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December 27, 1996
NRA 96-HEDS-04

**National Aeronautics and
Space Administration**

Research Announcement

Research Opportunities in Space Life Sciences

Gravitational Biology and Biomedical Research and Countermeasures Programs

1996

**A Research Announcement for the
Life Sciences Division**

Letters of Intent Due: February 28, 1997
Proposals Due: April 1, 1997

OMB Approval No. 2700-0042

**NASA Research Announcement
Soliciting Proposals
for
Research Opportunities
in
Space Life Sciences**

**Gravitational Biology and Biomedical Research
and Countermeasures Programs**

NRA 96-HEDS-04

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Life Sciences Division

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

**NASA Research Announcement
Soliciting Proposals for
Research Opportunities
in
Space Life Sciences
Gravitational Biology and
Biomedical Research and Countermeasures
Programs**

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NASA Research Announcement

Research Opportunities in Space Life Sciences

Gravitational Biology and Biomedical Research and Countermeasures Programs

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals to participate in research opportunities in two of the three major programs in Space Life Sciences. 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. In consonance with NASA's fundamental mission and the Human Exploration and Development of Space (HEDS) Strategic Plan, research supported by the Life Sciences Division will increase knowledge of nature's processes using the space environment, aid in the exploration and settlement 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.

The major means that the Life Sciences Division will employ in supporting these goals are scientific research and technology development using space platforms, such as the Space Shuttle and the International Space Station, and ground facilities. The specific programs that are included in this Announcement are Gravitational Biology and Biomedical Research and Countermeasures. Proposals submitted in response to this Announcement may be for ground-based research investigations or for limited types of space flight experiments designed for the Shuttle middeck or for the earliest phase of utilization of the International Space Station. Proposals may be for activities lasting up to three years and beginning in FY 1998. Proposals to conduct ground-based research leading to developing mature experiments for flight are particularly encouraged.

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

Participation in this Announcement is open to all individuals and all categories of domestic and foreign organizations, industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Proposals that will enhance or complement the scientific return from research currently being supported by the National Institutes of Health, the National Science Foundation, or other government agencies are encouraged. In addition, proposals to advance relevant technology and develop practical applications of NASA-developed technology are also sought under this Announcement.

Because of the severe limitations of access to flight research opportunities, the vast majority of proposals approved in response to this Announcement will be primarily for ground-based research. Proposals for flight experiments are very competitive and should be based on solid ground-based research findings. A letter of intent to propose is requested by February 28, 1997. Proposals may be submitted at any time up to April 1, 1997.

Proposals will be evaluated for overall scientific or technical value and cost by an independent peer-review panel. Relevance to NASA's programmatic needs and goals and the feasibility of implementation will be evaluated separately by NASA. A selection announcement will be made between October and November of 1997, pending budget availability. Funding of selected proposals will begin sometime between October 1997 and September 1998.

Further details relevant to these programs are included in the attached appendices and the associated companion document. Appendix A provides relevant technical information applicable only to this Announcement. Appendix B contains basic guidance needed for the preparation of solicited proposals in response to this Announcement. Appendix C contains detailed instructions and the required application forms. The document titled *Space Life Sciences Standard Companion Document 1996* describes the evaluation process to be used, special ground facilities available for use by proposers, the experiment accommodations provided in the middeck of the Shuttle and on the International Space Station during the earliest utilization phase, and the space flight equipment that may be available to support these opportunities.

The following items apply only to this Announcement.

Solicitation Announcement Identifier:	NRA 96-HEDS-04
Number of Copies Requested:	Original + 20 copies
Letters of Intent Due:	February 28, 1997

Proposals Due: April 1, 1997

Selecting Official: Director
Life Sciences Division
Office of Life and Microgravity
Sciences and Applications

Obtain Additional Information From: the appropriate Science Program or Element Coordinator, as indicated in the table below, at the following address: UL/Life Sciences Division
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-2530
Fax: (202) 358-4168

Program or Element	Program or Element Coordinator
Gravitational Biology	Tom K. Scott, Ph.D.
Biomedical Research and Countermeasures	Victor S. Schneider, M.D. or Mary Anne Frey, Ph.D.
Environmental Health	Victor S. Schneider, M.D.
Space Radiation Health	Walter Schimmerling, Ph.D.
Behavior and Performance	Victor S. Schneider, M.D.
Advanced Technology Development	Bette Siegel, Ph.D.
Flight Experiments	Peter R. Ahlf

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

Special instructions apply to foreign (non-U.S.) proposals. In addition to sending the original (signed) proposal and twenty (20) copies to NASA through Information Dynamics, Inc., as directed above, **one (1) additional copy along with the Letter of Endorsement from the sponsoring agency or organization must** be forwarded to:

Ms. M. Ruth Rosario
IH/Space Flight Division
Ref: NRA 96-HEDS-04
NASA Headquarters
Washington, DC 20546-0001
USA

Proposals and Letters of Intent hand delivered or sent by commercial delivery or courier services are to be delivered to the above addresses between the hours of 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.

Letters of Intent (only) may also be submitted electronically via e-mail to the following address:

loi@hq.nasa.gov

Following receipt of a proposal by IDI, a postcard will be sent to the proposer confirming receipt of the proposal and notifying the proposer of any missing information that is required prior to review.

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 awards averaging \$125,000 (total costs) each annually will be made, although the total annual cost may vary from \$15,000 to \$350,000. Your interest and cooperation in participating in this effort are appreciated.

Original Signed by

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

**GRAVITATIONAL BIOLOGY AND
BIOMEDICAL RESEARCH AND COUNTERMEASURES
PROGRAMS**

I. Introduction

The Life Sciences Division of the National Aeronautics and Space Administration (NASA) seeks proposals for research that support the various scientific programs of the Division in support of the Human Exploration and Development of Space (HEDS) Enterprise. This Announcement (NRA 96-HEDS-04) is the primary solicitation used to obtain scientific proposals in two of the three major Life Sciences Division Programs: (1) Gravitational Biology and (2) Biomedical Research and Countermeasures. A companion Announcement, "*Research Opportunities in Space Life Sciences: Advanced Human Support Technologies Program*" (NRA 96-HEDS-05), summarizes the Life Sciences Division's technology development program. Together, these announcements are the two-part solicitation used to obtain scientific and technical proposals to be funded during Fiscal Year 1998, either for new research or for the continuation of research beyond the term specified in a previously funded proposal.

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. Proposals outside of the research emphases specifically defined in this Announcement will, in most cases, be rejected or returned to the proposer. However, NASA reserves the right to act in the best interests of the federal government in the matter of proposal acceptance and evaluation.

This Appendix describes the types of proposals that are acceptable for submission in response to this Announcement, defines the research programs of the Division that are included in this Announcement, and describes the current specific areas of ground-based and flight research that proposals should address. In addition, this Appendix includes guidelines for preparing and submitting proposals and defines the administrative policies governing the program and grantees.

The goal of the Human Exploration and Development of Space (HEDS) Enterprise is to “enrich life on Earth through people living and working in space.” Individuals participating in NASA’s Space Life Sciences Division programs are encouraged to help foster the development of a scientifically informed and aware public. The Space Life Sciences Division programs represent an opportunity for NASA to enhance and broaden public knowledge, understanding, and appreciation of life sciences research and of the value of research in the space environment. 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/or 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.

II. Proposal Types

Proposals should address one or both of the following:

1. Ground-Based Research Investigation

It is expected that the majority of proposals submitted in response to this solicitation will fall into the category of standard research proposals, i.e., proposals to carry out a scientific study in an Earth laboratory and having a clearly defined hypothesis and set of research objectives relevant to NASA’s mission. All proposals must be consistent with the program elements, research areas, and emphases defined in this Announcement to be considered for funding. In addition, all proposals must be consistent with the goals of NASA’s Human Exploration and Development of Space (HEDS) Enterprise. Proposals to conduct ground-based research aimed at developing mature flight experiments designed for later phases of the International Space Station utilization (from 2001 onward) are particularly encouraged. Some proposals may require special NASA Earth-based facilities for their completion (see the *Space Life Sciences Standard Companion Document 1996* for a description of special NASA facilities). Proposers should contact pertinent NASA centers to arrange for access to the facilities prior to submitting their proposal.

Finally, as part of their research plan, investigators may propose to analyze data from the Data Archive or tissues from organisms that have flown in space. These tissues, not required by the primary space flight investigations, will be provided through the Division’s Biospecimen Sharing Program (see Section IV of this Appendix).

2. Space Flight Experiment

Flight experiments will be accommodated on whichever carrier is best suited to the execution of each experiment. Three types of experiments are currently solicited: (1) short-duration experiments that can be implemented primarily on the Space Shuttle middeck without the use of major mission resources, (2) long-duration experiments that can be implemented with the limited resources available on the International Space Station (ISS) during the early assembly (construction) phase (1999-2001), and (3) “pre- and post-mission” studies involving testing of the astronaut crew prior to and on return from their space mission.

Space studies proposed for the Shuttle or the ISS are severely constrained by limitations on resources such as weight, power and crew time and by the availability of flight hardware (Section 3, Standard Companion Document). Proposals requiring resources beyond the capabilities defined in this Announcement and the Standard Companion Document should not be submitted in response to this Announcement.

Though it is recognized that flight proposals may, and often must, include ground-based research, flight investigations must represent mature studies strongly anchored in previous ground-based research and/or previous flight research (see Section IV of this Appendix).

Regardless of proposal type, every proposal should focus on at least one of the two scientific research programs defined in the next section, and should be relevant to the goals of the Human Exploration and Development of Space Strategic Plan cited in Section VIII (Bibliography) of this Appendix. A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research programs but, if this is the case, that fact should be stated clearly at the beginning of the proposal. Proposals should include a well-defined research plan that can be accomplished within three years or fewer.

NASA has a strong commitment to the ethical treatment of human and animal research subjects, and assurance of compliance with federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix C of this Announcement). **Potential applicants should note that review of a proposal will not be undertaken if the required information is not supplied.**

III. Research Programs and Emphases

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, 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 the quality of life on Earth.

To accomplish these goals, the Life Sciences Division supports activities in three distinct but related Programs: Gravitational Biology, Biomedical Research and Countermeasures, and Advanced Human Support Technologies (see NASA Research Announcement *Research Opportunities in Space Life Sciences: Advanced Human Support Technologies Program 1996* (NRA 96-HEDS-05) for solicitation information within the AHST Program). The Gravitational Biology and Biomedical Research and Countermeasures Programs contain several elements (see Figures 1 and 2) and extend from gravitational basic research in the biological, environmental, and psychosocial sciences to applied 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. In addition, the Division supports the utilization of the facilities and development of special technologies required in the pursuit of its research goals. This Announcement is concerned with two of the major Programs: (1) Gravitational Biology and (2) Biomedical Research and Countermeasures.

In the remainder of this section, the research programs and elements encompassed by this Announcement are defined, their research foci are delineated, and the specific emphases solicited for the 1998 fiscal year (October 1997 - September 1998) are specified. **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.**

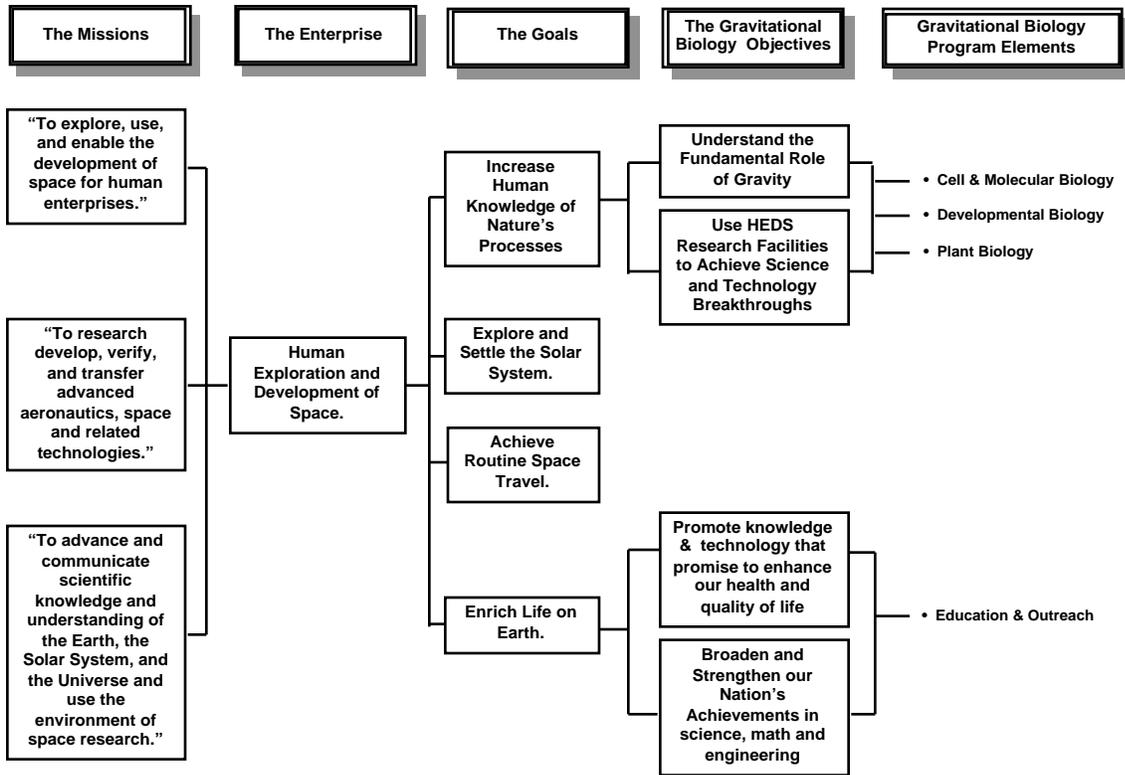


Figure 1. Relationship of the Gravitational Biology Program to the NASA/HEDS Strategic Plan

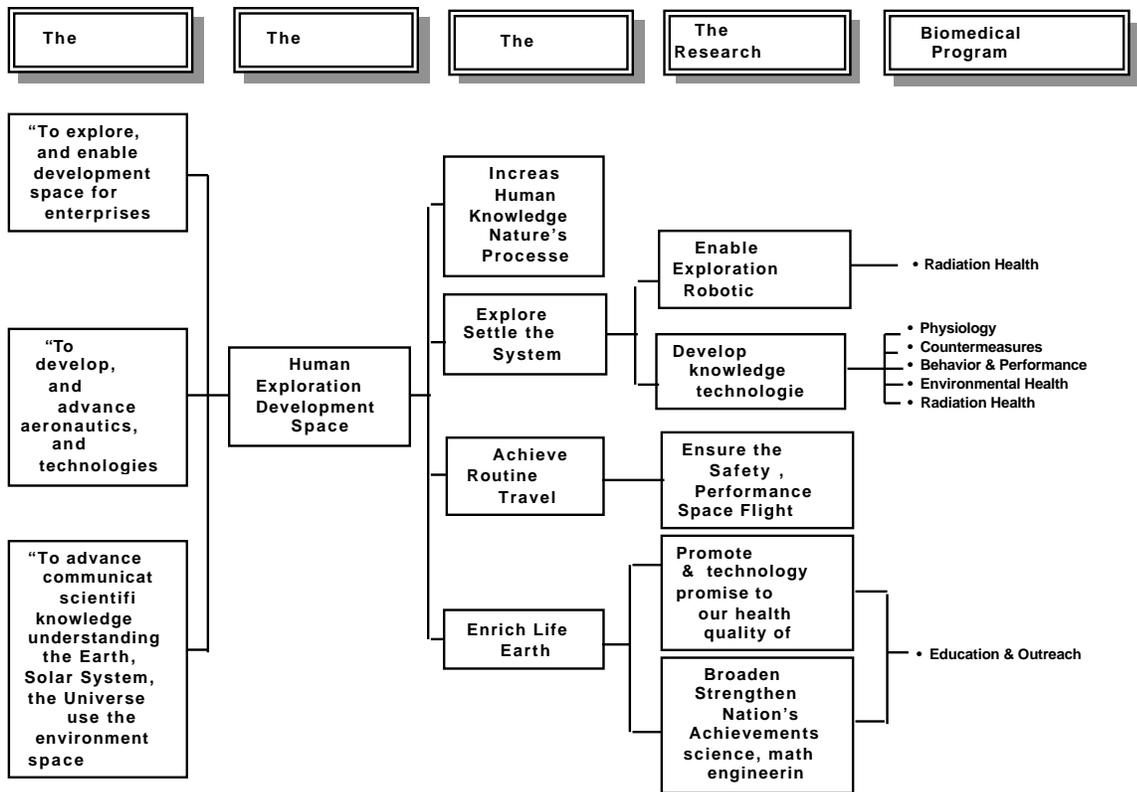


Figure 2. Relationship of the Biomedical Research and Countermeasures Program to the NASA/HEDS Strategic Plan

A. Gravitational Biology Program

Program Description

The Gravitational Biology Program is firmly rooted in the NASA missions and the Human Exploration and Development of Space (HEDS) Enterprise strategic goals (See Figure 1). The Program focuses on research designed to develop our understanding of the role of gravity in the evolution, development, and function of biological processes. This is accomplished by using a variety of gravitational environments (hypergravity, simulated hypogravity, and microgravity) as research tools or by determining the effects of the interaction of gravity (hypergravity or microgravity) with other environmental factors on biological systems. The emphasis in this Program is on using these gravitational research tools to advance fundamental knowledge in the biological sciences. Research that supports NASA's other goals of enabling human exploration of space and improving the quality of life on Earth is also encouraged.

The Program emphasizes research in developmental biology, cellular and molecular biology, and comparative and plant biology that seeks an understanding of basic mechanisms underlying the effects of gravity on evolution, development, morphology, and function. Studies may include animals (including humans), plants, tissues, or cells. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process. (See the "Special Matters" instructions in Appendix B.) Researchers are encouraged to take advantage of transgenic and mutant species as well as comparative biology approaches that may enhance their research scope. NASA continues to value ground-based research that leads to flight experiments that can confirm or refute the fidelity of ground-based models and hypotheses. It is anticipated that research in cell and molecular biology (to include microbiology) will be emphasized in the utilization flights that are planned for or precede the International Space Station. Please refer to the document titled *Space Life Sciences Standard Companion Document, 1996* for a list of hardware that will be available for research.

Elements and Emphases for FY 1998

This section describes the elements and research emphases within the Gravitational Biology Program for FY 1998.

- i. Cellular and Molecular Biology Proposals elucidating the mechanism(s) for gravity sensing in cells, unicellular organisms, or organized structural and functional units of multicellular biological systems are encouraged. Research into the influence of gravity on biological functions at the cellular level

should be focused on identifying how cells perceive gravity. This may include the interactions of gravity with environmentally mediated effects. The goals should be to determine how gravitational information is transduced in cells; how cells respond to both acute and long-term variations in gravity; and the role of gravity on the cytoskeleton, ion channels, and function of cells. For example, research might focus on determining the role gravity plays on cellular responses to growth factors, or how it affects the three-dimensional microenvironment of the cell with respect to information content within the cell. Research may also focus on how the cell perceives changes in the environment and responds acutely or chronically to these changes.

- ii. Comparative and Plant Biology The program in comparative and plant biology focuses on the characterization and explanation of the effects of gravity on the growth, development, composition and functions of animals and higher plants across the phylogenetic scale. Goals for comparative biology are to understand the role of gravity in such phenomena and mechanisms as homeostasis, metabolism, stimulus-secretion coupling, compensatory hypertrophy, neuroendocrine regulation, episodic secretion and feedback, growth factors, and mechanical loading interactions. **Comparative biology approaches are particularly welcome.** Similarly, goals for the plant biology approaches are to understand how plants perceive, transduce, and respond to a gravitational force; the role of hypergravity and hypogravity in developmental and reproductive processes; and how gravity and other environmental factors interact.
- iii. Developmental Biology NASA's goals in developmental biology are to determine the mechanisms by which gravity induces normal development and function, how gravity affects the capacity of animal species to reproduce, and the mechanisms by which subsequent generations are affected by gravity. Proposals that use different gravitational states to elucidate the effects of gravity during animal development are encouraged. Research in developmental biology should be focused on the influence of hypergravity and microgravity in the critical stages of development on animal growth, morphology, behavior, reproduction, genetic integrity, life span, senescence, and subsequent generations. A pressing issue concerning developmental biology in space is whether an organism can undergo a complete life cycle in microgravity conditions. Examples of suitable molecular and genetic model systems for use in developmental studies are *Drosophila* and *Caenorhabditis elegans*, and rats or mice for developmental neurobiology.

B. Biomedical Research and Countermeasures

Program Description

The Biomedical Research and Countermeasures Program is directly related to NASA's missions and the Human Exploration and Development of Space (HEDS) Enterprise (see Figure 2). It also responds directly to the requirements established by the Medical Policy Board (see *Medical Policies and Requirements Document*, Bibliographic reference #5 of this Appendix).

The current goals of the Biomedical Research and Countermeasures Program are (1) to integrate the physiological and behavioral responses that are responsible for space flight-related biomedical changes in humans and risk assessment to human health and performance and (2) to develop countermeasures that allow humans to live and work in microgravity for durations over a year; minimize the risks in readapting to Earth's gravity; and optimize crew safety, well-being, and performance. The emphasis of the ground-based component of this research program is to study problems associated with the extended periods of flight that will be characteristic of International Space Station (ISS) missions or of missions to explore the solar system. The Biomedical Research and Countermeasures Program supports basic and applied research utilizing hypogravity and hypergravity models and includes human subjects as well as other animal models. Assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the "Special Matters" instructions in Appendix B). The Biomedical Research and Countermeasures Program is composed of five elements: Space Physiology and Countermeasures, Environmental Health, Space Radiation Health, Behavior and Performance, and Advanced Technology Development. The research emphases of each element are unique and are described in the sections below.

Elements and Emphases for FY 1998

This section describes the elements and research emphases within the Biomedical Research and Countermeasures Program for FY 1998.

i. Space Physiology and Countermeasures Description and Emphases for FY 1998

Element Description

Removal of the force of gravity results in structural and functional changes, especially in weight-bearing muscle, bone, and connective tissue. Muscles

lose protein, size, and strength and undergo changes in metabolism, neuromuscular control and individual muscle fiber characteristics. Furthermore, space flight makes muscle more susceptible to injury. The investigation of human muscles is particularly challenging because they are composed of various proportions of fast and slow fiber types arranged in a mosaic. There are muscles of lower mammals, on the other hand, that are composed predominantly of fast or slow fibers, thus simplifying interpretation of experimental results. Examination of muscle obtained from animals after space flight revealed tissue damage; however, results obtained from animals sacrificed during the flight of SLS-2 indicate that the muscle injury does not occur during exposure to microgravity or space flight per se but occurs during re-ambulation after returning to Earth's gravity. A recent NASA panel recommended that "heavy resistance paradigms, involving isometric, concentric, and eccentric muscular actions, should be designed to optimally load the lower extremity and trunk musculature to maintain positive protein balance in these muscle groups," and "in all preventive and therapeutic activity paradigms, attention should be paid to the incidence of, and proneness for, injury to soft and hard tissues, and short- and long-term consequences of such injury should be determined." It is known that an unaccustomed bout of high intensity exercise results in muscle damage, soreness, and strength loss. Ground-based studies have also shown that unloading human skeletal muscle makes it more susceptible to exercise-induced damage.

Weight-bearing bones atrophy with loss of both mineral and collagen matrix. The resultant loss of architecture and strength may increase the risk of fracture on return to Earth after International Space Station (ISS) stays or planetary trips. Changes also occur in other connective tissues. It is well documented that these changes occur during space stays of 130 to 439 days; however, few data are available that describe the time course or magnitude of skeletal recovery in normal, healthy individuals. Clinical studies that have found similar changes in patients during and after bed rest have failed to elucidate the processes or underlying mechanisms responsible for the deleterious changes, probably because there are usually confounding factors. Prolonged hypercalciuria may increase potential for formation of renal stones.

Bone loss and muscle atrophy are expected to be among the most serious problems for extended-duration space flight, and exercise protocols or other countermeasures will be required as part of an effort to mitigate these effects or accelerate post-flight rehabilitation.

Cardiovascular function is altered during space flight with dampening of baroreflex response, decrease in plasma volume, and decrease in cardiac mass. Orthostatic intolerance is a problem for astronauts returning from stays in microgravity as evidenced by responses to post-flight stand tests. Identifying the underlying mechanisms for orthostatic intolerance is complicated by the fact that, in addition to the cardiovascular deconditioning that occurs during space flight, astronauts don suits that impose thermal stress, fluid load in an attempt to improve plasma volume, inflate anti-G trousers, and are exposed to increased cabin temperatures prior to landing. Recent reports have indicated that control of cardiovascular function by the autonomic nervous system is further complicated by interactions between autonomic and neurovestibular influences. The interaction of these systems must be investigated, and the causes of cardiovascular changes must be elucidated so that effective countermeasures to post-flight orthostatic intolerance can be developed.

Stimulation of gravity receptors and proprioceptors and nervous system interpretation and processing of the afferent input are changed immediately upon exposure to microgravity and again upon re-exposure to gravity. Changes also occur in general sensorimotor function, including neuromuscular function, and in spatial orientation; postural instability is evident after flight.

Changes also occur during space flight in endocrine, hematological, immunological, metabolic, nutritional and gastrointestinal, renal, sleep, biological rhythms, and temperature regulation; changes in pharmacokinetics and pharmacodynamics may further confound crew health care. Red cell mass decreases early in space flight secondary to decreased erythropoietin stimulation. Changes in immune function may be related to living in a “closed environment,” the space habitat, the effect of stress during launch or landing, or inhibition of white cell maturation.

Why and how these changes progress with flight duration is not well defined. As astronauts undertake longer tours of duty, multiple trips in space, and missions to more remote settings, changes may become more pronounced and may even result in pathological conditions.

In general, proposals are requested that integrate the underlying **mechanisms** of the changes discussed above to develop **countermeasures** to prevent or minimize undesirable responses to microgravity, or that enhance recovery and physiological readaptation following space flight. This general request includes proposals that utilize **human and/or appropriate animal subjects** and encourages proposals for appropriate **integrated**

approaches studying responses of several physiological systems to hypogravity and hypergravity states. Proposals determining **basic mechanisms of physiologic responses** to hypergravity and simulated hypogravity using animal or human subjects will be considered.

Proposals related to **countermeasures** should include a comprehensive plan to develop ground-tested countermeasures by the end of the grant period. A schedule/milestone chart for the development of the delivered countermeasure, including a description of any special hardware to be used or delivered and protocols required for implementation, **must** be a part of the grant application for full consideration.

Element Emphases for FY 1998

For FY 1998, emphasis in the Space Physiology and Countermeasures Element will be on understanding and developing countermeasures to the effects of long-duration space flights on the sensorimotor, musculoskeletal, and cardiovascular systems as described in detail below.

- a. Sensorimotor and spatial orientation system For the sensorimotor and spatial orientation system, the program is seeking outstanding proposals that will (1) identify mechanisms of changes in sensorimotor and spatial orientation systems, including changes that affect balance and fine motor control during and after flight and (2) produces effective countermeasures to the undesirable changes observed in space flight. Purely descriptive or observational studies should not be proposed.
- b. Musculoskeletal system For the musculoskeletal system, the program is seeking outstanding proposals that will produce effective, ground-tested countermeasures to prevent the loss of muscle and bone. Therefore, proposals are also encouraged that (1) investigate the risks of soreness, damage and strength loss associated with astronauts performing in-flight, high intensity concentric and/or eccentric muscle actions; and (2) develop effective pre-conditioning protocols or training paradigms that will protect the muscles of astronauts from deleterious changes when performing exercise or EVA activities during space flight, including those required for the construction of the space station. Research and resulting countermeasures must be applicable to an astronaut population of men and women between the ages of 30 and 60 years. Proposed countermeasures must have realistic requirements for crew time and other resources, and must be safe for the crew.

- c. Cardiovascular system For the cardiovascular system, the Program is seeking outstanding proposals that will identify interactions between the vestibular and autonomic nervous systems contributing to post-flight orthostatic intolerance and that will have a clear potential to lead to effective countermeasures.
- d. Countermeasure Development Priorities In addition to a through c above, high priority has been given to the development of appropriate prevention or rehabilitation programs to mitigate potential maladaptive physiological microgravity-induced changes. These include:
- 1) pharmacology and pharmacokinetics – absorption, action, and metabolism of drugs.
 - 2) nutrition and metabolism – changed nutritional requirements and the metabolism of lipids and carbohydrates.
 - 3) immunology – inter-relationship with a closed environment, microgravity, radiation, and stress.

Opportunities for flight experiments are severely limited. Outstanding proposals in this research area for experiments should be consistent with the program goals in animal and human physiology defined and should **advance our knowledge of the effects of space flight on humans** or lead to new **countermeasures**. Applicants should carefully consider the severe limitations and constraints for flight experiments (see Section V and also the document *Space Life Sciences Standard Companion Document, 1996*).

Flight proposals for early utilization of the Space Station (using the Human Research Facility) should address issues of critical basic physiology or operational importance, namely musculoskeletal function, cardiovascular function, and neuroendocrine control, and require the unique facilities and attributes of a Space Station. Potential applicants should note that crew time, power, and other resources will be very limited and that extravehicular activity (EVA) is scheduled for these flights; studies that are related to the **effects of EVA on crew members** and that can be performed within the constraints of Space Station operational scenarios are encouraged. Studies in non-human mammals will either not be available or will be extremely limited on the Space Station during its construction. Areas of importance include effects of human factors on behavior and performance (as affected by a culturally diverse crew, perturbed sleep-work cycles, commonly used medications, etc.); cardiovascular function (including atrial bubble detection);

muscle function, strength, endurance, and biomechanics; energy balance; and neuroscience research using the planned computer workstation.

ii. Environmental Health Description and Emphases for FY 1998

Element Description

NASA has the primary responsibility to ensure the health, preserve the safety, and enhance the performance of space crews during the human exploration of space. Thus, defining, creating, and maintaining a safe and habitable environment is an indispensable element of space travel. Safe air and water are essential for human life. However, the unique characteristics of space flight present many challenges in this regard. Exposure to microgravity and other flight-related stressors results in complex adaptational responses in any organism that evolved on Earth, including humans. The closed nature of the spacecraft environment means that microbial contamination must be minimized and any chemicals brought aboard or produced by human or microbial metabolism must not significantly contaminate the air or water supply. Moreover, crews are exposed continuously to many contaminants that are present for the duration of the mission. Water will be reclaimed from various onboard sources and treated and recycled for crew consumption. Finally, the severe constraints imposed on equipment weight, volume, and power limit the capability for monitoring the environment and for medical diagnosis and therapy in flight. It is clear that the complexity of spacecraft environments mandates a multidisciplinary approach to creating and maintaining a safe habitat. In addition, a well-controlled environment is essential to those who use the space laboratory for carefully controlled biological experiments.

Prebreathe research is an area of active interest to improve EVA operations. The Martian atmosphere has argon as a constituent which will appear in the breathing mixture unless costly and heavy systems are provided to separate it from the nitrogen. The prebreathe implications of breathing some argon in the mixture must be determined. The question of what is the best gas mixture for reduced atmosphere space vehicles should be investigated. In addition, research on ways to remove nitrogen from body tissue by biochemical decompression prior to exposure to reduced pressures so that prebreathe can be eliminated from operational consideration is sought.

Research into the concept of a mechanical counter pressure suit which will allow a crew person to use the human body's natural cooling mechanism are sought to both improve mobility, reduce the risk associated with breach of

the pressure vessel, and reduce the complexity of the portable life support system.

To meet these challenges, the Environmental Health element of the Biomedical Research and Countermeasures Program has established the following goals: (1) to understand the effects of the spacecraft environments on humans and other organisms; (2) to specify, measure, and control these environments; (3) to develop standards and countermeasures, where necessary, to optimize crew health, safety, and productivity; and 4) enhance health care delivery to injured or sick crew members, taking into consideration the physiological changes of space flight.

Research within the Environmental Health element includes four interrelated disciplines, each dealing with a specific aspect of the spacecraft environment – barophysiology, microbiology, toxicology, and water quality. Research is necessary for the development of monitoring techniques, procedures, and standards for extended missions aboard the Space Shuttle and the International Space Station. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix B). Refer also to NASA Research Announcement #96-HEDS-05 for solicitation of technology development for environmental monitoring and control.

Element Emphases for FY 1998

For FY 1998, the primary areas of emphasis for the Environmental Health element include:

- Determining the mechanisms of decompression sickness relative to extravehicular activity during space flight with the goal of minimizing oxygen prebreathe time
- Determining and understanding the effects of the spacecraft environment on the susceptibility of crew members to toxic chemicals in air or water
- Understanding the growth of microorganisms, their sensitivity to antibiotics, and human-microbial interactions in space
- Assessing the impact of spacecraft microbial ecology on human health
- Studying the effects of the interactions among gas composition, pressure, temperature, and humidity on the crew or on research specimens.

In general, research is encouraged that is relevant to the establishment of space flight environmental standards for human health and performance. Specifically, proposals are encouraged that:

- Establish physiological norms for atmospheric gases in habitable and research spacecraft
- Describe microbial populations in space craft for long-duration flight including their numbers, pathogenicity, or products
- Identify optimal nitrogen washout protocols
- Utilize ground-based studies to anticipate the effects of closed systems in space.

iii. Space Radiation Health Description and Emphases for FY 1998

Element Description

The space radiation environment consists of protons and electrons trapped in the Earth's magnetic field, protons (and some heavier particles) emitted in the course of solar energetic particle (SEP) events, and protons and the energetic nuclei of other elements (HZE – high atomic number Z and energy E – particles) that constitute galactic cosmic rays (GCR). The SEP particles are mainly protons of energies up to several hundred MeV and intensities that can increase by four or five orders of magnitude within a few hours. The GCR particles have energies up to several thousand MeV per nucleon. The fluences of GCR nuclei vary slowly as a function of the solar cycle and of position in the interplanetary magnetic field. Average crew dose rates on the Shuttle have been measured to be in the range of approximately 0.03 to approximately 2.5 milliGray/day, depending on altitude and inclination, peaking to 3.6 milliGray/hour during passage through the South Atlantic Anomaly. These values are comparable to measurements reported on the Russian space station MIR. For the purposes of radiation protection, average quality factors, Q, have been evaluated using measured distributions of linear energy transfer (LET) and internationally recognized assumptions regarding the dependence of Q on LET. In low Earth orbit, average values of Q are in the range of 1.4 to 3; for the GCR component, the range of values is between 4 and 6.3.

The Space Radiation Health element of the Biomedical Research and Countermeasures Program aims to establish the scientific basis for the radiation protection of humans engaged in the exploration of space, with particular emphasis on the knowledge base required to support future planetary exploration. Objectives are to accurately predict the probabilities of deleterious health effects due to radiation exposure during human space

activities (principally, but not exclusively, various types of cancer, in excess of natural incidence, effects on the nervous system, and effects on the length and quality of life). These predictions should be valid for any mission architecture, behind any shielding or structural materials, at any time in the solar cycle. Finally, this research is expected to lead to the timely development of countermeasures (evasion strategies, shielding design, and, eventually, selection intervention and treatment techniques for management of unplanned radiation exposures).

In pursuit of these objectives, the program emphasizes ground-based studies using accelerated beams of high energy protons and nuclei to simulate space radiation. Energetic beams of protons and of some of the nuclei found in GCR are available at ground-based laboratories. The beams can be used to simulate components of the space radiation environment in order to acquire the necessary database, study basic mechanisms of biological responses to radiation, explore potential preventive or recovery-enhancing countermeasures, and develop effective dosimetry. 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 4.0 of *Space Life Sciences Standard Companion Document, 1996*). **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 but, if exposures at other facilities are needed for proposed studies, proposers must obtain them free of charge. **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. The appropriate user fees must also be included in the investigator's budget.**

Ongoing research within the Radiation Health element encompasses the following scientific areas:

- Interaction of radiation with matter (e.g., shielding, tissue). This area encompasses research into the physics of the space radiation

environment and of its modification by spacecraft, habitats, tissues and other materials.

- Risk assessment standards. Current methods of risk assessment are based on the use of dose equivalent, the product of dose and quality factor. HZE particles can result in biological damage for which this approach may not be adequate. For this reason, direct methods of risk prediction are also supported.
- Radiation biology. Radiation biology comprises the research needed with cells, tissues, or animals to understand the basic mechanisms involved in the responses of living systems to radiation exposure and to develop methods to eventually prevent or limit the consequences to human health.

Element Emphases for FY 1998

For FY 1998, the primary areas of emphasis for the Space Radiation Health element is on ground-based experimental radiobiology studies using proton and high-energy heavy ion beams in the energy range corresponding to space radiation.

Proposals addressing **genetic sensitivity to space radiation and genetic intervention to alter such sensitivity will be particularly encouraged**. Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix B).

Proposals will be considered in the following areas:

- Studies leading to significant advances in our understanding of the **genetic mechanisms of radiation damage and repair in cells and tissues**, especially those aspects that are complementary to research in genomic instability currently being jointly funded with the National Cancer Institute
- Studies likely to result in the development of **selection or biological countermeasures in humans** that could lead to prevention or intervention (including pharmacological agents) against effects of space radiation damage and enhancement of repair
- Studies linking biological mechanisms to significant improvements in the accuracy of predictions of radiation risk for exposure of humans in space (especially **carcinogenesis**).

A very strong rationale will be required to justify support of studies not directly using protons or heavy ions in the relevant energy range or not directly relevant to the interpretation of experiments already conducted at such facilities. Research that can lead to future space flight investigations will be welcome.

iv. Behavior and Performance Description and Emphases for FY 1998

Element Description

The Behavior and Performance element of the Biomedical Research and Countermeasures Program is designed to develop knowledge of the mechanisms by which mission design and events and space craft environment affect behavior and performance of crews and dependent support. It also addresses psychosocial and cross-cultural aspects of human missions in space. Individual and group relationships are both addressed. The use of existing databases and ground simulations in extreme and isolated analogs and test beds is encouraged. Specific issues related to human factors and human-machine interactions are not part of this solicitation. Individuals interested in these areas should refer to NRA 96-HEDS-05 titled “*Research Opportunities in Space Life Sciences - Advanced Human Support Technologies Program 1996.*” Note that assurance of compliance with applicable federal regulations regarding human subjects and/or animal care and use is required as part of the proposal submission process (see the “Special Matters” instructions in Appendix B).

The Behavior and Performance element of the Biomedical Research and Countermeasures Program supports both scientific and technical activities. Potential applicants should refer to Section VI.A of this Appendix for definitions of each of these activities. Potential applicants should also note that all proposals submitted to this element should include a section that addresses how any proposed knowledge or technical development will benefit current or future NASA mission planning or technology development projects. If proposals depend on availability of crew, technologies, facilities, data, or simulation capabilities, it is recommended that investigators demonstrate within the proposal that such availability and access has been assured by the lead center (Johnson Space Center) personnel or other non-NASA source.

Element Emphases for FY 1998

For FY 1998, the Behavior and Performance research priorities include:

a. Psychiatric Issues

- Research on the behavioral and performance side effects of pharmacological countermeasures
- Study of mechanisms regulating rhythms during space flight and ground control operations and their implications on the quality of sleep, rest, and performance

b. Psychological Development

- Development of the methodology, for space missions, to measure performance of meaningful tasks essential to mission safety and mission completion that is transparent to daily crew work
- Methodologies to quantify task errors (e.g. eye-hand coordination, visual memory of scenes, orientation of self and objects)
- Research on cognitive processing and emotion, as these are affected by age and gender during space missions
- Research on the effect of noise, crowding, light, and other environmental variables (e.g., CO₂) on the health, sleep patterns, and mood on space mission and related crews

c. Group Psychological Development:

- Analysis of how healthy cultures are developed for small groups on space missions
- Research on group dynamics with respect to space missions both within the mission team and between the mission team and the ground control team

For a more detailed listing of NASA Life Sciences Behavior and Performance research priorities, please reference the Countermeasures Task Force Report on Behavior and Performance available by phoning (202) 358-4180 and providing your full name, mailing address, phone number, and the title of the document you are requesting.

Interested proposers should note that Space Human Factors Engineering is addressed in the companion Announcement titled *Research Opportunities in Space Life Sciences: Advanced Human Support Technologies Program 1996* (NRA #96-HEDS-05) which addresses the development of new processes and procedures and draws on performance expertise in aeronautics to optimize crew training, automated systems design, proficiency, and productivity.

iv. Advanced Technology Development Description and Emphases for FY 1998

Element Description

The Advanced Technology Development (ATD) element of the Biomedical Research and Countermeasures Program develops technologies that will enable new space life sciences investigations; significantly improve the science return of existing investigations; minimize cost, schedule, and program risk to life sciences flight experiments; and, wherever possible, ensure that these technologies find application in the commercial sector. The ATD element thus sponsors technology development activities that

- Enhance the capability, reliability, or quality of life sciences flight hardware
- Solve technical problems that currently limit science return from existing flight equipment and from dependence on use of flight crew time
- Enable new types of scientific investigations in space not presently possible
- Promote technology transfer of life sciences technology to industry
- Establish partnerships with industry, universities, and other agencies to facilitate technology development and transfer, both into and out of NASA.

The ATD element supports only those generic technology definition and development proposals that have application across several scientific disciplines or programs. Technology development proposals that are specifically focused on one particular program should be submitted under that particular program. Proposals that are selected will be funded through the phase of initial demonstration of feasibility and suitability for use in the ground-based or flight programs (the breadboard demonstration stage). Once a sufficient level of maturity is demonstrated, further development (e.g., packaging or brass boarding) becomes the responsibility of the benefiting ground-based or flight project.

Potential applicants should note that all proposals submitted to the ATD element of the Program should include a section that addresses how the proposed technological development may be integrated into current or future NASA technology development projects and a section that discusses potential Earth benefits of the proposed work, including but not limited to technology transfer to the commercial sector, potential benefits to medical sciences and technology, and potential general benefits to human welfare.

ATD solicits scientific and technical proposals that are highly innovative and, although based upon sound principles, may contain some risk of failure. Bold, novel approaches to solving technology needs are encouraged. At an appropriate point in the development of these technologies and after suitable evaluation, the appropriate NASA field center will become increasingly involved in the technology development in order to ensure that requirements for future use are being addressed in the technology development effort. Finally, technologies advancing to a near flight-ready stage will be tested first in integrated ground-based systems and then in flight as appropriate to ensure their efficacy prior to becoming incorporated into flight experiments or flight systems.

Element Emphases for FY 1998

For FY 1998, the primary emphasis of the ATD element is on advanced biological and physiological sensors and monitoring systems.

New proposals in the primary area of emphasis will have the highest programmatic priority. Proposals are also sought for development of technologies in other areas of interest to space life sciences, described below.

Additionally, other innovative technology development proposals not specifically addressed in this section will also be funded if exceptional benefits to future space life sciences investigations can be demonstrated.

The following additional information describes technology needs for FY 1998 in more detail.

- a. Advanced Biological and Physiological Sensor Systems Advanced sensors and systems are needed to detect a wide range of physiological parameters in human subjects. Noninvasive and minimally invasive systems are solicited to accurately detect and quantify levels of blood gases, electrolytes, and other serum components such as metabolites, hormones, and enzymes, as well as physical parameters (core

temperature, blood pressure, heart rate, respiration, etc.) and hormone levels.

- b. Advanced Sensing, Processing, and Imaging Systems Noninvasive systems are needed to quantify the gross effects of microgravity on human physiology. The combination of miniaturized digital X-ray systems, advanced imaging modalities, and intelligent processing systems shows great promise for the quantification of effects such as bone demineralization and muscle tissue loss. Ultrasound scanning, processing, and 3-D imaging systems are needed for volume determination, flow mapping, and cardiac imaging.
- c. Non-refrigerated Sample Preservation Processes and systems are solicited for storing biological samples without the need for refrigeration, thereby reducing payload power and volume requirements on space craft.
- d. Wireless Payload Communications Technologies are needed for wireless communication of information between astronaut-worn sensors, sensor arrays, sensor data preprocessing systems, head-mounted displays, actuators, and facility subsystems that process, store, and communicate with ground operations.
- e. Training and Visualization Technologies such as virtual environments, haptic interfaces, and displays are required for onboard medical and payload training applications. Tools to allow 3-D visualization of data from health systems (ultrasound, magnetic resonance imaging, computed tomography scan, etc.) and payload systems are needed, including display of data fusion products combining 3-D data from medical scanning systems with live video of a patient to aid in diagnosis and treatment.
- f. Automated Medical Diagnosis Technologies are required that process data from multiple medical sensor systems, analyze the data, and propose further tests or generate a diagnosis. Such systems could include multisensors (blood chemistry, blood gases, temperature, etc.), signature recognition from a catalog of possible diagnoses, and pattern recognition of multisensor spatial data to physically locate an abnormal medical condition.

IV. Biospecimen Sharing

Biospecimen Sharing provides the scientific community with access to NASA's inventory of biological materials from organisms that have flown in space. These materials were not required by the primary experiments of the space flights on which they were flown. The available material often includes material from appropriate flight and/or ground control studies that were designed to enable the primary investigation to be carried out successfully. Applicants may submit proposals specifically for analysis of materials obtained from this Program or as an adjunct or supplementary component of an experimental proposal in one of the other research areas above. In either case, it is expected that the use of the requested materials will be fully justified in the proposal. Applicants should indicate their requirement for materials at the appropriate place on Form B (Appendix C).

Previously Collected Materials. Rodent, avian, and plant materials are currently available from previously flown flight experiments. Specific information regarding which samples are still available, characteristics of each mission from which the samples were obtained (e.g., mission length and orbital inclination), experimental conditions used to obtain and preserve the samples, and protocols (e.g., diet, light/dark cycle, housing, fixation/storage) used by the primary investigation can be obtained by contacting

Mr. Marc Shepanek
UL/Life Sciences Division
NASA Headquarters
Washington, DC 20546
(202) 358-2530
(202) 358-4168 (Fax).

V. Flight Experiments

For FY 1998, proposals for space flight experiments may be submitted in response to this Announcement if they involve any of three special types of scientific studies:

1. **Short-duration experiments** that can be implemented primarily on the Shuttle without the use of major mission resources
2. **Long-duration experiments** that can be implemented with the limited resources available on the International Space Station during the early assembly (construction) phase (1999-2000)

3. **Pre- and Post-mission studies** that involve testing of the astronaut crew prior to and upon return from their space flight

All of these experiment types are highly constrained in a number of ways (described below); *proposals requiring resources beyond the capabilities defined below should **not** be submitted in response to this Announcement.*

Potential applicants should recognize that, given the limited flight opportunities that are available at present, the flight experiments area is likely to be one of the most competitive arenas within the space life sciences for 1997. It is expected that successful flight experiment proposals will represent mature studies strongly anchored in previous or current ground and/or flight research. Ground-based research may, and often must, represent one component of a flight experiment proposal, but that research should be limited to activities that are essential for the final development of an experiment for flight and for the completion and publication of the scientific results of the experiment. In this case, only one (flight) proposal need be submitted. 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.

Note that all flight experiments must address one or more of the research programs and emphases defined in Section III above. Applicants proposing flight experiments must fill out the information required on Form C (Appendix C). Flight experiment proposals should emphasize the actual experiment, duration requirements, and experiment conditions. The investigators should allow for flexibility so that the best available hardware to accomplish the experiment goals can be selected. It should be noted that the informed consent of human subjects must be obtained prior to carrying out any study in space, and potential proposers should be aware that obtaining such informed consent will involve a uniform process regardless of the country of origin of the proposer.

Applicants should note that flight experiments should be proposed as if the actual flight of the experiment will occur in 1999 or 2000. Experiments that cannot be accomplished within this time period should not be proposed to this Announcement. Preference will be given to those proposals requesting only one flight to accomplish the proposed research; however, with strong justification, applicants may request multiple flight opportunities.

Once selected, flight investigators and NASA must agree on the duration of the period (nominally one year) following receipt of specimens and data during which their investigation will be completed. At the end of this period, investigators must provide a final report to NASA and should publish the results of their experiments in appropriate peer reviewed journals. All suitable

experimental and reduced data must be submitted to NASA in a format appropriate for archiving in the Space Life Sciences Data Archive, where it will be available to the scientific community.

Finally, potential applicants should be aware that selection for flight is a multi-step process. Following the initial evaluation of flight proposals, a small group of investigators will receive a letter informing them that their experiment has been selected for definition. During the definition phase, NASA will interact with the applicant and determine whether the proposed experiment can actually be carried out on a space mission. At the end of this phase, NASA will select a smaller group of investigations to be developed for flight. **Normally, investigator research funding does not begin until the initiation of the development phase.**

Descriptions of the hardware items available to support human and non-human experiments are included in the International Flight Hardware Catalog (Section 3.0 of *Space Life Sciences Standard Companion Document 1996*). Investigators may propose to use one or more pieces of this flight-certified hardware to implement their experiments, or may propose to utilize their own currently existing flight hardware. The development of experiment-unique equipment to implement experiments is discouraged, and individual agencies may not allow such development. However, when exceptional circumstances justify the need for such equipment, such items should be proposed as new developments, and the additional costs should be included in the proposal.

A. Short-Duration Flight Experiments

Short-duration experiment proposals submitted in response to this Announcement are restricted to experiments that can be accommodated on the Shuttle in addition to the primary mission and that use existing flight hardware. The experiments themselves are usually stand-alone studies that require limited crew training and involvement to execute. It is possible to take advantage of the location in the Shuttle middeck to obtain late preflight installation and early post-flight retrieval of materials.

More information on the shuttle middeck accommodations can be found at the web site:

<http://www.ksc.nasa.gov/shuttle/technology/sts-newsref/stsover-prep.html#stsover-mpaccomm>

It is expected that a limited number of flight opportunities will exist for the use of human (crew) subjects and non-human subjects. Note that the number of crew subjects available to support such studies will be limited due to both the late

manifesting of middeck experiments and the limited amount of crew time available to support such experiments.

B. Long-Duration Flight Experiments

Limited research opportunities will be available during the construction phase of the International Space Station. These opportunities will be longer than the current Shuttle limit of approximately 16 days but will be constrained in a variety of other ways. Research opportunities will be available during utilization flights when the Shuttle visits the Space Station and during the time period between the utilization flights when the permanent onboard crew will act as experiment operators and, if necessary, as subjects. The duration of microgravity exposure during the 1999-2001 time frame can, in theory, be indefinite with periodic disturbances every 30 days caused by the U.S. and Russian transportation vehicle docking activities. The primary opportunities to transport scientific equipment, supplies, and samples will be on the utilization flights of Shuttle; however, modest capabilities for research-related deliveries and sample returns will be available on assembly flights that take place every 40-90 days.

During the period of time covered by this solicitation, space life sciences research is restricted to a limited hardware set. The hardware available at this time represents the early configuration of the Human Research Facility and the European Space Agency's Modular Cultivation System.

It is expected that the following resources will be severely constrained throughout 1999-2001: crew availability for science operations, power, and logistics resupply (both frequency and mass) to and from Space Station. Refrigerated stowage on the Shuttle for transport of samples will be very limited, and during certain time frames, refrigerated stowage may not be available on the Space Station. Experiments with few and/or simple in-flight activities will be most technically feasible during this time frame.

It is expected that competitive proposals will address issues of critical basic physiological or operational importance and will require the unique facilities or attributes of microgravity exposure in excess of 16 days for their completion. As noted earlier, the experimental concept must have evolved from a clearly defined and rigorous program of successful ground-based or space flight investigations.

C. Pre- and Post-Mission Studies

Opportunities will be available to perform experiments, collect samples, and take physiological measurements utilizing the astronaut crew both prior to their space mission and following their return to Earth. Such proposals are considered flight

experiments, and should specify the desired activities, time frame in which these activities must be performed prior to and following the mission, and the required mission duration (e.g., a short duration shuttle mission versus an ISS mission).

VI. Proposal Evaluation And Awards Selection Process

The following information is specific to this NRA and **supersedes** the information contained in Sections 13 and 14 of Appendix B, *Instructions for Responding to NASA Research Announcements for Solicited Research Proposals*.

A. Evaluation Factors

The principal elements considered in the independent peer review evaluation of proposals received in response to this NRA will be the **overall scientific or technical value** of the proposed research or technology development and the **cost of the project**. **Relevance to NASA's programmatic needs and goals** will be evaluated in a separate process by NASA. In addition, space flight proposals and proposals to utilize special NASA ground-based facilities will also be evaluated for the **feasibility of implementation** of the proposed project utilizing the requested flight hardware or ground facilities.

For the purposes of this Announcement, scientific proposals are differentiated from technical proposals by two characteristics: the underlying objective of the proposal and the method proposed for reaching that objective. Scientific proposals generally have, as their primary objective, the development of new knowledge through the scientific method (i.e., through the development and testing of a scientific hypothesis). Technical proposals, on the other hand, usually have the development of technologies or processes as their primary objective and propose engineering methods, evaluations, and trade studies to reach their objective. It is the responsibility of each applicant to determine whether his or her submitted proposal is scientific or technical; NASA reserves the right to reclassify submissions prior to review.

Within each of these elements, the following factors are critical to the proposal evaluation and awards selection process:

1. Overall Scientific/Technical Value

The criteria listed below are considered by reviewers when determining overall scientific or technical value.

- Clarity of the project's hypotheses and objectives
- Feasibility of the approach and adequacy of the methods and procedures to carry out the proposed project
- Innovation of the research design
- Originality of the proposed project
- Likelihood that the proposed project will lead to new discoveries or fundamental advances within its field
- Likelihood that the proposed project will lead to new technologies that contribute to NASA's mission or to the health and welfare of the American people
- Familiarity of investigators with the relevant published literature
- Background and documented experience and skills of the investigators and their scientific publication record as an indication of their ability to accomplish and disseminate the proposed research or activity
- For flight investigations, documented maturity of the proposed project (i.e., is project scientifically/technically ready for flight or is further development required?)
- Availability of the investigators to devote adequate time and effort to the project
- Adequacy of institutional resources, facilities, and equipment to support proposed research
- Overall standing among similar proposals available for evaluation and/or evaluation against the known state-of-the-art.

2. Cost

Appropriateness of the budget, including the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

3. Relevance to NASA's Programmatic Needs and Goals

Responsiveness to the areas of program element emphasis described in this Announcement.

4. Implementation Feasibility *(Not applicable to all proposals)

Ability to implement the proposed project utilizing the flight and/or ground facilities available.

* *For those proposals for which implementation feasibility is necessary to assess, it will be given a weight equal to that of overall scientific/technical value.*

B. Evaluation Techniques

Upon receipt, proposals will be reviewed for compliance with the requirements of this Announcement. All compliant proposals, regardless of type, will undergo merit review by a panel of experts. The number 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 emphasis described in Section III of this Appendix. An engineering and technical review will be conducted by an appropriate engineering evaluation team for those proposals that require determination of the feasibility of implementing the proposed projects utilizing available flight and/or ground facilities. Following these reviews, NASA program scientist coordinators will prepare a selection plan for each program described in this Announcement. This plan will be based on (1) the ratings and evaluations of the panels of experts according to the above criteria and (2) the contribution of each proposal to the development of a sound scientific/technical research program having the appropriate balance of tasks required by the critical research issues confronting the program as determined by the Human Exploration and Development of Space Strategic Plan. This selection plan will be presented by the program scientist coordinators to the Life Sciences Management Council, a group of senior NASA Headquarters Life Sciences scientists. Following acceptance of the plan by the Council, selection for funding will be made by the Director of the Life Sciences Division.

VII. Program Management Information

A. Type of Awards to be Made

The award instrument will be appropriate to the submitting institution. NASA will fund the institution one year at a time. It is expected that such funding will continue for a total period between one and three years, depending on the proposal requirement, the recommendation of the review panels, and the continuing programmatic contribution of the activity. The number of proposals selected for support will depend on the quality of the proposals received and the availability of funds. However, it is anticipated that approximately 60 awards averaging \$125,000 (total costs) annually will be made, although the total annual cost may vary from \$15,000 to \$350,000. The appropriate program scientist coordinators of NASA's Life Sciences Division will have a primary role in oversight of these awards and will be responsible, with the appropriate NASA field center, for annually evaluating their progress and out-year plans.

B. Eligibility

All categories of institutions and scientists are eligible to submit proposals in response to this NRA. Multi-institutional consortium arrangements also are eligible: the applying entity 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 and/or training in any institution or for any investigator is neither a prerequisite to submission of a proposal nor is it a competing factor in the selection process.

C. Foreign Proposals

NASA will accept proposals from all countries in response to this Announcement. Proposals from non-U.S. entities should not include a cost plan. Non-U.S. proposals and U.S. proposals that include non-U.S. participation must be endorsed in writing by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such written endorsement should indicate that

- (1) The proposal merits careful consideration by NASA, and
- (2) If the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

In addition to sending the original (signed) proposal and twenty (20) copies to NASA through Information Dynamics, Inc., as directed in the next section, **one (1) additional copy along with the Letter of Endorsement must be forwarded to:**

Ms. M. Ruth Rosario
IH/Space Flight Division
Ref: NRA 96-HEDS-04
NASA Headquarters
Washington, DC 20546-0001
USA

All proposals must be typewritten in English. **All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S.** Non-U.S. proposals and U.S. proposals that include non-U.S. participation must follow all other guidelines and requirements described in this NRA. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating this Announcement. Copies of these letters will be sent to the sponsoring government agency.

Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Space Flight Division (Mail Code: IH) will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging its respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (1) A letter of notification by NASA; and/or
- (2) An exchange of letters between NASA and the sponsoring government agency.

D. Program Reporting

Applicants should note that investigators selected from proposals submitted in response to this Announcement will be expected to provide NASA with annual summary information about their projects. This information will consist primarily of an abstract, bibliographic list, copies of publications, and a statement of progress. This information will be made available to the scientific community and will be used to assess the strength of the Division's programs. 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.

Investigators selected to carry out space-flight experiments must also provide NASA with two special reports:

- (1) A "quick-look" report of preliminary flight results that is due one month after the space flight takes place, and
- (2) A final report containing all data and information on the flight study due approximately one year after all required data is 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.

Additional information may be required of investigators at the time of their annual funding renewal.

E. Deadlines

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**, which is not binding, by 4:30 PM EST, Friday, February 28, 1997. The letter of intent, which should be no more than two pages, should contain:

- The names, addresses, and telephone numbers of a single principal investigator and all co-investigators
- A title descriptive of the research or technical proposal
- A brief summary describing the proposed research, indicating clearly the research program(s) defined in this Announcement that are most relevant to the proposal
- The major participating institutions
- Up to six (6) key words that best describe the research area of the pending proposal. Refer to Appendix C, Required Application Forms and Instructions for Proposal Preparation, for a list of acceptable key words.

Letters of Intent may be submitted through the U.S. Postal Service or commercial delivery services in the same manner as proposals, described below. In addition, letters of intent may be submitted electronically via e-mail to the following address:

loi@hq.nasa.gov

An original signed proposal, plus twenty (20) complete copies of that proposal, and a 3.5-inch computer disk containing an electronic copy of the Principal Investigator's name, address, telephone and fax numbers, e-mail address, and the complete Project Title and Abstract (as provided on Form B) in either Macintosh or IBM (or clone) format must be received by 4:30 PM EDT, Tuesday, April 1, 1997.

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

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

F. Proposal Schedule

The following schedule is planned for the acquisition of investigations under this Announcement:

- Letter of Intent to Propose Due February 28, 1997
- Proposal Due April 1, 1997
- Selection Announcement October- November 1997
- Initial Funding Available October 1997 - September 1998

VIII. Bibliography

1. **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. University or medical school librarians should be able to conduct requested searches; individuals can perform their own searches after establishing an NLM account. Additional information may be obtained from the SPACELINE Office: phone: 301-295-2482; email: **SPACELINE@usuhsb.usuhs.mil**
Web address 1 **<http://nssdc.gsfc.nasa.gov/life/spaceline.html>**
Web address 2 **<http://www.nlm.nih.gov>**

2. National Aeronautics and Space Administration, Life Sciences Division, Washington, DC 20546. Series of **Discipline Science/Technology Plans** produced by the programs of the Division.*
 - a. **Cardiopulmonary Discipline Science Plan**, Space Physiology and Countermeasures Program (1991). (NTIS #N9319648 - \$17.50)
 - b. **Environmental Health Discipline Science Plan**, Environmental Health Program (1991). (NTIS #N9321369 - \$17.50)
 - c. **Musculoskeletal Discipline Science Plan**, Space Physiology and Countermeasures Program (1991). (NTIS #N9319892 - \$17.50)
 - d. **Neuroscience Discipline Science Plan**, Space Physiology and Countermeasures Program (1991). (NTIS #N9319882 - \$17.50)
 - e. **Regulatory Physiology Discipline Science Plan**, Space Physiology and Countermeasures Program (1991). (NTIS #N9319891 - \$17.50)
 - f. **Space Biology: Cell Biology Discipline Plan**, Space Biology Program (1993).
 - g. **Space Biology: Developmental Biology Discipline Plan**, Space Biology Program (1993).
 - h. **Space Biology: Gravity Sensing Neuroscience Discipline Plan**, Space Biology Program (1991).
 - i. **Space Biology: Musculoskeletal (Support Structures and Biomineralization) Discipline Plan**, Space Biology Program (1991).
 - j. **Space Biology: Regulatory Biology Discipline Plan**, Space Biology Program (1991).
 - k. **Space Biology: Plant Biology Discipline Science Plan**, Space Biology Program (1993).

- l. **Space Human Factors Program Plan**, Space Human Factors Program (1995).
 - m. **Space Human Factors Requirements Definition**, Space Human Factors Program (1996).
 - n. **Space Human Factors Discipline Science Plan**, Space Human Factors Program (1991).
 - o. **Space Radiation Health Program Plan** (1991). (*NTIS #N9318375 - \$17.50*)
3. Federation of American Societies for Experimental Biology (FASEB), Bethesda, MD 20814. Series of reports on space biomedical research.*
 - a. **Research Opportunities in Cardiovascular Deconditioning: Final Report Phase I**. 1983. M. N. Levy and J. M. Talbot (Eds.). NASA Contractor Report 3707. (*NTIS #N8329992 - \$26.00*)
 - b. **Research Opportunities in Space Motion Sickness: Final Report Phase II**. 1983. J. M. Talbot (Ed). NASA Contractor Report 3708. (*NTIS #N8329993 - \$25.00*)
 - c. **Research Opportunities in Bone Demineralization: Final Report Phase III**. 1984. S. A. Anderson and S. H. Cohn (Eds.). NASA Contractor Report 3795. (*NTIS #N8427417 - \$26.00*)
 - d. **Final Report Phase IV. Research Opportunities in Muscle Atrophy**. 1984. G. J. Herbison and J. M. Talbot (Eds.). NASA Contractor Report 3796. (*NTIS #N8427416 - \$26.00*)
 - e. **Research Opportunities in Immunocompetence in Space**. 1985. W. R. Beisel and J. M. Talbot (Eds.). NASA Contractor Report 176482. (*NTIS #N8621138 - \$25.00*)
 - f. **Research Opportunities in Human Behavior and Performance**. 1985. J. M. Christensen and J. M. Talbot (Eds.). NASA Contractor Report 3924. (*NTIS #N8519640 - \$26.00*)
 - g. **Research Opportunities in Loss of Red Blood Cell Mass in Space Flight**. 1985. J. M. Talbot and K. D. Fisher (Eds.). Contract Number NASW3924. (*NTIS #N8527517 - \$25.00*)
 - h. **Research Opportunities in Nutrition and Metabolism in Space**. 1986. P. L. Altman and K. D. Fisher (Eds.). Contract Number NASW3924.
 4. National Aeronautics and Space Administration, Life Sciences Division, Washington, DC 20546. Cumulative bibliographies of publications resulting from research supported by the Division.*
 - a. **Space Human Factors Publications: 1980-1990**. 1991. K. J. Dickson (Ed.). NASA Contractor Report 4351. (*NTIS # N9120620 - \$22.00*)

- b. **Publications of the Space Physiology and Countermeasures Program, Regulatory Physiology Discipline: 1980-1990.** 1992. J. W. Robinson, K. J. Dickson, E. Hess, and J. V. Powers (Eds.). NASA Contractor Report 4469. (*NTIS #N9233657 - \$34.50*)
 - c. **Publications of the Space Physiology and Countermeasures Program, Musculoskeletal Discipline: 1980-1990.** 1992. E. Hess, J. W. Robinson, K. J. Dickson, and J. V. Powers (Eds.). NASA Contractor Report 4468. (*NTIS #N9312898 - \$34.50*)
 - d. **Publications of the Space Physiology and Countermeasures Program, Cardiopulmonary Discipline: 1980-1990.** 1992. J. V. Powers, J. W. Robinson, K. J. Dickson, and E. Hess (Eds.). NASA Contractor Report 4475. (*NTIS #N9318376 - \$27.00*)
 - e. **Publications of the Space Physiology and Countermeasures Program, Neuroscience Discipline: 1980-1990.** 1992. K. J. Dickson, J. W. Robinson, J. V. Powers, and E. Hess (Eds.). NASA Contractor Report 4476. (*NTIS #N9315583 - \$27.00*)
 - f. **Publications of the Environmental Health Program: 1980-1990.** 1992. J. W. Robinson, E. Hess, and K. J. Dickson (Eds.). NASA Contractor Report 4455. (*NTIS #N9229341 - \$19.50*)
 - g. **Publications of the NASA Controlled Ecological Life Support System (CELSS) Program: 1989-1992.** 1994. J.V. Powers (Ed.). NASA Contractor Report 4603. (*NTIS #N9430122 - \$17.50*)
5. **Medical Policies and Requirements Document.** National Aeronautics and Space Administration, Medical Policy Board. Arnauld Nicogossian, Chairperson. NASA Headquarters, August, 1996.
 6. **A Strategy for Space Biology and Medical Science for the 1980s and 1990s.** National Academy of Sciences. National Research Council. Committee on Space Biology and Medicine. Jay M. Goldberg, Committee Chairperson. 1987. Washington, DC: National Academy Press. (*NTIS #N8924024 - \$46.50*)
 7. **Assessment of Programs in Space Biology and Medicine.** National Academy of Sciences. National Research Council. Committee on Space Biology and Medicine. 1991. Washington, DC: National Academy Press. (*NTIS #N9313327 - \$19.50*)
 8. **Exploring the Living Universe: A Strategy for Space Life Sciences.** National Aeronautics and Space Administration Advisory Council. Life Sciences Strategic Planning Study Committee. Frederick C.

- Robbins, Committee Chairperson. 1988. Washington, DC: National Aeronautics and Space Administration.*
9. **1989-90 NASA Space Biology Accomplishments**, T. Halstead, R. Dutcher, L. Pleasant (Eds). 1991. NASA TM 4258. Washington, DC: National Aeronautics and Space Administration. (NTIS #N9119697 - \$36.50)
 10. **1992-93 NASA Space/Gravitational Biology Accomplishments**. T. W. Halstead (Ed.). 1994. NASA TM 110130. Washington, DC: National Aeronautics and Space Administration.
 11. **NASA Workshop on Biological Adaptation**. E. Morey-Holton and M. Tischler (Eds.). 1988. NASA TM 89468. Moffett Field, CA: Ames Research Center, National Aeronautics and Space Administration. (NTIS #N8818174 - \$34.50)
 12. **Biological and Medical Experiments on the Space Shuttle 1981-1985**. T. W. Halstead and P. A. Dufour (Eds.). 1986. Washington, DC: National Aeronautics and Space Administration.*
 13. **Space Physiology and Medicine, 3rd ed.** A. Nicogossian, C. Huntoon, and S. Pool. (Eds.). 1994. Philadelphia, PA: Lea & Febiger.
 14. **Plants in Space**. T. W. Halstead and F. R. Dutcher. 1987. *Annual Review of Plant Physiology* 38:317-345.
 15. **Proceedings of the NASA Symposium on the Influence of Gravity and Activity on Muscle and Bone**. R. T. Whalen. 1991. *J. Biomechanics*, Vol. 24, Suppl. 1.
 16. **Proceedings of a Conference on Correlations of Aging and Space Effects on Biosystems**. R. L. Sprott and C. A. Combs. 1991. *Experimental Gerontology*, 26:121-309.
 17. **Gravity Effects on Reproduction, Development and Aging**. J. Miguel and K. A. Souza. 1991. In: *Advances in Space Biology and Medicine*, 1:71-97.
 18. **Gravity and the Cell**. Conference Report. 1991. *ASGSB Bulletin*, Vol. 4, No. 2, 260 pp.

19. **Clinostats and Centrifuges.** Symposium Report. 1992. *ASGSB Bulletin*, Vol. 5, No. 2, 91 pp.
20. **COSMOS 2044 Mission.** 1992. Supplement to *Journal of Applied Physiology* 73(23).
21. **Spaceflight Immunology.** G. R. Taylor (Ed.). 1993. *J. Leukocyte Biol.*, 54:179-268.
22. **Space and the Vestibular System.** L. R. Young (Ed.). 1993. *J. Vestibular Research*, 3:203-372.
23. **The Effects of Space Travel on the Musculoskeletal System.** R. W. Lynn, S. L. Gordon, and F. M. Sulzman. 1992. NIH Publication No. 93-3484. Bethesda, MD: NIAMS, National Institutes of Health.
24. **Report of the Workshop on Research in the Microgravity Environment Related to Cardiovascular, Pulmonary, and Blood Functions and Diseases.** 1994. Bethesda, MD: NHLBI, National Institutes of Health.*
25. **Space Biology and Medicine: Volume II, Life Support and Habitability.** F. M. Sulzman and A. M. Genin (Eds.). 1994. Washington, DC: American Institute of Aeronautics and Astronautics.
26. **Gravitational Cellular and Developmental Biology.** B. S. Spooner (Ed.). 1994. *J. Experimental Zoology*, 269:177-285.
27. **Impact of Altered Gravity on Aspects of Cell Biology.** D. E. Claassen and B. S. Spooner. 1994. *Int. Rev. of Cytology*, 156:301-373.
28. **NASA's Enterprise for the Human Exploration and Development of Space: The Strategic Plan.** 1996. Washington, DC: National Aeronautics and Space Administration. *

* *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 (703) 487-4650. If you are unable to locate a document through this means, please contact Information Dynamics, Inc. at (202) 358-4180.

**Instructions for Responding
to
NASA Research Announcements
for
Solicited Research Proposals**

1. Foreword

- a. NASA depends upon industry, educational institutions and other nonprofit organizations for most of its research efforts. While a number of mechanisms have been developed over the years to inform the research community of those areas in which NASA has special research interests, these instructions apply only to “NASA Research Announcements”, a form of “broad agency announcement” described in 6.102(d)(2) and 35.016 of the Federal Acquisition Regulation (FAR). The “NASA Research Announcement (NRA)” permits competitive selection of research projects in accordance with statute while at the same time preserving the traditional concepts and understandings associated with NASA sponsorship of research.
- b. These instructions are Appendix I to 18-70.203 of the NASA Federal Acquisition Regulation Supplement.

2. Policy

- a. NASA fosters and encourages the submission of research proposals relevant to agency mission requirements by solicitations, "NASA Research Announcements," which describe research areas of interest to NASA. Proposals received in response to an NRA will be used only for evaluation purposes.
- b. 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.
- c. 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. Purpose

These instructions are intended to supplement documents identified as "NASA Research Announcements." The NRAs contain programmatic information and certain "NRA-specific" 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. Relationship to Award

- a. A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded on the basis of a proposal submitted in response to an NRA. NASA does not have separate "grant proposal" and "contract proposal" categories, so all proposals may be prepared in a similar fashion. NASA will determine the appropriate instrument.
- b. Grants are generally used to fund basic research in educational and nonprofit institutions, while research in other private sector organizations is accomplished under contract. Additional information peculiar to the contractual process (certifications, cost and pricing data, facilities information, etc.) will be requested, as necessary, as the procurement progresses. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement (NHB 5100.4). Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NHB 5800. 1).

5. Conformance to Guidance

- a. NASA does not have any mandatory forms or formats for preparation of responses to NRAs; however, it is requested that proposals conform to the procedural and submission guidelines covered in these instructions. In particular, NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.
- b. In order to be considered responsive to the solicitation, 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. NASA reserves the right to reject any or all proposals received in response to an NRA when such action is considered in the best interest of the Government.

6. NRA-Specific Items

- a. Several proposal submission items will appear in the NRA itself. These include the unique NRA identifier, when to submit proposals, where to send proposals, number of copies required, and sources for more information.
- b. Items included in these instructions may be supplemented by the NRA, as circumstances warrant. Examples are: technical points for special emphasis, additional evaluation factors, and proposal length.

7. Proposal Contents

- a. The following general information is needed in all proposals in order 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.

b. Transmittal Letter or Prefatory Material

- (1) The legal name and address of the organization and specific division or campus identification if part of a larger organization
- (2) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press
- (3) Type of organization e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.
- (4) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation
- (5) Identification of any other organizations that are currently evaluating a proposal for the same efforts
- (6) Identification of the specific NRA, by number and title, to which the proposal is responding

- (7) Dollar amount requested of NASA, desired starting date, and duration of project
- (8) Date of submission
- (9) 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).

c. Restriction on Use and Disclosure of Proposal Information

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, but 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.

d. Abstract

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

e. Project Description

- (1) 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 in the field, and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the general plan of work, including the broad design of experiments to be undertaken and an adequate description of experimental methods and procedures. The project description should be prepared in a manner that addresses the evaluation factors in these instructions and any additional specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Note, however, that subcontracting significant portions of a research project is discouraged.
- (2) When it is expected that the effort will require more than one year for completion, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should, of course, 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.

f. Management Approach

For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and any necessary arrangements for ensuring a coordinated effort should be described. Aspects of any required intensive working relations with NASA field centers that are not logical inclusions elsewhere in the proposal should be described in this section.

g. Personnel

The principal investigator is responsible for direct supervision of the work and participates 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, 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.

h. Facilities and Equipment

- (1) 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 on the project.
- (2) 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 to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for both research and non-research purposes should be explained.

i. Proposed Costs

- (1) 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; 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 manpower data in terms of man-months or fractions of full-time.
- (2) 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. (Standard Form 1411 may be used).

- (3) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 18-31 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

j. Security

Proposals should not contain security classified material. However, if the proposed research requires access to or may generate security classified information, the submitter will be required to comply with applicable Government security regulations.

For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

k. Special Matters

- (1) 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.
- (2) 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.

8. Renewal Proposals

- a. Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. It is not necessary that a renewal proposal repeat all of the information that was in the original proposal upon which the current support was based. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the proposal are expected to be covered during the period for which extended 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.
- b. NASA reserves the right to renew an effort either through amendment of an existing contract or by a new award.

9. Length

Unless otherwise specified in the NRA, every effort should be made to keep proposals as brief as possible, concentrating on substantive material essential for a complete understanding of the project. Experience shows that few proposals need exceed 15-20 pages. Any necessary detailed information, such as reprints, should be included as attachments rather than in the main body of the proposal. 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: their availability may be mentioned in the proposal.

10. Joint Proposals

- a. Some projects involve joint efforts among individuals in different organizations or mutual efforts of more than one organization. Where multiple organizations are involved, the proposal may be submitted by only one of them. In this event, 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.
- b. Where a project of a cooperative nature with NASA is contemplated, the proposal should describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. However, the proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which purport to specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

11. Late Proposals

A proposal or modification thereto received after the date or dates specified in an NRA may still be considered if the selecting official deems it to offer NASA a significant technical advantage or cost reduction.

12. Withdrawal

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

13. Evaluation Factors

- a. 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.
- b. Evaluation of its intrinsic merit includes the consideration of the following factors, none of which is more important than any other:
 - (1) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
 - (2) The offeror's capabilities, related experience and publications, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
 - (3) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel who are critical in achieving the proposal objectives.
 - (4) Overall standing among similar proposals available for evaluation and/or evaluation against the known state-of-the-art.
 - (5) Deliverables and schedules where appropriate.
- c. Evaluation of the cost of a proposed effort includes the consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

14. 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, however, proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house where NASA has particular competence; others are evaluated by a combination of in-house people 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. Regardless of the technique, the final decisions are always made by a designated NASA selecting official. A proposal which is scientifically and programmatically meritorious, but which is not selected for award during its

initial review under the NRA may be included in subsequent reviews unless the proposer requests otherwise.

15. Selection for Award

- a. When a proposal is not selected for award, and the proposer has indicated that the proposal is not to be held over for subsequent reviews, the proposer will be notified that the proposal was not selected for award. NASA will notify the proposer and explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.
- b. 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 with the submitter. Formal RFPs are not used to obtain additional information on a proposal selected under the NRA process. However, the contracting officer may request certain business data and may forward a model contract and other information which will be of use during the contract negotiation.

16. Cancellation of NRA

NASA reserves the right to make no awards under this NRA and, in the absence of program funding or for any other reason, to cancel this NRA by having a notice published in the Commerce Business Daily. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation. Cancellation may be followed by issuance and synopsis of a revised NRA, since amendment of an NRA is normally not permitted.

**Required Application Forms
and
Instructions for Proposal Preparation**

This section contains the general instructions for proposal preparation and the specific forms required by proposers responding to agency solicitations in the space life sciences for 1997. The forms at the end of this section include the following:

Agency-Independent Forms

- Form A Solicited Proposal Application
- Form B Proposal Summary
- Form C Space-Flight Experiment Supplementary Application Information (Optional)
- Form D Checklist for Proposers
- Form E Multinational Space Station Human Research Informed Consent

Agency-Specific Forms

National Aeronautics and Space Administration (NASA)

- Form US-1 Program Applicability
- Form US-2 Detailed Budget, First Year
- Form US-3 Detailed Budget, Entire Project Period
- Form US-4 Certification Regarding Drug-free Workplace Requirements
- Form US-5 Certification Regarding Debarment, Suspension, and Other Responsibility Matters
- Form US-6 Certification Regarding Lobbying

Instructions for Proposal Preparation

The information contained in these instructions is specific to this Announcement and supplements the general guidance provided in Appendix B.

All U.S. proposals should include one copy of each of the forms provided in this Appendix as part of the complete submission, with the exception of Form C that is submitted only with flight experiments. Non-U.S. proposals with no U.S. component are not required to submit Forms US-1, US-2, US-3, US-4, US-5, or US-6.

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

- (1) Transmittal Letter
- (2) Cover Page: Solicited Proposal Application (Form A)*
- (3) Proposal Abstract (Form B)
- (4) Detailed Budget, 12 Month (Form US-2)
- (5) Detailed Budget, Entire Project Period (Form US-3)
- (6) Proposal Title Page, with Notice on Restriction on Use and Disclosure of Proposal Information, if any
- (7) Project Description
- (8) Space Flight Experiment Supplementary Application Information (to be submitted with flight experiments only) (Form C)
- (9) Management Approach
- (10) Personnel
- (11) Facilities and Equipment
- (12) Supporting Budgetary Information
- (13) Special Matters (specific information on animal and/or human subjects protocol approval required, if applicable)*
- (14) Certification Regarding Drug-Free Workplace (Form US-4)*
- (15) Certification Regarding Debarment, Suspension, and Other Responsibility Matters (Form US-5)*
- (16) Certification Regarding Lobbying (Form US-6)*
- (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
- (18) Checklist for Proposers (Form D)
- (19) Appendices, if any

* One signed original required

Except for the Project Description Section, there is no specific page limitation on proposals submitted. However, every effort should be made to keep proposals as brief as possible. 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 four (4) years but should be suitable for the project proposed.

(1) Transmittal Letter

The transmittal letter should contain, at least:

- (a) The legal name and address of the organization and specific division (or campus identification if part of a larger organization) that proposes to carry out the project
- (b) A brief project title intelligible to a scientifically literate reader and suitable for use in the public press
- (c) The name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation
- (d) The identification of the specific NRA, by number and title, to which the proposal is responding
- (e) The signature of the responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization

A copy of the Checklist for Proposers (Form D) should be attached to this letter. Only one copy of the transmittal letter is required; it should be attached to the single original signature version of the submitted proposal.

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

The information on Form A must be filled out completely, and one original signature version of this form should be submitted with the transmittal letter above.

For Item (7) on this form, new means that a proposal for this project has not been submitted to NASA in 1995 or 1996, renewal means that this proposal is for the continuation of an already funded task beyond the term of the funded proposal, and revised means that this proposal represents a revision of a proposal

submitted to NASA in 1995 or 1996, but not funded. A proposal previously submitted but not funded should be termed revised even if the original principal investigator has changed for 1997. Renewal and revised applications should contain special material described in the Project Description section, below.

Note that items (9) and (10) on Form A require assurance of compliance with human subject and/or animal care provisions of NASA regulations (see Special Matters section, below). Applicants should be aware that review of a proposal will not be undertaken without prior assurance of compliance.

(3) 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 Division. Applicants are requested to classify their proposals as either scientific or technical. Scientific proposals should be differentiated from technical proposals by two characteristics – the underlying objective of the proposal and the method proposed for reaching that objective. Scientific proposals generally have, as their primary objective, the development of new knowledge through the scientific method (i.e., through the development and testing of a scientific hypothesis). Technical proposals, on the other hand, usually have the development of technologies or processes as their primary objective, and propose engineering methods, evaluations, and trade studies to reach their objective.

(4) Detailed Budget, 12 Month (Form US-2)

(5) Detailed Budget, Entire Project Period (Form US-3)

These forms are self-explanatory budget forms that 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.

Foreign proposals with no U.S. component should not submit these forms but, as explained in Appendix A, should be endorsed in writing by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. This endorsement should indicate that:

- (a) The proposal merits careful consideration by NASA, and
- (b) If the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(6) Proposal Title Page, with Notice on Restriction on Use And Disclosure of Proposal Information, If Any

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, but 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.

(7) Project Description

The length of the Project Description section of the proposal should not exceed 25 pages using regular (12 point) type. The proposal should contain sufficient detail to enable a reviewer 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 indicate clearly 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). If an investigator wishes to propose related studies of two different types (e.g., a ground-based research investigation and a related space-flight experiment), then two proposals should be submitted with their linkage described in each proposal.

Renewal applications (for competing renewal of currently funded activity) must include a progress report as an Appendix to the proposal, and should refer to this Appendix appropriately throughout the Project Description section.

Revised applications (revisions of 1995 or 1996 submissions) must include, as part of the Project Description section, an **Introduction** that contains responses to the criticisms in the previous critique. Applicants should 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 and/or include substantial revisions may be penalized in the review process.

(8) Space Flight Experiment Supplementary Application Information (Optional, Form C)

All applicants proposing space flight research should complete Form C. The information on this form is essential for the evaluation of the feasibility of carrying out the proposed study. Before filling out this form, applicants should read Section 2.0 of the *Space Life Sciences Standard Companion Document 1996* carefully and make certain that they understand the accommodation constraints that are associated with flight experiments. In addition, applicants should utilize available equipment to implement the proposed experiment (as listed in Section 3.0 of the companion document), or should provide a low-cost available alternative. Failure to do this may preclude implementation of the experiment.

(9) 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 should state clearly and unambiguously whether these key personnel have reviewed the proposal and endorsed their participation.

(10) Personnel

The principal investigator is responsible for direct supervision of the work and participates 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, and 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.

(11) Facilities and Equipment

Describe the 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 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 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 typically can be used for both research and non-research purposes should be explained.

(12) Supporting Budgetary Information

This section should include the supporting information required by Forms US-2 and US-3. In this NRA, the terms "cost" and "budget" are used synonymously. Sufficient proposal cost detail and supporting information will facilitate a speedy evaluation and award. Dollar amounts proposed with no explanation (e.g.,

Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award. Generally, NASA will evaluate costs as to reasonableness, allowability, and allocatability. The budgetary forms define the desired detail, but each category should be explained in the body of the proposal. 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 manner to prepare 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. Example:

<u>Hours</u>	<u>Rate</u>	<u>Amount</u>
Principal Investigator	100	\$19.34 \$1,934
Co-Investigator	450	\$11.78 \$5,301
Clerical Support	<u>75</u>	<u>\$ 8.70</u> <u>\$ 652</u>
Total	625	\$7,887

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.

Other Costs

Each significant cost category, such as travel, should be detailed, explained, and substantiated. Past experience has indicated that up to six trips may be necessary for a flight experiment. (i.e., Crew Familiarization (Johnson Space Center, JSC), pre-flight Science Verification Test (Kennedy Space Center, KSC), L-14 day

Press Briefing (JSC), Mission Preparation/Operations (KSC), Post-Flight Ground Control (KSC), Post-Flight Results Symposium). Format should be as follows:

Travel Costs

<u>Destination</u>	<u>Duration</u>	<u>Airfare</u>	<u>Per Diem</u>	<u>Total</u>
Moffett Field, CA	3 days	\$500	\$300	\$800
Washington, DC.	1 day	\$500	\$100	\$600
Total				\$1,400

If the proposal is for competitive renewal of an ongoing research effort beyond the present period of approval, the proposal cost section should include an estimate of any significant amount of unspent or uncommitted funds remaining at the completion of the current period of performance.

The supporting budgetary information section of the proposal should include information concerning other current projects being conducted by the Principal Investigator and funded either by NASA or any other Government agency.

Provide the title of project, the sponsoring agency, the project period, the investigator's time commitment, and the value of the project. The following format is recommended:

Funding Organization	Title	Number	Total Project		
			Period	Total Effort	Direct Costs
NIH	Bone Mineralization	R01 NS 01234-06	12/89-11/94	30%	\$100,000
NSF	Osteosclerosis	DRF 7683-05	6/90-5/93	10%	\$20,000

(13) 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 and/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 (ACUC) or both, as appropriate, regarding approval of the experimental protocol, should be included with each copy of the proposal. All non-NASA proposals providing ACUC approval must also contain the institution's Public Health Assurance number. All non-US proposals should provide certification from the investigator's institution stating that the proposal has been reviewed and approved to be compliant with international regulations on bioethics standards for the use of animals or humans in research. Applicants should note that this is a strong requirement: **Review of the proposal will not be undertaken until this information is supplied to NASA.**

NASA is a participating agency for the "Presidential Early Career Awards for Scientists and Engineers." NASA will select its Awardees based on exceptionally meritorious proposals funded through the traditional grants process, including this NRA. Awardees must be U.S. citizens, nationals, or permanent residents who have received their highest degree within five years.

- (14) Certification Regarding Drug-Free Workplace (Form US-4)**
- (15) Certification Regarding Debarment, Suspension, and Other Responsibility Matters (Form US-5)**
- (16) Certification Regarding Lobbying (Form US-6)**

These three certifications are required of all U.S. applicants before a grant/contract can be awarded. They are not required of foreign proposals with no budget section.

- (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**

Self-explanatory.

- (18) Checklist for Proposers (Form D)**

One copy of a completed version of this checklist should be attached to the transmittal letter.

(19) Appendices, If Any

Renewal applications (for competing renewal of currently funded activity) must include an Appendix providing a Progress Report of the previously funded activity. That report should give the beginning and ending dates for the period covered since the project was last reviewed competitively and provide a list of all personnel who have worked on the project during this period (including dates of service and percentages of their appointments devoted to the project). The report should also summarize the previous project's original goals and specific objectives and provide a succinct account of published and unpublished results indicating progress toward their achievement. Changes in these objectives during the course of the project and a rationale for these changes should be presented. The importance of the findings should be summarized and discussed. Finally, a list should be provided of the titles and complete references to all publications, manuscripts submitted or accepted for publication, patents, invention reports, and other printed materials that have resulted from the project since it was last competitively reviewed.

Other Appendices may be appropriate for particular proposals.

FORM A

SOLICITED PROPOSAL APPLICATION FOR SPACE LIFE SCIENCES
 IN RESPONSE TO ANNOUNCEMENT # _____

PLEASE FOLLOW INSTRUCTIONS CAREFULLY

LEAVE BLANK

NUMBER

REVIEW GROUP

DATE RECEIVED

1. COMPLETE TITLE OF PROJECT

2. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR *(First, middle, and last name; degrees; position title)*

3. COMPLETE MAILING ADDRESS

4. TELEPHONE NUMBER
(area code, number, extension)
 FAX NUMBER
 E-MAIL ADDRESS

5. CONGRESSIONAL DISTRICT (U.S. ONLY)

6. SOCIAL SECURITY # (U.S. ONLY)

7. IS THIS PROPOSAL NEW RENEWAL REVISED

8. HAS THIS PROPOSAL (OR SIMILAR REQUEST) BEEN SUBMITTED TO ANY OTHER AGENCY?
 No Yes IF YES, SPECIFY AGENCY AND YEAR SUBMITTED:

9. CO-INVESTIGATORS *(First, middle, and last name; degrees)*

10. CO-INVESTIGATOR'S ORGANIZATION

11. DATES OF ENTIRE PROPOSED PROJECT PERIOD

12. COSTS REQUESTED FOR FIRST 12-MONTH BUDGET PERIOD

13. PROPOSED BUDGET PERIOD

From:
 Through:

12a. Direct Costs
 \$

12b. Total Costs
 \$

13a. Direct Costs
 \$

13b. Total Costs
 \$

14. APPLICANT ORGANIZATION *(Organization Name)*

15. TYPE OF ORGANIZATION (U.S. ONLY)

Non Profit For Profit *(General)* For Profit *(Small Business)* Public, Specify: Federal State Local

16. ~~ORGANIZATION OFFICIAL TO BE NOTIFIED IF AN AWARD IS AWARDED~~

17. OFFICIAL SIGNING FOR APPLICANT ORGANIZATION

18. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR ASSURANCE:

SIGNATURE OF PERSON NAMED IN 2
(In ink "Per" signature not acceptable.)

DATE

19. CERTIFICATION AND ACCEPTANCE:

SIGNATURE OF PERSON NAMED IN 17
(In ink "Per" signature not acceptable.)

DATE

FORM B

PROPOSAL ABSTRACT

Principal Investigator: _____

Proposal Title: _____

Abstract

{Prepare a brief description of the application stating the broad, long-term objectives and specific aims of the proposed work. Describe concisely the research design and methods for achieving these objectives and aims. This abstract is meant to serve as a succinct and accurate description of the proposed work when separated from this application. Limit abstract to 300 words or fewer.}

Key Words:

{Assign numbers (1- highest relevance, 3-moderate relevance) to the areas that best describe your proposed research. Choose a maximum of three areas}

- | | | |
|---|--|--|
| <input type="checkbox"/> Neuroscience | <input type="checkbox"/> Spacecraft Systems and Hardware | <input type="checkbox"/> Developmental Biology |
| <input type="checkbox"/> Regulatory Physiology | <input type="checkbox"/> Space Suit Design | <input type="checkbox"/> Genetics |
| <input type="checkbox"/> Behavior | <input type="checkbox"/> EVA/IVA Physiology | <input type="checkbox"/> Plant Biology |
| <input type="checkbox"/> Human Factors Studies | <input type="checkbox"/> Radiation Biology | <input type="checkbox"/> Molecular Biology |
| <input type="checkbox"/> Skeletal System | <input type="checkbox"/> Cell Biology | <input type="checkbox"/> Reproductive Physiology |
| <input type="checkbox"/> Muscle Physiology | <input type="checkbox"/> Radiation Physics | <input type="checkbox"/> Immunology |
| <input type="checkbox"/> Air/Food/Water
Regeneration | <input type="checkbox"/> Cardiopulmonary Physiology | <input type="checkbox"/> Other _____ |

FORM C
SPACE FLIGHT EXPERIMENT SUPPLEMENTARY APPLICATION FORM

The following form should be completed by all investigators proposing flight experiments. This form should be inserted into the Project Description section of the proposal. (Provide responses on additional sheets, as necessary.)

Principal Investigator _____

Proposal Title _____

Type of Flight Experiment: ___ Short Duration ___ Long Duration ___ Pre/Post-Flight

- (1) If humans are required as subjects for the proposed investigation, please list
 - a) number of subjects
 - b) special subject restrictions, such as specific dietary regimens or fluid intake regulation
 - c) special experiment protocols, such as specific work/rest cycles or exercise
 - d) physiological variables to be measured.
- (2) If non-humans are required for the proposed investigation, please list
 - a) scientific name of species and common name
 - b) gender, strain, age, stage, and weight (if applicable)
 - c) minimum number required, desired number, and a rationale for both
 - d) special requirements for maintenance or manipulation of the specimens.
- (3) List major hardware items required in this investigation. Hardware items are listed in the document titled "*Standard Companion Document for Space Life Sciences, 1996*".
- (4) Estimate access time
 - a) Is late access needed and when (i.e., do you need to load the experiment and/or species within a certain time period before a launch)?
 - b) Is early removal needed and when (i.e., do you need to remove the experiment and/or species within a certain time period after landing? If so, please specify requirement.)?
- (5) Identify potentially hazardous materials, including biowaste.
- (6) Are there any specific conditions requested, such as air composition, humidity, temperature control, or illumination?
- (7) For Space Station experiments, estimate the maximum and minimum number of days of microgravity exposure required.
- (8) Estimate the total set of operations required to carry out the experiment in space (e.g., the number of sessions of crew activity and the time required for each session).
- (9) Estimate amount of time for crew participation with experiment before, during and after flight (e.g., data collection, crew training, etc.)

Responses (continue on additional sheets):

FORM D

CHECKLIST FOR PROPOSERS

The following Checklist should be enclosed with the transmittal letter and annotated to indicate that the stated items have been included in the proposal package.

Principal Investigator/Program Director _____

<input type="checkbox"/> Form A: Solicited Proposal Application*	<input type="checkbox"/> Facilities and Equipment
<input type="checkbox"/> Form B: Proposal Summary	<input type="checkbox"/> Supporting Budgetary Information (include current support: list of other funded projects)
<input type="checkbox"/> Form US-2: Detailed 12 month Budget (First year of support)	<input type="checkbox"/> IRB or ACUC letter/ form regarding protocol approval, if applicable*
<input type="checkbox"/> Form US-3: Summary Budget Form	<input type="checkbox"/> Form US-4: Certification Regarding Drug-Free Workplace*
<input type="checkbox"/> Title Page	<input type="checkbox"/> Form US-5: Certification Regarding Debarment, Suspension, and Other Responsibility Matters*
<input type="checkbox"/> Project Description	<input type="checkbox"/> Form US-6: Certification Regarding Lobbying*
<input type="checkbox"/> Form C: Space-Flight Exp. Supplementary Information, if applicable	<input type="checkbox"/> Appendices, if any
<input type="checkbox"/> Management Approach	<input type="checkbox"/> 20 copies of all material listed above
<input type="checkbox"/> Personnel, CVs; Biographical Summaries	<input type="checkbox"/> 3.5 inch computer diskette

*One signed original form required.

Only one copy of the following materials needs to be submitted:

<input type="checkbox"/> Transmittal Letter
<input type="checkbox"/> Form D: This checklist indicates all items have been enclosed

FORM E
MULTINATIONAL SPACE STATION
HUMAN RESEARCH INFORMED CONSENT*

1. I, the undersigned, do voluntarily give my informed consent for my participation as a test subject in the following research study, test, or investigation:

NAME OF INVESTIGATION _____

MISSION TO WHICH ASSIGNED _____

PRINCIPAL INVESTIGATOR _____

RESPONSIBLE PROJECT SCIENTIST _____

I understand or acknowledge that:

- (a) This procedure is part of an investigation approved by participating agencies.
- (b) I am performing these duties as part of my employment with _____.
- (c) This research study has been reviewed and approved by the Multinational Review Board (MRB) which has also determined that the investigation involves _____ risk to the subject.
(minimal or reasonable)
- (d) Definitions:
“Minimal risk” means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

“Reasonable risk” means that the probability and magnitude of harm or discomfort anticipated in the research are greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests, but that the risks of harm or discomfort are considered to be acceptable when weighed against the anticipated benefits and the importance of the knowledge to be gained from the research.
- (e) The research procedures were explained to me prior to the execution of this form. I was afforded an opportunity to ask questions, and all questions asked were answered to my satisfaction. A layman’s description was provided to me.**
- (f) I consider myself physically and mentally qualified to participate in the investigation.
- (g) I know that I can refuse to participate in the tests at any stage of their performance, and my refusal will be honored, except in those cases when, in the opinion of the responsible physician, termination of the tests could have detrimental consequences for my health and/or the health of the other subjects. However, understanding the significance of the investigations (tests), I will give every effort to perform the full scope of the program.
- (h) In the event of injury resulting from this study, I understand that I will receive medical attention and necessary treatment. I also understand that I will be compensated for any injuries to the extent permitted under current _(TBD)_ and the provisions of the contract between _(TBD)_. My agreement to participate shall not be construed as a release of _(TBD)_ or any third party from any future liability which may arise from, or in connection with, the above procedures.

- (i) Consistent with statutory and Agency-approved routine uses under the _(TBD)_, the confidentiality of any data obtained as a result of my participation as a research subject in this study shall be maintained, so that no data may be linked with me as an individual. However, if a “life-threatening” abnormality is detected, the investigator will notify me and the _(TBD)_. Such information may be used to determine the need for care or medical follow-up, which, in certain circumstances, could affect my professional (flight) status.

Test Subject

Date

2. I, the undersigned, the Principal Investigator of the investigation designated above, certify that:

- (a) I have accurately described the procedure and related risk(s) to the test subject.
- (b) The test setup involves _____ risk to the test subject as determined by the MRB.
(minimal or reasonable)
- (c) All equipment to be used has been inspected and certified for safe and proper operation.
- (d) The test subject is qualified to participate in my experiment protocol.
- (e) The test protocol has not been changed from that originally approved by the MRB.

Principal Investigator

Date

Concurrence:

Project Scientist

Date

Notes:

* This form is valid for the period including preflight, in-flight, and postflight data collection sessions for the mission. Before the first baseline data collection, the Principal Investigator will repeat the briefing concerning risks involved in the investigation. A signed, dated copy of this form with attachments must be forwarded to Chair, Multinational Review Board.

** A detailed description of the investigation will be attached to this consent form. The Principal Investigator is responsible for formulating this document, which should be in layman’s terms such that the subject clearly understands what procedures will be required and the risks associated therewith. The detailed description of the research procedures must specifically list the risks associated with the procedures to be employed, the possible adverse reactions of all medications to be administered, and the risks/hazards resulting from exposure to ionizing radiation. Further, the investigator must clearly specify all forms of subject behavior interdicted by the research protocol (exercise, diet, medications, etc.).

PROGRAM APPLICABILITY

Principal Investigator: _____

Co- Investigators: _____

Proposal Title: _____

Proposal Type:

SCIENTIFIC PROPOSAL _____
OR
TECHNICAL PROPOSAL _____

GROUND-BASED RESEARCH _____
OR
SPACE FLIGHT EXPERIMENT _____

{Place a single check in the "Primary Area" column next to the program that is most closely aligned with your proposal. Optional: Place a check in the "Secondary Area" column if your proposal has a dual-program emphasis}

	<u>Primary Area</u>	<u>Secondary Area</u>
GRAVITATIONAL BIOLOGY	_____	_____
SPACE PHYSIOLOGY	_____	_____
ENVIRONMENTAL HEALTH	_____	_____
SPACE RADIATION HEALTH	_____	_____
BEHAVIOR & PERFORMANCE	_____	_____
ADVANCED TECHNOLOGY DEVELOPMENT	_____	_____
SPACE HUMAN FACTORS ENGINEERING	_____	_____
ADVANCED LIFE SUPPORT	_____	_____
ADVANCED ENV. MONITORING & CONTROL	_____	_____

FORM US-2

PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR: _____

DETAILED BUDGET FOR 12-MONTH BUDGET PERIOD DIRECT COSTS ONLY		FROM	THROUGH		
Duplicate this form for each year of grant support requested		DOLLAR AMOUNT REQUESTS <i>(Omit cents)</i>			
PERSONNEL <i>(Applicant Organization Only)</i>		EFFORT ON PROJECT	SALARY	FRINGE BENEFITS	TOTALS
NAME	ROLE IN PROJECT				
	Principal Investigator				
SUBTOTALS →					
CONSULTANT COSTS					
EQUIPMENT <i>(Itemize, use additional sheet if needed)</i>					
SUPPLIES <i>(Itemize by category, use additional sheet if needed)</i>					
TRAVEL	DOMESTIC				
	NON-DOMESTIC				
OTHER EXPENSES <i>(Itemize by category, use additional sheet if needed)</i>					
TOTAL DIRECT COSTS FOR FIRST 12-MONTH BUDGET PERIOD <i>(Item 12a, Form A)</i>				\$	
INDIRECT COSTS FOR FIRST 12-MONTH BUDGET PERIOD				\$	
TOTAL COSTS FOR FIRST 12-MONTH BUDGET PERIOD <i>(Item 12b, Form A)</i>				\$	

FORM US-3

PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR: _____

BUDGET FOR ENTIRE PROJECT PERIOD DIRECT COSTS ONLY

BUDGET CATEGORY TOTALS		1st BUDGET PERIOD	ADDITIONAL YEARS OF SUPPORT REQUESTED		
			2nd	3rd	4th
PERSONNEL (Salary and Fringe Benefits) (Applicant organization only)					
CONSULTANT COSTS					
EQUIPMENT					
SUPPLIES					
TRAVEL	DOMESTIC				
	NON-DOMESTIC				
OTHER EXPENSES					
TOTAL DIRECT COSTS FOR EACH BUDGET PERIOD		\$	\$	\$	\$
TOTAL INDIRECT COSTS FOR EACH BUDGET PERIOD		\$	\$	\$	\$
TOTAL DIRECT + INDIRECT COSTS FOR EACH BUDGET PERIOD		\$	\$	\$	\$
TOTAL DIRECT + INDIRECT COSTS FOR ENTIRE PROJECT					\$

JUSTIFICATION FOR UNUSUAL EXPENSES (Detail Justification in Cost Section of Proposal)

CERTIFICATION REGARDING DRUG-FREE WORKPLACE REQUIREMENTS

certification is required by the regulations implementing the Drug-Free Workplace Act of 1988, 34 CFR Part 85, Subpart F. The regulations published in the January 31, 1989 Federal Register, require certification by grantees, prior to award, that they will maintain a drug-free workplace. The certification set out below is a material representation of fact upon which reliance will be placed when the agency determines to award the grant. A certification or violation of the certification shall be grounds for suspension of payments, suspension or termination of grants, or government suspension or debarment (see 34 CFR Part 85, Sections 85.615 and 85.620).

GRANTEES OTHER THAN INDIVIDUALS

The grantee certifies that it will provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing a drug-free awareness program to inform employees about --
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will --
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;
- (e) Notifying the agency within ten days after receiving notice under subparagraph (d) (2) from an employee or otherwise receiving actual notice of such conviction;
- (f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d) (2), with respect to any employee who has been so convicted --
 - (1) Taking appropriate personnel action against such an employee, up to and including termination; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or Local health, Law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

The grantee shall insert in the space provided below the site(s) for the performance or work done in connection with the specific grant:
Site of Performance (Street address, city, county, state, zip code)

_____ if there are workplaces on file that are not identified here.

GRANTEES WHO ARE INDIVIDUALS

The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance in conducting any activity with the grant.

Organization Name AO or NRA Number and Title

Name and Title of Authorized Representative

Signature Date

**CERTIFICATION REGARDING
DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS
PRIMARY COVERED TRANSACTIONS**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participants' responsibilities. The regulations were published as Part VII of the May 28, 1988 Federal Register (pages 19160-19211). Copies of the regulations may be obtained by contacting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, D.C. 20202-4725, telephone (202) 732-2505.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- (a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- (b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

AO or NRA Number and Title

Printed Name and Title of Authorized Representative

Signature

Date

Printed Principal Investigator Name

Proposal Title

**CERTIFICATION REGARDING
LOBBYING**

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, an or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Organization Name

AO or NRA Number and title

Printed Name and Title of Authorized Representative

Signature

Date

Printed Principal Investigator Name

Proposal Title