of each professional staff member. Concluding with present position, list, in chronological order, previous employment, experience, and honors. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications. Do not exceed two pages. Omit social security numbers and other personal items which do not merit consideration in evaluation of the proposal. Provide similar biographical information on other senior professional personnel who will be directly associated with the project. Provide the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(9) Other Support (Form E)

Use the format described in Form E to list other sources of research support (including active NASA support) for the proposed Principal Investigator and each of the proposed Co-Investigators. Please list all active support as well as any pending support.

(10) Facilities and Equipment

Describe the available facilities and major items of equipment specially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use on the project. Provide evidence that such facilities or equipment will be made available if the applicant is successful in obtaining funding. Before requesting a major item of capital equipment, the proposer should determine if the sharing or loan of equipment already within the organization is a feasible alternative to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that can be typically used for research and non-research purposes should be explained. If proposals depend on availability of NASA or non-NASA technologies, facilities, data, or simulation capabilities, it is **required** that investigators demonstrate within the proposal that such availability and access has been assured by the responsible NASA personnel or appropriate non-NASA sources.

(11) Special Matters

The Special Matters section must contain a statement from the proposer's institution which states that the proposed work will meet all Federal and local human subject requirements and animal care and use requirements, if applicable. Note that no animal subjects may be utilized unless specific

information justifying and describing their use is included in the proposal. Policies regarding the protection of human research subjects in NASA-sponsored research are detailed in NASA Management Instruction (NMI) 7100.8B (Protection of Human Research Subjects), and animal care and use requirements are detailed in the NASA Code of Federal Regulations (CFR) 1232 (Care and Use of Animals in the Conduct of NASA Activities), both of which are available from the Life Sciences Division, Code UL, NASA Headquarters, Washington, DC 20546. Assurance of compliance with human subject or animal care provisions is required on Form A, to be submitted with each proposal. In addition, a letter signed by the chairperson of the Institutional Review Board (IRB) or Institutional Animal Care and Use Committee (IACUC), or both, as appropriate, regarding approval of the experimental protocol, should be included with each copy of the proposal. If IRB or IACUC review is unavoidably delayed beyond the submission of the application, enter "Pending" on Line 9b or 10a of Form A, and be advised that the certification must be received within 60 days after the due date for which the application is submitted. If certification is not received within 60 days after the application due date, the application will be considered incomplete, and will not be reviewed. NASA shall require current IRB or IACUC certification prior to each year's award. All U.S., non-NASA proposals providing IACUC approval must also contain the institution's Public Health Assurance number.

**(12) Detailed Budget, 12 Month (Form F) and
(13) Detailed Budget, Entire Project Period (Form G)**

These forms must be submitted with each U.S. proposal, or with non-U.S. proposals that have a U.S. component for which NASA funding is sought. NASA intramural Principal Investigator's research budgets for all years are to be submitted in a full-cost mode in accordance with the NASA CFO, Enterprise Office and Center full-cost budget policy. Funds to support the Resident Research Assistant (RRA) Postdoctoral Program costs (e.g., stipend, travel, computer time, supplies, etc.) are to be budgeted within the NASA intramural Principle Investigator budget.

If travel is planned, the proposal must include travel funds for 1) an annual Principal Investigator meeting, 2) visits to NASA field centers (as appropriate), and 3) presentation of findings at professional society meetings. Foreign proposals from entities who are not members of ESA member countries, Canada, or Japan which have no U.S. component should not submit these forms.

(14) Supporting Budgetary Information

This section must include information which supports the costs submitted in Forms F and G. In this solicitation, the terms "cost" and "budget" are used synonymously. Sufficient proposal cost detail and supporting information are required; funding amounts proposed with no explanation (e.g., Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award. Generally, costs will be evaluated as to realism, reasonableness, allowability, and allocation. The budgetary forms define the desired detail, but each category should be explained in this section. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following examples indicate the suggested method of preparing a cost breakdown:

Direct Labor

Labor costs should be segregated by titles or disciplines with estimated hours and rates for each. Estimates should include a basis of estimate, such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means including comparison to similar skills at other organizations.

Other Direct Costs

Please detail, explain, and substantiate other significant cost categories as described below:

- Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
- Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.
- Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
- Other: Enter the total of direct costs not covered by a) through e). Attach an itemized list explaining the need for each item and the basis for the estimate.

Indirect Costs

Indirect costs should be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates should be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts.

All awards made as a result of this NRA are to be funded as grants and will not be negotiated as contracts. Therefore, while proposals submitted by "for profit" organizations are allowed, they cannot include a "fee."

(15) Checklist for Proposers (Form H)

One copy of a completed version of this checklist should be attached to Form A of the original proposal.

(16) Appendices, if Any

Appendices may be included, but proposers should be aware that reviewers are not required to consider information presented in appendices.

(17) Computer Diskette

A diskette (3.5 inch, Macintosh or PC format) should contain an electronic copy of the Principal Investigator's name, address, telephone and fax numbers, e-mail address, and the complete project title and abstract as provided on Form B.

**The Required Application Forms
must be downloaded separately from**

http://peer1.idi.usra.edu/peer_review/nra/99_HEDS_03.html

**APPENDIX C
NRA 99-HEDS-03**

**INSTRUCTIONS FOR RESPONDING TO
NASA RESEARCH ANNOUNCEMENTS**

(JANUARY 1997)

A. General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

B. NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

C. Proposal Content. The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater

detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) *Transmittal Letter or Prefatory Material.*

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) *Restriction on Use and Disclosure of Proposal Information.* Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

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

(3) *Abstract.* Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) *Project Description.*

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) *Management Approach.* For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) *Personnel.* The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) *Facilities and Equipment.*

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) *Proposed Costs.*

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations). NASA does not provide separate funding for direct and indirect costs; thus, the amount of the award requested is the total of all costs submitted in the proposed budget.

(9) *Security.* Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) *Current Support.* For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) *Special Matters.*

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

D. Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

E. Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

F. Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

G. Late Proposals. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

H. Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

I. Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

J. Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

K. Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

L. Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.