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**National Aeronautics and
Space Administration**

Research Announcement

**Research Opportunities
in
Space Life Sciences**

**Advanced Human Support
Technology Program**

2001

**A Research Announcement for the
Bioastronautics Research Division**

Notices of Intent Due:
Proposals Due:

February 26, 2001
April 26, 2001

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NASA Research Announcement

Research Opportunities in Space Life Sciences

Advanced Human Support Technology Program

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) is restricted to the Advanced Environmental Monitoring and Control (AEMC) and Advanced Life Support (ALS) Projects within the Advanced Human Support Technology (AHST) Program and the Advanced Extravehicular Activity (AEVA) Project. Investigators should read carefully the individual project descriptions in Appendix A and focus their proposals on the specific research emphases defined in this Announcement. Note that the Space Human Factors Engineering Project within the AHST Program is not soliciting research through this Announcement. The Space Human Factors Engineering Project will solicit research and technology development through the NRA for the Biomedical Research and Countermeasures Program. Information on the release of this and other life sciences NRAs can be found on the following website:

<http://peer1.idi.usra.edu>

*Proposals received outside of the annual NRA cycle are considered to be **unsolicited proposals**.. Programmatically relevant unsolicited proposals in most cases will be held until the next annual review period or will be returned to the proposer without review. Proposals for Research and Technology Development (R&TD) in areas outside those defined in this Announcement will be returned to the proposer without review. However, in all cases, NASA reserves the right to act in the best interests of the Federal Government in the matter of acceptance for evaluation of unsolicited proposals received outside the annual NRA cycle.*

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals to participate in research opportunities in the Advanced Human Support Technology (AHST) Program of the Bioastronautics Research (BR) Division of NASA's Biological and Physical Research (BPR) Enterprise. This Announcement solicits research proposals that support the opening of the space frontier by exploring, using, and enabling the development of space, and by expanding human experience in space. The research supported by the BR Division will increase knowledge of nature's processes using the space environment, aid in the exploration of the Solar System, support the achievement of routine space travel, and enrich life on Earth through the use of space technology and the application of biomedical knowledge. The BPR Enterprise also seeks to share new knowledge, technologies, and assets that promise to enhance the quality of life on Earth.

The mission of the BPR Enterprise is to use the synergy between physical, chemical and biological research in space to acquire fundamental knowledge and generate applications for

space travel and Earth applications. The Enterprise will use interdisciplinary fundamental and applied research to find new ways to withstand the space environment, to take advantage of the unique space environment for conducting research in science and engineering, and to generate new technology.

Research in the AHST Program is in consonance with the following goals of NASA's BPR Enterprise:

- Conduct research to enable safe and productive human habitation of space
- Use the space environment as a laboratory to test the fundamental principles of physics, chemistry and biology
- Use space research opportunities to improve academic achievement and the quality of life

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

The AHST Program seeks to fund the development of advanced technologies for use on the International Space Station (ISS) beyond the currently baselined technologies, on a Mars Transit Habitation vehicle, or for use in a Lunar or Martian habitat. Special emphasis is placed on those technologies that will have a dramatic impact on the reduction of required mass, power, volume, crew time, and increased safety and reliability.

For Fiscal Year 2002, each of the three areas of this NRA has a unique proposal solicitation with particular needs for specific kinds of proposals in specific areas of emphasis. Therefore, it is critical that potential applicants read carefully the AHST Program and Project descriptions in Appendix A of this announcement.

Proposals will be evaluated by independent peer review panels for overall scientific or technical merit, including an assessment of the innovativeness of the proposed work. Where appropriate, NASA will also conduct separately an assessment of the cost, relevance to AHST programmatic needs and goals, flight feasibility and the feasibility of implementation by NASA after the work is completed. See Appendix A, section V for more details on proposal evaluation and awards selection process.

A selection announcement will be made in September of 2001, pending budget availability. Funding of selected proposals will begin between October and December of 2001. NASA's obligation to make awards is contingent upon the receipt of proposals that the government determines are acceptable for award under this NRA and the availability of annually

appropriated funds from which payment for award purposes can be made. Continuation of multiple year awards is dependent on evidence of satisfactory annual progress (see Appendix A, sections VI.A. and VI.D.) and availability of funding.

It is anticipated that there will be 15-20 total awards for proposals submitted in response to this NRA and that awards will average approximately \$175,000 per year. Support for Pilot Studies will be somewhat lower, approximately \$80,000 per study.

Due to programmatic needs and funding constraints, NASA may in certain cases elect to fund only a portion of a proposed effort and/or may request that the applicant collaborate with other investigators in a joint investigation. In these cases, the applicant will be given the opportunity to accept or decline such partial acceptance or teaming with other investigators prior to a NASA selection. Where collaboration with other investigators as a team is agreed to, one of the team members will be designated by NASA as its leader or contact point.

Participation in this Announcement is open to all individuals and all categories of 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 industry or by other government agencies are encouraged. Although NASA under certain circumstances will review proposals from non-U.S. institutions, NASA does not fund research at non-U.S. institutions (see Appendix A, section VI.C.).

Awards made as a result of this NRA will primarily be funded as grants. Either a grant, cooperative agreement, or contract may be used; however, to accomplish an effort funded in response to this NRA, NASA will determine the appropriate instrument. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1D). Commercial organizations are encouraged to propose resource sharing in their cost plans.

Further details concerning the AHST Program and the preparation of proposals in response to this Announcement are included in the attached appendices.

- Appendix A provides technical information about AHST Program Projects and other information that is applicable only to this Announcement.
- Appendix B contains a description of NASA facilities.
- Appendix C contains detailed instructions that apply specifically to this NRA and includes the relevant application forms.
- Appendix D contains general instructions applicable to the preparation of proposals in response to NASA Research Announcements.

A notice of intent (NOI) to propose is requested by February 26, 2001 by 4:30 PM Eastern Time (see Appendix A, section VI.F.). NOIs should be submitted via the World-Wide Web (WWW) at:

http://peer1.idi.usra.edu/expro/noi/01_OBPR_01_noi.cfn

If you do not have access to the World-Wide Web, you may submit an NOI via email to:

noi@hq.nasa.gov

The subject heading of the e-mail message should read “NOI NRA 01-OBPR-01.” If you do not have access to e-mail, you may submit an NOI by U.S. Postal Service or commercial delivery to the address listed below for proposal submission.

Proposals may not be submitted electronically. ***Proposals must be received by April 26, 2001, 4:30 PM Eastern Time.*** Proposals and NOIs mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA c/o NASA Peer Review Services (NPRS)
SUBJECT: NASA AHST Research Proposal
500 E Street, SW
Suite 200
Washington, DC 20024

Proposals and NOIs that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 AM and 4:30 PM EDT. The telephone number, 202-479-9030, may be used when required for reference by delivery services. NPRS cannot receive deliveries on Saturdays, Sundays, or federal holidays. Upon receiving a proposal, NPRS will send a notification to the proposer confirming its arrival.

In order to be accepted as a complete submission, proposals **must include** completed copies of the appropriate forms provided in Appendix C. Special instructions apply to proposals by institutions that are not entities of the United States (see Appendix A, section VI.C.).

The following items apply only to this Announcement:

Solicitation Announcement Identifier:	NRA 01-OBPR-01
Number of Proposal Copies Required:	Original + 20 copies, double-sided pages highly encouraged
Notice of Intent Due:	February 26, 2001
Proposals Due:	April 26, 2001
Selecting Official:	Director Bioastronautics Research Division Biological & Physical Research Enterprise

Additional Programmatic Information:

Charles J. Barnes, Ph.D., Acting Lead
Advanced Human Support Technology Program
Bioastronautics Research Division

NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-2365
Fax: (202) 358-4168

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

Kathie L. Olsen, Ph.D.
Acting Associate Administrator for
Office of Biological and Physical Research

Advanced Human Support Technology Program

I. Introduction

The National Aeronautics and Space Administration (NASA) Bioastronautics Research (BR) Division seeks proposals for the Advanced Human Support Technology (AHST) Program in support of the Biological and Physical Research (BPR) Enterprise. This Announcement solicits scientific and technical proposals to be funded during fiscal year 2002, either for new research or for the continuation of research beyond the term specified in a previously funded proposal.

This announcement solicits proposals for the following projects within the AHST Program and for the Advanced Extravehicular Activity project. These projects are:

- Advanced Environmental Monitoring and Control (AEMC)
- Advanced Life Support (ALS)
- Advanced Extravehicular Activity (AEVA)

Note: It is critical that the prospective investigator read the relevant project description section(s) in this Appendix carefully, as many of the areas of programmatic emphases are different from those in previous Life Sciences Division NASA Research Announcements (NRA).

In addition to requirements specified in other sections of this NRA, investigators responding to this announcement for the AHST Program will be expected to do the following:

- Include a one-page justification on how the proposed research satisfies the unique requirements of the AHST program in general and the research element in particular. The justification should include reference to relevant risks identified in the Critical Path Research Plan (available at <http://criticalpath.jsc.nasa.gov/>, follow links to appropriate discipline area) that the proposed research might mitigate. In fulfilling this requirement, investigators are encouraged to refer also to current Project Plans and other relevant background documents. These documents may be found at http://peer1.idi.usra.edu/peer_review/prog/prog.html (see Bibliography, section VII, this Appendix).
- Establish contact with appropriate NASA field center personnel to determine how the proposed research or technology development activity might fit into NASA's AHST Program.

- Discuss (and quantify, if possible) in their proposal the potential benefit of their work to NASA in terms of minimization of mass, power and crew time utilized, increased system reliability, safety, or other factors for present or future missions. Investigators are encouraged to refer to the system analysis assumptions as reflected in the ALS baseline values and assumption document (BVAD) and the discussion of equivalent system mass (ESM) in the ALS Metric. These documents may be found at the following website: http://peer1.idi.usra.edu/peer_review/prog/prog.html.
- Assure compliance with federal regulations regarding human subjects and/or animal care as part of the proposal submission process (see the “Special Matters” section in Appendix C). NASA has a strong commitment to the ethical treatment of human and animal research subjects. Applicants should note that review of proposals involving human or animal research subjects will not be undertaken if the required information is not supplied.

II. Types of Proposals Sought

Each of the project areas described in this announcement has unique needs for specific kinds of proposals in specific areas of emphasis. *Proposals for Research and Technology Development (R&TD) in areas outside the specific areas of emphasis listed in this Announcement will likely receive lower priority for funding.*

A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research and technology development project areas. For such proposals, the teaming arrangements should be clearly stated. Flight proposals should include a well-defined development plan that can be accomplished within **three** (or fewer) years.

In addition to the overview information listed below, prospective investigators should also read carefully the individual Project descriptions in section III of this Appendix. Investigators also should be aware of the concept of Technology Readiness Levels (TRL) as it applies to their work (see Figure 1). *Research and technology development funded through this NRA will be at lower TRL levels only.*

Investigators who are interested in developing higher TRL architectures, infrastructure and advanced systems concepts that pertain to advanced human support technology and can advance the emergence of key capabilities needed for human exploration and commercial development of space are encouraged to apply to the NASA Human Exploration and Development of Space (HEDS) Enterprise Cooperative Agreement Notice, CAN-HEDS-01-1. This notice can be found at the following website:

http://research.hq.nasa.gov/code_m/nra/current/CAN-HEDS-01-1/index.html

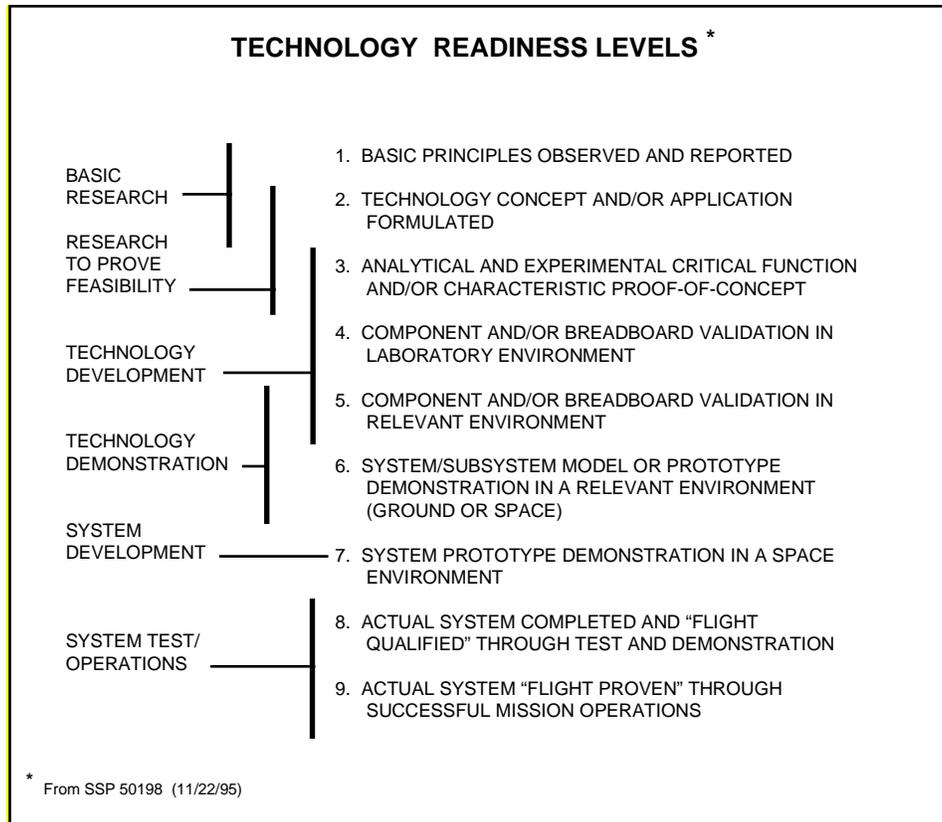


Figure 1. NASA Technology Readiness Levels

The AHST Program solicits the following kinds of proposals for FY 2002:

1. Ground-Based Research and Technical Development (open to all project areas for FY 2002)

These are proposals to carry out a research or technical study in a ground-based laboratory. Typically these will be for low TRL work (TRL 1-3, see Figure 1) with a clearly defined set of technical objectives relevant to NASA's BPR Enterprise goals. Awards in this category are for no more than three years.

2. Ground-Based, Pilot Studies (open to all project areas for FY 2002)

High-innovation, high-risk technology development Pilot Study proposals for low TRL work (1-2) are solicited. Pilot Studies are expected to propose highly innovative approaches or to explore new research paradigms or concepts that will strongly affect human support technologies, even if they are highly speculative or contain a substantial risk of failure. The goal of this type of proposal solicitation is the rapid insertion of highly innovative new research ideas into demonstration technologies (e.g., for the International Space Station (ISS) or for the BIO-Plex facility). Awards in this category are for no more than 18 months and require attendance at two NASA-lead Principal

Investigators (PI) team meetings during the course of funding. PIs given a Pilot Study award will be expected to form and participate in teams that develop follow-on proposals for longer term work leading to direct insertion into a NASA AHST application.

To facilitate the overall goal of rapid insertion, the review of Pilot Studies will emphasize specific review criteria. Pilot Studies will also have unique follow-on requirements. Review criteria and follow-on requirements are detailed in section V.B. of this Appendix.

For the Pilot Study proposal category, the initial 18 months of Phase One funding is envisioned to be the first of two possible phases. Phase Two funding is not guaranteed by Phase One funding; however, Phase One funding is a prerequisite. Phase Two will emphasize the integration of Phase One approaches into actual technology development, with a strong emphasis on teaming. Teams will be developed among PIs and between PIs and NASA researchers. Team development for Phase Two will be facilitated through the NASA Headquarters (HQ) lead and the NASA Technical Monitor for the Phase One projects. Teams developed for Phase Two projects will be expected to propose within three months of completion of Phase One. Phase Two proposals will be separately evaluated, but will use criteria as described in section V.C. of this Appendix, with an emphasis placed on probability of successful development of a prototype instrument that can be demonstrated in a relevant environment at the end of the three-year funding period.

Currently funded AHST PIs may contact relevant NASA personnel if interested in participating in future teaming and proposal development.

3. Space-Flight Experiments (open to all project areas for FY 2002)

Flight experiments will be accommodated on the carrier that is best suited to the execution of each experiment. Proposals are sought to carry out one of two special types of scientific and technical studies in space:

- a. ISS flight experiments that can be implemented with the limited resources available during the late assembly phase
- b. Short-duration flight experiments that can be implemented primarily on the Shuttle middeck without the use of major mission resources

Space studies proposed for the Space Shuttle or ISS are severely constrained by limitations on resources, such as weight, power, and crew time, and by the availability of flight hardware. Proposals requiring resources beyond the capabilities defined in this Announcement should **not** be submitted at this time. Flight investigations must represent mature studies strongly anchored in previous ground-based research and/or previous flight research and must be thoroughly justified.

III. Areas of Research and Technology Emphasis for FY 2002

A. Advanced Environmental Monitoring and Control (AEMC)

Project Description

The AEMC Project of the AHST Program develops advanced technologies to monitor the physical, chemical, and microbial environments of both the human compartments and life support systems of current and future spacecraft and extravehicular activity (EVA) systems. The AEMC project provides technology for reducing crew and equipment risk that is comparable to or better than currently available technology. Advancements in microelectronics and biotechnology are expected to provide the backbone for these technologies in future missions. The AEMC Project also develops advanced control systems to maintain internal environments in the states necessary for crew health and safety. The control system may also take advantage of microtechnologies that are capable of effector functions, for example, generation of aerosol droplets and capture and removal of bioparticles.

Proposals Sought for FY 2002

Pilot Study Proposals (see section II.2. of this Appendix) are sought across all areas of sensor technologies and control concepts and implementation that will advance the goal of minimizing consumption of mass, power, crew time, while maximizing reliability, autonomy, and rapid system response. The environments of interest include air, water, surfaces, food supplies, and all life support processing technologies. EVA sensors of interest include small low power/mass technologies for monitoring spacesuit internal/external environment and biomedical parameters.

Proposals may cover the development of new technologies, the refinement and micro-miniaturization of currently available sensors, new control paradigms that clearly demonstrate reduced risk, or very high-risk, very high-payoff new concepts that may lead to advanced sensors or control concepts with vastly improved capabilities. Technologies that may meet these needs with multi-use capability are desirable. Sensors that can monitor multiple media (e.g., air and water) have the potential to reduce mass and volume in terms of redundant units (i.e., one unit may serve as a backup for two systems). Environmental monitoring technologies may be useful for noninvasive physiological measurements, as well as for habitat use.

For FY 2002, the AEMC Project will emphasize:

Pilot Studies – Biologically Inspired Sensing

Biologically inspired sensors or control concepts are of particular interest. Also of particular interest are technologies or concepts for sample acquisition and preparation that support state-of-the-art sensors, minimize the need for crew time, meet the overall need for low power consumption, and minimize or eliminate waste generation.

Pilot Studies – Sensors for Measurements in Solid Substrate

Control of water and air in the root zone of plants is a critical problem for plant growth systems in microgravity. Research aimed at resolving this problem is limited by the current state-of-the-art in sensors to measure moisture, oxygen and electrical conductivity in solid substrate, and by water compatible, low pressure/vacuum pressure transducers.

Proposals that emphasize any of the other AEMC areas may be given a lower funding priority irrespective of the peer review proposal score.

AEMC Flight Experiments (see also Flight Experiments, section IV, this Appendix)

Microgravity effects can play a strong role for AEMC technologies in the space environment. Sensors that monitor or use liquids such as water generally face microgravity effects. Analysis of head space (the air space above a liquid sample) constituents, a common technique in ground-based laboratories, is problematic in microgravity.

Flight experiments should have as their objective the test or validation of monitoring and control technologies in the space environment. Of interest is the monitoring and control of environmental parameters, including air/water major constituents and trace contaminants, as well as the microbial environment in air, in water, and on surfaces. Initial activities should focus on the evaluation of advanced environmental sensors and controls that will help to ensure crew health and safety while moving well beyond ISS baseline in terms of lower volume, minimal mass and power consumption, with increased sensitivity and less reaction time.

NASA Technical Contacts

In order for applicants to better understand NASA's scientific and technological needs, and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA AEMC contact personnel listed below:

Charles J. Barnes, Ph.D.
Code UB/Bioastronautics Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
phone: 202-358-2365
email: cbarnes@hq.nasa.gov

Darrell L. Jan, Ph.D.
Jet Propulsion Laboratory
MS 125-224
4800 Oak Grove Drive
Pasadena, California 91109-8099
phone: 818-354-4542
email: djan@jpl.nasa.gov

Supporting Documents

- Advanced Environmental Monitoring and Control Project Plan (1999)
- Advanced Environmental Monitoring and Control Technology Requirements Document (1998)
- Advanced Environmental Monitoring and Control Strategic Plan (1996)
- Advanced EVA Systems Roadmaps (JSC 2000)
- Advanced EVA Exploration Requirements (JSC 2000)

These supporting documents can be accessed via the Internet at the following WWW address:

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

Related Areas

Research proposals to establish environmental standards for human health will be solicited through the Environmental Health Project as part of the Biomedical Research and Countermeasures Program NRA to be released in the fall of 2001.

B. Advanced Life Support (ALS)

Project Description

The ALS Project of the AHST Program develops technology for advanced regenerative life support systems to support human missions in space. Such missions, including the ISS and possible future planetary exploration, may last from months to years. Resupply of life support materials is expensive and, in some cases, may be extremely difficult, necessitating greater self-sufficiency of the subsystems used on the mission.

The BIO-Plex facility, currently under construction and being outfitted by the ALS Project, will be NASA's major test-bed in the next decade for demonstrating, validating and integrating physico-chemical and biological subsystems that fully recycle air and water, recover resources from solid wastes, provide thermal control, and provide and process food (fresh and pre-packaged) for the crew (see Appendix B for more information).

Proposals Sought for FY 2002

Pilot Study Proposals (see section II.2. of this Appendix) are sought in the area of waste processing, with a particular emphasis on water recovery from solid wastes.

In all areas, proposals are sought that will dramatically advance the goals of optimization of mass, power, volume, crew time, reliability, and autonomy for an ALS subsystem. The equivalent system mass (ESM) of the life support system serves as a good aggregate measure (see ALS Metric on the WWW at http://peer1.idi.usra.edu/peer_review/prog/prog.html) of life support system performance and is critical in determining the cost of human space flight. Therefore, proposals that take into consideration ESM are particularly encouraged.

For FY 2002, the ALS Project will emphasize:

Pilot Studies – Microgravity Waste Processing

Novel physico-chemical and biological research and technology development pilot study proposals that will help develop waste processing methods for sterilization and storage of wastes are of interest. It is envisioned that the results of these studies would be rapidly

inserted into the BIO-Plex or implemented on the ISS. In terms of resource recovery the main focus should be recovery of water from solid wastes. In developing these pilot studies microgravity compatibility must be taken into consideration.

Conventional Studies – Microgravity Crop Production

It is expected that a small amount of (primarily) salad crops will be grown on board transit vehicles to provide crews with dietary variety. Research is solicited in the area of plant production in the microgravity environment, specifically in understanding and managing the root zone environment. Research proposals that address gas, liquid, and solid phases of the root zone in the microgravity conditions of spacecraft are solicited.

Conventional Studies – Waste Processing

Waste processing methods are needed that deal with solid wastes that include human metabolic wastes, paper products, uneaten food, small amounts of inedible plant biomass, and other waste solids likely to be generated in a space-based vehicle and early planetary surface habitats. Examples of solid waste processing technologies include collection and transport of solid wastes, de-watering, sterilization, and safe storage methods. Research proposals covering all facets of solid waste processing are solicited.

Proposals that emphasize any of the other ALS areas may be given a lower funding priority irrespective of the peer review proposal score.

ALS Flight Experiments (see also Flight Experiments, section IV, this Appendix)

Knowledge of the effects of microgravity on life support systems is essential for their ultimate implementation in relevant environments. A major technology goal of the ALS Project is to resolve issues of performance in microgravity through research and evaluation in space. Therefore, the ALS Project solicits proposals to examine the gravitational sensitivity of candidate life support processes, components, and subsystems.

NASA Technical Contacts

Due to the applied nature of the ALS Project, proposals solicited by this Announcement tend primarily to be for technology development and applied, rather than fundamental, research. Research undertaken and technologies developed for ALS tend to find ready application and rapid integration into NASA's ongoing programs.

In order for applicants to better understand NASA's scientific and technological needs and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA ALS personnel listed below:

Charles J. Barnes, Ph.D.
Code UB/Bioastronautics Division
NASA Headquarters
300 E Street, SW

Donald L. Henninger, Ph.D.
Mail Code EC3
NASA Johnson Space Center
2101 NASA Road One

Washington, DC 20546-0001
phone: 202-358-2365
email: cbarnes@hq.nasa.gov

Houston, TX 77058
phone: 281-483-5034
email: dhennin1@ems.jsc.nasa.gov

Investigators should refer to the Advanced Life Support web site for additional information:

<http://advlifesupport.jsc.nasa.gov/>

Supporting Documents

Further information about the ALS Project can be found in the following documents (see Bibliography, section VII of this Appendix for details).

- Advanced Life Support Project Plan (1998)
- Advanced Life Support Requirements Document (1998)
- Advanced Life Support Current Technology Assessment Matrix (1998)
- Advanced Technology for Human Support in Space: NRC Report (1997)
- ALS Roadmap (1998)
- ALS Metric (1999)
- Baseline Values and Assumptions Document (BVAD, 1999)

These supporting documents can be accessed via the Internet at the following WWW address:

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

C. Advanced Extravehicular Activity (AEVA)

Project Description

The AEVA Project of the AHST Program develops basic concepts and technologies that enable humans to conduct complex work outside the pressurized volume of a spacecraft. As the current space shuttle and ISS EVA systems are not suitable for future planetary and deep space exploration applications, the AEVA Project for FY 2002 solicits research and development of life support systems and radiation protection. These efforts will enable future EVA crewmembers to accomplish mission objectives safely, reliably, comfortably and efficiently in a diversity of exploration environments and applications. An open architecture for remote locations is envisioned which can be readily adapted via flexible and modular systems utilizing common solutions and standardized interfaces. Teaming between the PI's and NASA engineers is encouraged to help focus and promote technology that can be practically integrated and tested with existing advanced hardware designs.

Proposals are sought for FY2002 that are applicable to either Concept or Pilot studies (**listed in order of priority**).

Atmosphere Revitalization

Methods are needed to reliably “scrub” CO₂, humidity and trace contaminants from the portable life support system (PLSS) during EVA. Regenerable solutions that do not require the use of disposable filters or other consumables are needed. Preferably this system should have long life, low power, and low weight impact to the suit and vehicle design.

A lightweight, minimal volume, easy-to-maintain, low power oxygen breathing system is sought for EVA use. For example, a sub-critical or liquid oxygen system could be ideal for EVA portability and for commonality with future vehicle habitats and propellants. Of specific near term interest are components independent of the O₂ storage vessel (e.g., ejectors, regulators, noise abatement, recharge connectors and stations).

Regenerable closed loop thermal control devices, which do not consume resources, are needed. Highly conductive alternatives to water circulation lines and low power heating/cooling devices are sought.

Environmental Protection

Passive and/or active portable radiation protection is needed to enable work beyond low earth orbit. This capability must be lightweight and must not degrade the suited crew’s mobility or manual dexterity.

Flight Experiments

Flight experiments for the AEVA Project are not being solicited at this time.

NASA Contacts

Charles J. Barnes, Ph.D.
Code UB/Bioastronautics Division
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
phone: 202-358-2217
email:cbarnes@hq.nasa.gov

Richard K. Fullerton
Mail Code XA
NASA Johnson Space Center
2101 NASA Road One
Houston, TX 77058
phone: 281-483-2589
email:richard.k.fullerton1@jsc.nasa.gov

Supporting Documents

Further information about the Advanced Extravehicular Activity Project can be found in the following documents (see Bibliography, section VII of this Appendix for details).

- Advanced EVA Systems Roadmaps (JSC 2000)
- Advanced EVA Exploration Requirements (JSC 2000)
- Advanced Technology For Human Support In Space (NRC 1997)

These supporting documents can be accessed via the Internet at the following WWW address:

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

Additional reference data is available at the following JSC Internet addresses:

<http://www.jsc.nasa.gov/xa/>

IV. Flight Experiments

Proposals for space flight experiments for the time period between **2004 and 2006** may be submitted. All flight experiments must address one or more of the research programs and emphases described in this Research Announcement.

It is expected that the majority of experiments selected will be performed on the International Space Station (ISS). A small number of opportunities may exist for short duration experiments that do not require ISS resources and can be accommodated in the middeck area of the Space Shuttle. Because this prospect is uncertain, proposals for research appropriate for ISS will have the highest priority for selection and funding.

The experiment opportunities are highly constrained in a number of ways. 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, the flight experiments area is likely to be one of the most competitive arenas within biological and physical space research for 2002. Above all, flight experiments must have a justification that requires microgravity. Furthermore, only flight experiment proposals representing mature studies strongly anchored in previous or current ground-based or flight research or technical evaluation will be selected. Ground-based research may, and often must, represent one component of a flight experiment proposal. That research should be limited to activities that are essential for the final development of an experiment for flight, such as definition of flight protocols and ground control activities of the flight experiment. In this case, only one (flight) proposal need be submitted.

It is anticipated that flight experiments will make use of existing hardware for Space Shuttle missions or planned hardware for ISS, or will propose the development of new hardware. Proposals for new hardware development should be compatible with implementation in Shuttle middeck lockers or in EXPRESS racks on ISS.

Flight experiments should be proposed as if the actual flight of the experiment will occur between **2004 and 2006**. Experiments that cannot be implemented within this time period should not be submitted. Proposals requesting only one flight to meet their proposed research goals have a higher probability of being accomplished, but multiple flight opportunities may be granted if justified. Informed consent of human subjects must be obtained prior to carrying out any human-related study in space, and potential investigators should be aware that obtaining

such informed consent will involve a uniform process regardless of the country of origin of the proposer or astronaut.

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 form 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.

1. 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.
2. During the definition phase, NASA will interact with the applicant to determine whether the proposed experiment can actually be carried out on a space mission and to refine the cost estimates for the space-flight experiment.
3. At the end of the definition phase, NASA will select a smaller group of investigations to be developed for flight. Normally, full investigator research funding does not begin until the initiation of the development phase.

Note: All experiments selected for flight are subject to possible deselection in accordance with the Advanced Human Support Technology Flight Experiment Management Policy available on the WWW at:

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

All experiments are also subject to re-review every three years to determine continued retention.

A. International Space Station (ISS) Flight Experiments

Research opportunities will be available during the construction phase of the ISS. The research will be accomplished during utilization flights when the Space Shuttle visits the ISS 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 can, in theory, be indefinite with periodic disturbances every 30 days caused by U.S. and Russian transportation vehicle docking activities.

It is expected that crew availability for science operations, power, and logistics resupply (frequency and mass to and from ISS) will be severely constrained throughout 2003 to 2005. The primary opportunities to transport scientific equipment, supplies, and samples will be on the utilization flights of the Shuttle. However, modest capabilities for research-related deliveries and sample returns will be available on assembly flights that will occur every 40 to 90 days.

Refrigerated stowage for transport of samples on the Shuttle will be very limited, and during certain time frames, refrigerated stowage may not be available on the Space Station. Power outages may also be experienced during the assembly of ISS. Experiments with few or simple in-flight activities have the greatest potential for selection during this time frame due to their simpler logistic requirements.

B. Short Duration Flight Experiments

Short duration experiment proposals submitted in response to the research solicitations are restricted to experiments that can be accommodated on the Space Shuttle for approximately 11 days of microgravity exposure. The experiments are usually stand-alone studies that require limited crew training and involvement to execute. In limited opportunities, it is possible to take advantage of the location in the Space Shuttle middeck to obtain late pre-flight installation and early post-flight retrieval of materials. Experiments that do not require Orbiter power are more easily accommodated.

C. Potential Dedicated Shuttle Research Mission

It is possible that a dedicated Space Shuttle research mission may become available over the next couple of years. In the event that this becomes a reality, proposals submitted to this solicitation may be selected for such a mission.

V. Proposal Evaluation and Awards Selection Process

The following information is specific to this NRA and supersedes the information contained in Appendix D, Instructions for Responding to NASA Research Announcements.

A. Responsiveness to the NRA

All proposals must respond to the general requirements of the Announcement. Upon receipt, proposals will be reviewed for responsiveness to the requirements of this Announcement. This includes:

- Submission of complete proposals on or before the due date specified in this Announcement (see section VI.F. of this Appendix)
- Responsiveness to the general requirements of NASA and the AHST Program as described in this Announcement and to the specific Project areas of emphasis as described in section III of this Appendix

- Submission of a complete proposal, including a project description that does not exceed 20 pages in length (see Instructions, Appendix C)
- For proposals that represent revisions to proposals previously submitted to NASA, submission of a proposal with clearly marked revisions and a preface containing an explanation of how the revised proposal has addressed criticisms from previous NASA review (see Instructions, Appendix C)
- Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects. (see Instructions, Appendix C)
- Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not to exceed 18 months for Pilot Study proposals or three years in duration for all others (see section VI.A. of this Appendix)
- Submission of all other appropriate forms as required by this NASA Research Announcement (refer to Checklist for Proposers, Form H, Appendix C)

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

B. Overall Evaluation Process

The overall evaluation process for proposals submitted in response to this Announcement will include the following reviews.

- **Merit Review:** A review for intrinsic technical or scientific merit will be conducted for all proposals.

Only those proposals most highly rated in the merit review process will undergo the following additional reviews:

- **Feasibility of NASA Implementation Review:** Product useable by NASA
- **Flight Feasibility Review:** Flight proposals only
- **Review for Relevance and Cost:** Relevance to NASA and proposed project cost

The most important element in the evaluation process is the merit review, which carries the highest weight in final evaluation and selection. The other factors are approximately equal in weight to each other.

Follow-on Requirements for Pilot Studies

For the Pilot Study proposal category, the initial 18 months of Phase One funding is envisioned to be the first of two phases. Phase Two funding is not guaranteed by Phase One funding; however, Phase One funding is a prerequisite. Phase One will include two meetings with NASA Project PIs and other NASA-funded external PIs. The first meeting will occur shortly after funding is initiated, for introduction to ideas, projects and people. The second meeting will occur approximately two-thirds of the way through the funding period and will focus on the

development of application teams with concepts for taking Pilot Studies into existing application needs. Follow on proposals, for three years funding, are expected to be generated by these teams.

Phase Two will emphasize the integration of Phase One approaches into actual technology development, with a strong emphasis on team development. Teaming will be encouraged amongst PIs and between PIs and NASA researchers, NASA-funded SBIRs and NASA CSTCs. Team development for Phase Two will be facilitated through the NASA HQ lead, the NASA AHST Project leads and the NASA Technical Monitors for the Phase One projects. Teams developed for Phase Two projects will be expected to propose at the completion of Phase One, no later than within three months of Phase One completion. Phase Two proposals will be separately evaluated, but will use criteria described later in this section for the merit reviews, with a strong emphasis placed on probability of a demonstration capability in a relevant environment at the end of the three-year funding period.

C. Merit Review

A merit evaluation will be conducted for all proposals that are accepted by NASA for review (see Responsiveness to the NRA, section V.A., this Appendix).

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

The score assigned by this panel will neither be affected by the cost of the proposed work nor will it reflect the programmatic relevance (meaning the relative priority of the proposed work to NASA). However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal’s budget and relevance to NASA.

Reviewers will be asked to consider the following five criteria for each proposal. Panelists are instructed to address and consider each of these five criteria in assigning the overall score; however, review panels are given considerable latitude in integrating the evaluation of these criteria into a final score.

Review Criteria

- **Innovation:** Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?
- **Significance:** Does this study address an important problem within the context of the AHST Program as described in this NRA? If the aims of the application are achieved,

how will knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field?

- **Approach:** Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics? Is the proposal high risk and high payoff? Is it likely that the proposed implementation timeline will be met?
- **Investigator:** Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the investigator's productivity satisfactory?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?

Peer review panels will be asked to comment on the quality of the education/public outreach plan submitted with each proposal.

D. Feasibility of Implementation Review

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The Feasibility of Implementation Review will be conducted, appropriate to the TRL level of the research proposed, by an engineering and technical review team assembled by NASA. For Pilot Studies, Feasibility of Implementation will look for potential critical problems, evident in the idea itself, which could render the research unfeasible for use by NASA. For longer-term or more mature proposals, evaluation for the feasibility of implementation of the results of the proposed work (i.e., the resulting technology or research results) into an operational NASA system will be conducted. This review team will evaluate the feasibility of implementing the resulting technology or research results utilizing available NASA flight and/or ground facilities. The purpose of the feasibility of implementation review is to assess the likelihood that the proposed research, if completed successfully, would lend itself to continued R&TD in the context of the AHST Program goals.

E. Flight Feasibility Review

*This review will be conducted only for the most highly rated flight experiment proposals from the **merit** review.*

The Flight Feasibility Review is an evaluation of the feasibility of implementation of the proposed work on a space platform. This review will be conducted by a team qualified to determine the feasibility of implementing the proposed projects using available flight and ground facilities.

The following criteria will be used in performing the flight feasibility review:

- **Functional Requirement:** Will the available flight hardware meet the functional requirements of the experiment?
- **Space Platform Resource Requirements:** To what extent will this experiment consume the launch vehicle capacity and flight platform resources (such as crew time and electrical power) that are projected to be available? Are sufficient resources available? Does this experiment require such a large amount of the available resources that it will preclude conduct of other experiments? Based on the required number of samples or subjects, can the experiment be carried out within a reasonable period of time?
- **Operational Impacts:** For experiments that utilize the crew as research subjects, could the implementation of these experiments, even if considered safe, lead to an impact to the performance of the crew subjects?

F. Evaluation of Programmatic Relevance and Cost

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The evaluation of programmatic relevance and cost of each proposal will be conducted by NASA program scientists and managers as follows:

- **Programmatic Relevance:** In this context, programmatic relevance is the establishment of the relative priority of proposed projects for the AHST Program, based on current needs and considerations of programmatic balance. Programmatic relevance evaluation will include the Critical Path Research Plan (available at <http://criticalpath.jsc.nasa.gov/>).
- **Cost:** Evaluation of the proposed cost includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

G. Development of Evaluation Findings

Information resulting from these reviews will be used by NASA program scientists and managers to prepare evaluation findings developed for each of the AHST Program Projects described in this Announcement. This recommendation will be based on:

1. the score for merit from the peer review panel (all proposals);
2. the results of the feasibility of implementation review (when conducted);
3. the results of the flight feasibility review (when conducted); and
4. the programmatic relevance and cost of each proposal (when conducted).

The findings of these evaluations will be presented by NASA program scientists and managers to the Director of the Bioastronautics Research Division, who will make the selection for funding.

VI. Program Management Information

A. Type of Awards to be Made

Funding increment:	One year at a time.
Funding duration:	18 months for Pilot Studies, one to three years for all others.
Number awarded:	Approximately 15-20 expected. Actual number awarded depends on number received, review panel(s) recommendation, and available funding.
Average funding:	Pilot Study proposals will average \$80,000 per proposal; longer studies will average \$175,000 per year.
Funding range:	Variable, with justification.

Role of NASA Field Centers

The NASA AHST Field Center with primary programmatic responsibility will have a primary role in oversight of these awards and will be responsible, with NASA's Bioastronautics Research Division, for annually evaluating their progress and out-year plans.

B. Eligibility

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

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

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

C. Foreign Proposals

NASA will accept proposals from outside the U.S. and U.S. proposals that include non-U.S. participation. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

All foreign proposals must be typewritten in English and comply with all other submission requirements stated in this NRA. These proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received on or before April 26, 2001. Foreign sponsors may, in exceptional situations, forward a proposal without endorsement if the endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with a foreign proposal or a U.S. proposal with a foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities.

Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

1. an exchange of letters between NASA and the foreign sponsor; or
2. a formal Agency-to-Agency Memorandum of Understanding (MOU).

Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation

Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at

<http://www.pmdtc.org/> and <http://www.bxa.doc.gov/>.. Investigators are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

D. Program Reporting

The principal investigator is expected to maintain awareness of NASA's needs in these areas, and to maintain communication with the appropriate points of contact at NASA, which are listed for each of the projects within the AHST Program in section III of this Appendix.

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

Annual Report

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

- an abstract;
- a bibliographic list of publications;
- copies of publications; and
- a statement of progress, including a comparison with the originally proposed work schedule.

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

Investigators awarded Pilot Study Grants will be expected to provide NASA with quarterly summary information. This information will consist primarily of:

- a statement of progress, including a comparison with the originally proposed work schedule; and
- an update on teaming or collaboration discussions and agreements.

This information will be used to help develop teaming arrangements and to facilitate discussions and collaborations with other Pilot Study and NASA researchers.

Annual Task Book Reporting

The Biological and Physical Research Enterprise publishes a comprehensive annual document titled Life Sciences Program Tasks and Bibliography (Life Sciences Task Book), which includes descriptions of all peer-reviewed activities funded by the division during the previous fiscal year. The Task Book is an invaluable source of information for NASA Life Sciences as well as the scientific and technical communities.

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

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

- an abstract;
- a brief statement of progress during the fiscal year;
- a brief statement of benefits of the research with respect to life on Earth;
- a bibliographic list for the fiscal year;
- a copy or reprint of each publication listed in the bibliography for the fiscal year;
- a listing of presentations or activities conducted at K-12 educational institutions; and
- a listing of interactions, presentations, or other activities with the general public.

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

Final Report

A final report is required at the end of the funding period, which shall include all peer-reviewed publications. Information requested for inclusion in final reports is:

- project summary;
- statement of the specific objectives;
- significance of the work;
- background;
- Overall Progress during the performance period;
- narrative discussion of technical approaches – including problems encountered;
- accomplishments related to approach; and
- an appendix with bibliography and copies of all publications and reports. Any publications or other public materials containing data are particularly important to include in this section.

Implementation Plan (not for Pilot Studies)

Investigators are requested to submit a proposed plan of implementation one year prior to the project end date. This plan will describe the process by which the results of the project could be

implemented into a NASA program. Since construction of this plan will likely require one or more visits to NASA Field Centers, appropriate travel funds should be accounted for in the proposal (see section VI.E. in this Appendix). Please note that Pilot Study investigators are expected to allocate funds for two trips to a NASA Field Center for discussions during the proposal term.

Flight Experiment Reports

Investigators selected to carry out Space Flight experiments are expected to provide NASA with two reports:

1. A “quick-look” report of preliminary flight results that is due one month after the Space Flight takes place.
2. A post-flight final report containing all data and information on the flight study is due approximately one year after all required data/materials are provided by NASA to the investigator. At this time, all of the data must also be provided to NASA for placement in the Life Sciences Data Archive; data in this archive will be made available to the scientific and technical community.

E. Other Considerations

Required Travel

The proposal must include travel funds for the following:

- Annual Principal Investigators meeting
- Collaborative visits with other Pilot Study Co-Investigators (Pilot Studies only)

Optional Travel

- Visits to NASA Field Centers (as many as necessary)
- Presentation at a professional society meeting (highly desirable)

Resident Research Associates

Intramural investigators who plan to request Resident Research Associate (RRA) postdoctoral fellows supported by the NASA-NRC Program should include this information in their list of personnel and budget.

F. Notice of Intent and Proposal Submission Information

Notices of Intent

To facilitate proposal processing, potential Principal Investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a notice of intent (NOI) to

propose.. *The NOI, which is not binding, should be submitted electronically by February 26, 2001 by 4:30 PM EDT* (See Research Announcement, pages 3 and 4). If you do not have access to electronic submission, you may submit the NOI via U.S. Postal Service or by commercial delivery. The notice of intent, which should be no more than two pages, should contain:

- The name, address, and telephone number of a single principal investigator
- Names and affiliation of all co-investigators
- Identification of the research emphasis described in this Announcement that is most closely aligned with the proposal
- A descriptive title of the research or technical proposal
- A brief yet thorough summary describing the proposed research (not to exceed 500 words)
- The major participating institutions
- Up to six (6) key words that best describe the research area of the pending proposal

G. Proposal Schedule

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

Notice of Intent to Propose Due	February 26, 2001
Proposal Due	April 26, 2001
Selection Announcement	September 2001
Initial Funding Available	October - December 2001

VII. Bibliography

NASA Top Level Strategic Plans and Reviews:

- **National Aeronautics and Space Administration Strategic Plan. (2000).** NASA, Washington, DC. <http://www.hq.nasa.gov/office/codez/plans/pl2000.pdf>
- **NASA's Enterprise for the Human Exploration and Development of Space: The Strategic Plan. (2000).** NASA, Washington, DC. <http://www.plans.nasa.gov>
- **Advanced Technology for Human Support in Space. (1997).** Report of the National Research Council (NRC) Committee on Advanced Technology for Human Support in Space, Aeronautics and Space Engineering Board (ASEB), National Academy Press, Washington DC (ISBN 0-309-05744-2; 1997) <http://www.nap.edu/books/0309057442/html/10.html>
- **Assessment of Programs in Space Biology and Medicine. (1991)** National Academy of Sciences, National Research Council. Committee on Space Biology and Medicine, National Academy Press, Washington, DC (*NTIS #N9313327 - \$19.50*).

NASA AHST Discipline Science/Technology Plans and Requirements Documents produced by the projects within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

- **Advanced Human Support Technologies Program Plan (1999)**
- **Advanced EVA Exploration Requirements (JSC 2000)**
- **Advanced Life Support Project Plan (1999)**
- **Advanced Life Support Program Requirements (1998)**
- **Advanced Environmental Monitoring and Control Strategic Plan (1996)**
- **Advanced Environmental Monitoring and Control Program: Technology Development Requirements (1998)**
- **Advanced Environmental Monitoring and Control Program: Technical Assessment Matrix:**
Available at: http://peer1.idi.usra.edu/peer_review/prog/prog.html

NASA AHST Discipline Roadmaps produced by the projects within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

- **AEMC Roadmap (1999)**
- **ALS Roadmap (1998)**
- **Advanced EVA Systems Roadmaps (2000)**
Available at: http://peer1.idi.usra.edu/peer_review/prog/prog.html

NASA Cumulative Bibliographies: publications resulting from research supported by the Life Sciences Division:

- **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*).

NASA Strategic Planning Documents: publications resulting from activities supporting the development of strategic plans and research strategies:

- **A Strategy for Space Biology and Medical Science into the Next Century. (1998).** National Academy of Sciences, National Research Council, Committee on Space Biology and Medicine; Jay M. Goldberg, Committee Chairperson; National Academy Press, Washington, DC <http://books.nap.edu/books/0309060478/html/index.html>
- **Exploring the Living Universe: A Strategy for Space Life Sciences. (1988).** National Aeronautics and Space Administration Advisory Council. Life Sciences Strategic Planning Study Committee; Frederick C. Robbins, Committee Chairperson; National Aeronautics and Space Administration, Washington, DC.
- **Space Biology and Medicine: Volume II, Life Support and Habitability. (1994).** F.M. Sulzman and A.M. Genin (Eds.), American Institute of Aeronautics and Astronautics, Washington, DC.
- **Space Physiology and Medicine, 3rd ed. (1994).** A. Nicogossian, C. Huntoon, and S. Pool (Eds.) PA: Lea & Febiger, Philadelphia.
- **Strategic Considerations for Support of Humans in Space and Moon/Mars Exploration Missions. (1992).** National Aeronautics and Space Administration Advisory Council, Aerospace Medicine Advisory Council, National Aeronautics and Space Administration, Washington, DC.

Databases:

- **Spaceline.** An on-line bibliographic database, is available for searching for references to publications about space life sciences research.
Phone: (301) 295-2482 Email: SPACELINE@mx3.usuhs.mil
<http://spaceline.usuhs.mil/> <http://lgm.nlm.nih.gov> (MEDLINE)
- **Space Life Sciences Data Archive (LSDA).** An on-line database containing descriptions and results of completed NASA-sponsored flight experiments.
Phone: (281) 483-7876 Email: lsda@semail.jsc.nasa.gov
<http://lsda.jsc.nasa.gov/>

Other Documents: Relevant research papers, review papers, conference reports and engineering documentation

- **Aftereffects and sense of presence in virtual environments: Formulation of a research and development agenda,** International Journal of Human-Computer Interaction; 10 (2) 134-187 1998, Lawrence Erlbaum Assoc Inc, Mahwah
- **Elements of Spacecraft Cabin Air Quality Control Design (1998),** J.L. Perry, NASA TP-1998-207978
- **Expert Panel Review of Analytical Technologies Suitable for a Second-Generation Air Quality Instrument for the International Space Station (1998),** sponsored by the NASA/JSC Toxicology Group, JSC 28254, Lyndon B. Johnson Space Center, Houston, Texas

Ground Facility: Bioregenerative Planetary Life Support Systems Test Complex (BIO-Plex)

Description

The **BIO-Plex** is a multi-chamber facility currently under construction at the Johnson Space Center in Houston, Texas. BIO-Plex will serve as an advanced life support test bed to carry out long-duration, closed-chamber, integrated tests lasting up to 500 days with a crew of four. BIO-Plex is being designed and built as a high-fidelity test bed in that all equipment will be internal to the test bed. Additionally, it will be controllable from within the test bed such that autonomous operations can be evaluated.

The facility will consist of five chambers connected to a central tunnel. Each chamber is 4.6 meters (15 feet) in diameter and 11.3 meters (37 feet) in length. The five chambers are connected to a central tunnel, which is 3.7 meters (12 feet) in diameter and 19.2 meters (63 feet) in length. Access to the facility is through an airlock, which is 3.7 meters (12 feet) in diameter and 4.6 meters (15 feet) in length. Each chamber will serve a particular function within the overall facility. The Habitation Chamber (HAB) will be used for crew quarters, galley, and common meeting area. The Life Support Chamber (LSC) will contain discrete subsystems that will be used to recycle air, water, and process solid waste. The Laboratory Chamber (LAB) will be used to monitor the general chamber environment for safety, and to provide analytical capabilities to answer specific scientific questions related to BIO-Plex testing. There will be two Biomass Production Chambers (BPCs) that will be used to grow agricultural crops for processing into food for the crew (up to 165 m² growing area). The Interconnecting Transfer Tunnel (ITT), which connects all the chambers, will be used for, crop processing, food processing, stowage and other operations.

The facility is being built in two stages. Initial testing will occur with three chambers (HAB, LSC and BPC1) and the ITT. The first test is currently scheduled to last 120 days and will occur in FY2003. Buildup for the first configuration and test will take place from FY2001 into FY 2003. The second stage will add the LAB and BPC2. This configuration is scheduled for use in tests lasting from 240 days to 540 days. Buildup and testing for this second configuration should occur between FY2004 and FY2007.

For further information, contact Leah Pate, (281) 483-4544, or Terry O. Tri, (281) 483-9234, at the Johnson Space Center.

Additional information concerning the BIO-Plex is located on the Advanced Life Support Project's World Wide Web site at:

<http://advlifesupport.jsc.nasa.gov/>

For information about other NASA research facilities see

http://peer1.idi.usra.edu/peer_review/nra/01_OBPR_01.html

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

This section contains the general instructions for proposal preparation and the specific forms required by investigators responding to this Announcement. This section is specific to this NRA and supercedes the information contained in Appendix D. The forms at the end of this section include the following:

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

Instructions for Proposal Preparation

Applicants are encouraged to print their proposals double-sided (except forms), single-spaced, in a 12 point text font (except forms), and on 8.5" x 11" plain white paper. Also, proposals should be bound using only metal staples or metal binder clips.

All proposals must include each of the forms provided in this Appendix as part of the complete submission, with the exception of Form C, which is submitted only with flight experiments, and Forms F and G, which are not required for some non-U.S. proposals (see the form-specific instructions included in this Appendix).

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

1. Cover Page: Solicited Proposal Application (Form A), including certification of compliance with U.S. code (if applicable)*
2. Proposal Abstract (Form B)
3. Proposal Title Page, with Notice on Restriction on Use and Disclosure of Proposal Information, if any
4. Statement of Justification
5. Project Description Preface (Revised Proposals only)
6. Project Description
7. Space Flight Experiment Preliminary Description Form (required for Flight Experiments only) (Form C)
8. Management Approach
9. Letter of Assurance of Foreign Support (if applicable)
10. Biographical Sketch (Form D)
11. Other Support (Form E)
12. Facilities and Equipment
13. Special Matters (specific information on animal or human subjects protocol approval required, if applicable)*
14. Detailed Budget, 12 Month (Form F)
15. Detailed Budget, Entire Project Period (Form G)
16. Supporting Budgetary Information
17. Checklist for Proposers (Form H)
18. Appendices, if any
19. Computer diskette (3.5 inch, Macintosh or PC format) containing an electronic copy of the principal investigator's name, address, telephone and fax numbers, e-mail address, and the complete project title and abstract as provided on Form B

* One signed original required

The Project Description section is limited to 20 pages. Any pages in this section beyond 20 will not be reviewed. There is no specific page limitation on other sections of submitted proposals. 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.

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

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

For Item (7) on this form, new means that a proposal for this project has not been submitted to NASA in 1997, 1998, or 1999; renewal means that this proposal is for the continuation of a currently funded task beyond the term of the funded proposal; and revised means that this proposal represents a revision of a proposal submitted to NASA and reviewed in 1997, 1998, or 1999, but not funded. A proposal previously submitted but not funded should be termed revised even if the original Principal Investigator has changed. Renewal and revised applications should contain special material described in the Project Description section below.

Note: Items (9) and (10) on Form A require assurance of compliance with human subject or animal care provisions of NASA regulations (see “Special Matters” section below). If IRB or ACUC review is unavoidably delayed beyond the submission of the application, enter “Pending” on line 9b or 10b in Form A. Applicants should be aware that proposal review will not be undertaken without prior assurance of compliance.

2. Proposal Abstract (Form B)

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

3. Proposal Title Page

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

NOTICE

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in

confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

4. Statement of Justification

The one page justification should include a discussion on how the proposed research satisfies the unique requirements of the AHST program in general and the proposed research element in particular. In developing the justification, the Proposer(s) should refer to the relevant Program documents listed in Bibliography and identify how the proposed research would address issues such as systems integration, risk mitigation or reduction in the equivalent system mass.

5. Project Description Preface (Revised Proposals only)

Revisions of 1997, 1998, or previous 1999 submissions to the NASA Office of Life and Microgravity Sciences and Applications must include a preface to the project description. This preface should be two to three pages in length and must contain clearly notated responses to the criticisms of the previous review. The pages in the preface will not count toward the 20-page limit of the project description. Revised proposals require further notation as described in the next section of this Appendix. Note that revised applications that do not address the criticisms in the previous critique or do not include substantial revisions will be considered non-responsive and will be returned without review.

6. Project Description

The length of the Project Description section of the proposal should not exceed 20 pages using regular (12 point) type. **Pages beyond the 20-page limit will not be reviewed.** The proposal should contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with the resources requested and with their own resources. In addition, the proposal should clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement.

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

Revised applications (revisions of 1997, 1998, or 1999 submissions) must include appropriate notation in the project description. Applicants must highlight the changes they have made in their research plan by appropriate bracketing, indenting, or changing of typography. Clearly present any work done since the prior version was submitted. Note that revised applications that do not address the criticisms in the previous critique (in a preface as described above) or do not

include substantial revisions will be considered non-responsive and will be returned without review.

7. Space-Flight Experiment Preliminary Description Form (if applicable, Form C)

All applicants proposing space flight research must provide the information requested on Form C. The information on this form is essential for the evaluation of the feasibility of performing the proposed study.

8. Management Approach

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

9. Letter of Assurance of Foreign Support

Applications submitted by non-U.S. entities as well as applications with non-U.S. participation submitted by U.S. entities must include a written endorsement from the respective agency or funding/sponsoring institution (see Appendix A, section VI.C. of this Announcement for details).

10. Biographical Sketch (Form D)

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

11. Other Support (Form E)

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

12. Facilities and Equipment

Describe the available facilities and major items of equipment specially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use on the project. Provide evidence that such facilities or equipment will be made available if the applicant is successful in obtaining funding. Before requesting a major item of capital equipment, the proposer should determine if the sharing or loan of equipment already within the organization is a feasible alternative to purchase. Where such arrangements cannot be made, the proposal should so state. The need for items that can be typically used for research and non-research purposes should be explained.

13. Special Matters

The Special Matters section must contain a statement from the proposer's institution that 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 Office of Biological and Physical Research, NASA Headquarters, Washington, DC 20546. Assurance of compliance with human subject or animal care provisions is required on Form A to be submitted with each proposal. In addition, a letter signed by the chairperson of the Institutional Review Board (IRB), 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. If IRB or ACUC review is unavoidably delayed beyond the submission of the application, the certification must be received within 60 days after the due date for which the application is submitted. *If certification is not received within 60 days after the application due date, the application will be considered incomplete.* NASA shall require current IRB or ACUC certification prior to award. All U.S., non-NASA proposals providing ACUC approval must also contain the institution's Public Health Assurance number.

14. Detailed Budget, 12 Month (Form F) and (15) Detailed Budget, Entire Project Period (Form G)

These forms must be submitted with each U.S. proposal, or with non-U.S. proposals that have a U.S. component, for which NASA funding is sought. NASA intramural Principal Investigator's research budgets for all years are to be submitted in a full-cost mode in accordance with the

NASA CFO, Enterprise Office, and Center full-cost budget policy. Funds to support the Resident Research Assistant (RRA) Postdoctoral Program costs (e.g., stipend, travel, computer time, supplies, etc.) are to be budgeted within the NASA intramural Principle Investigator budget.

Foreign proposals with no U.S. component should not submit these forms.

16. Supporting Budgetary Information

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

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

Direct Labor

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

Other Direct Costs

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

- a) Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- b) Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
- c) Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- d) Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.

- e) Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
- f) Other: Enter the total of direct costs not covered by (a) through (e). Attach an itemized list explaining the need for each item and the basis for the estimate.

Indirect Costs

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

17. Checklist for Proposers (Form H)

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

18. Appendices, if any

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

19. Computer Diskette

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

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

http://peer1.idi.usra.edu/peer_review/nra/01_OBPR_01.html

**APPENDIX D
NRA 01-OBPR-01**

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 2000)

(a) General.

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

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

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

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

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

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

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

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

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

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.

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

(4) Project Description.

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

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

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

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the

proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

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

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

(8) Proposed Costs (U.S. Proposals Only).

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

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

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of

supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

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

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

(11) Special Matters.

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

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

(d) Renewal Proposals.

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

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

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

(f) Joint Proposals.

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

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

(g) Late Proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

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

(i) Evaluation Factors.

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

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

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

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

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

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

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

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

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

(k) Selection for Award.

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

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

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without

endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

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