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National Aeronautics and
Space Administration

Research Announcement

Research Opportunities
in
Space Life Sciences

Advanced Human Support
Technology Program

2000

A Research Announcement for the
Life Sciences Division

Notices of Intent Due:	**February 18, 2000**
Proposals Due:	**April 18, 2000**

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NASA Research Announcement

Research Opportunities
in
Space Life Sciences

Advanced Human Support
Technology Program

This Announcement is restricted to the technology and science projects within the Advanced Human Support Technology (AHST) Program – Advanced Environmental Monitoring and Control (AEMC), Advanced Life Support (ALS), Space Human Factors Engineering (SHFE), and Advanced Extravehicular Activity (AEVA). Proposers should read carefully the individual project descriptions in Appendix A and focus their proposals on the specific research emphases defined in this Announcement. Separate Life Sciences Division Announcements for the Gravitational Biology and Ecology Program and the Biomedical Research and Countermeasures Program are scheduled to be released in the fall of 2000.

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 NRA annual 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 Space Life Sciences Division. In consonance with the mission of the Human Exploration and Development of Space (HEDS) Strategic Enterprise, this Announcement solicits proposals for research and for development of technologies that will enable humans to more safely and effectively live and work in space.

The mission of the HEDS Strategic Enterprise is to open the space frontier by exploring, using, and enabling the development of space. The Enterprise will develop the tools and skills to live and work in space, to take advantage of its unique environment for conducting research in science and engineering, and to generate new technology.

Research in the AHST Program supports the following goals of NASA's HEDS Strategic Enterprise:

- Explore the space frontier
- Expand scientific knowledge
- Enable humans to live and work permanently in space

- Enable the commercial development of space
- Share the experience and benefits of discovery

The AHST Program seeks to fund the development of advanced technologies for use on the International Space Station 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 on increased safety and reliability.

For Fiscal Year 2001, each of the three project areas within the AHST Program 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 carefully read the AHST Program description and the 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.

A selection announcement will be made in September of 2000, pending budget availability. Funding of selected proposals will begin between October and December of 2000. NASA's obligation to make awards is contingent upon the availability of annually appropriated funds from which payment for award purposes can be made and the receipt of proposals that the government determines are acceptable for award under this NRA. Annual continuation of multiple year awards is dependent on evidence of satisfactory progress and availability of funding.

It is anticipated that there will be 16 total awards for proposals submitted in response to this NRA and that awards will average approximately $150,000 per year. However, requests for support for higher Technology Readiness Level (TRL, see Figure 1, Appendix A) R&TD and for Virtual Research Centers may be somewhat higher. Also, it is expected that up to 6 of the 16 total awards will be for low-cost, high risk, 1-year Pilot Studies for the AEMC Project in the amount of approximately $60,000 each.

Due to programmatic needs and funding constraints, NASA may in certain cases elect to fund only a portion 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 normally be designated 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 from non-U.S. institutions (see Appendix A, Section VI, Part C of this Announcement for details).

Awards made as a result of this NRA will primarily be funded as grants. Either a grant or cooperative agreement 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 5800.1). No awards made as a result of this NRA will be funded as contracts. Therefore, while proposals submitted by commercial organizations are allowed, they cannot include profit or a fee. 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's BIO-Plex facility.
- 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 18, 2000 by 4:30 PM Eastern Time (see Appendix A, Section VI, Part F of this Announcement). NOIs should be submitted via the World-Wide-Web (WWW) at:

http://peer1.idi.usra.edu/expro/noi/00_HEDS_01_noi.cfn

If you do not have access to the WWW, you may submit an NOI via email to:

noi@hq.nasa.gov

The subject heading of the e-mail message should read "NOI NRA 00-HEDS-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 below.

Proposals may not be submitted electronically. ***Proposals must be received by April 18, 2000 by 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 InDyne, Inc.
SUBJECT: NASA Life Sciences Research Proposal
300 D Street, SW
Suite 801
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 EST. The telephone number, 202-479-2609, may be used when required for reference by delivery services. InDyne, Inc. (IDI) cannot receive deliveries on Saturdays, Sundays, or federal holidays. Upon receiving a proposal, IDI will send a postcard to the proposer confirming its arrival.

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

The following items apply only to this Announcement:

Solicitation Announcement Identifier:	NRA 00-HEDS-01
Number of Proposal Copies Required:	Original + 20 copies, dbl-sided preferred
Notice of Intent Due:	February 18, 2000
Proposals Due:	April 18, 2000
Selecting Official:	Director Life Sciences Division Office of Life and Microgravity Sciences and Applications
Additional Programmatic Information:	AHST Project Coordinator (indicated in table below) UL/Life Sciences Division NASA Headquarters Washington, DC 20546-0001 Telephone: (202) 358-0220 Fax: (202) 358-4168

AHST Project/Area	Project/Area Coordinator
Space Human Factors Engineering	June Ellison
Advanced Environmental Monitoring & Control	Elizabeth Cantwell, Ph.D.
Advanced Life Support	Charles Barnes, Ph.D.
Advanced Extravehicular Activity	Guy Fogleman, Ph.D.
Flight Experiments	Peter R. Ahlf

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

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

APPENDIX A
NRA 00-HEDS-01

Advanced Human Support Technology Program

I. Introduction

The NASA Life Sciences Division seeks proposals for the Advanced Human Support Technology Program (AHST) in support of the Human Exploration and Development of Space Enterprise. This Announcement solicits scientific and technical proposals to be funded during Fiscal Year 2001, 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 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)
- Space Human Factors Engineering (SHFE)
- 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.

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

- Quantify in their proposal the 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. Proposers 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

- The principal investigator is expected to maintain awareness of NASAs 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.

- Include in their proposal a projected timeline for the anticipated use of their research and technology in (or in support of) operational systems such as, for example, BIO-Plex (see BIO-Plex facility description, Appendix B). In fulfilling this requirement, proposers are encouraged to refer to current Project Plans (see Bibliography, Section VII of this Appendix; and http://peer1.idi.usra.edu/peer_review/prog/prog.html) and to contact appropriate NASA Field Center personnel.

- 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 of this Announcement). 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.

- Include in their proposal, a plan to promote general scientific literacy and public understanding of life sciences, the space environment, the AHST Program, and the investigators own work through formal and informal education opportunities and through direct communication to the public. This plan may be judged as part of the Proposal Evaluation and Award Selection Process (see Section V, this Appendix). Such education/public outreach might include:

    - education activities involving the training of undergraduate, graduate students and post-doctoral appointees
    - development and utilization of outreach programs involving educational institutions, civic groups or industry
    - public information programs utilizing mass media , including webpages on the internet

II. Types of Proposals Sought

For FY 2001, each of the project areas within the AHST Program has unique needs for specific kinds of proposals in specific areas of emphasis for FY 2001. 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.

In addition to the overview information listed below, prospective proposers should also carefully read the individual project descriptions in Section III of this Appendix. Where appropriate, proposers also should be aware of the concept of technology readiness levels (TRL) as it applies to their work (see Figure 1, later in this Appendix).

The AHST Program primarily solicits the following kinds of proposals for FY 2001:

1. **Ground-Based Research and Technical Development (open to all project areas for FY 2001)**
   It is expected that the majority of proposals submitted in response to this solicitation will fall into the category of technology development proposals, i.e., proposals to carry out a technical study in an ground-based laboratory and having a clearly defined set of technical objectives relevant to NASA's mission. Proposals to conduct ground-based research leading to the development of technologies for testing/evaluation in the BIO-Plex facility are particularly encouraged (see BIO-Plex facility description, Appendix B, this Announcement). Awards in this category are for no more than three years.

2. **Ground-Based, Low-TRL Pilot Studies (open to AEMC only, for FY 2001)**
   High Innovation, High Risk, Low Technology Readiness Level (TRL) (see Figure 1, later in this Appendix) Technology Development Pilot Studies. This year, Pilot Studies are only being solicited in the AEMC Project. Pilot Study proposals are expected to be for highly innovative new approaches or for the exploration of new research paradigms or new 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 ISS and for the BIO-Plex facility). Awards in this category are for one year only.

3. **Ground-Based, Virtual Research Centers (open to AEMC only, for FY 2001)**
   Virtual Research Center proposals are expected to be essentially a consortium for the development of collaborative efforts across a number of PI's or institutions, all of whom must be included in the proposal. A Virtual Research Center must, however, be led by a single PI from a single institution. Research projects in the focused area(s) being solicited are expected to be developed and implemented during the three to five year duration of the award for these Centers. Virtual Research Centers that exceed three years in duration will be required to undergo a mid-term peer review by NASA. This year, a Virtual Research Center is only being solicited in the area of advanced integrated sensors and controls for life support systems. A description can be found in the AEMC Project solicitation in Section III of this Appendix.

4. **Space-Flight Experiments (open to all project areas for FY 2001)**
   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 on the International Space Station (ISS) 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 (see Section IV of this Appendix) and must be thoroughly justified.

A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research and technology development elements. 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.

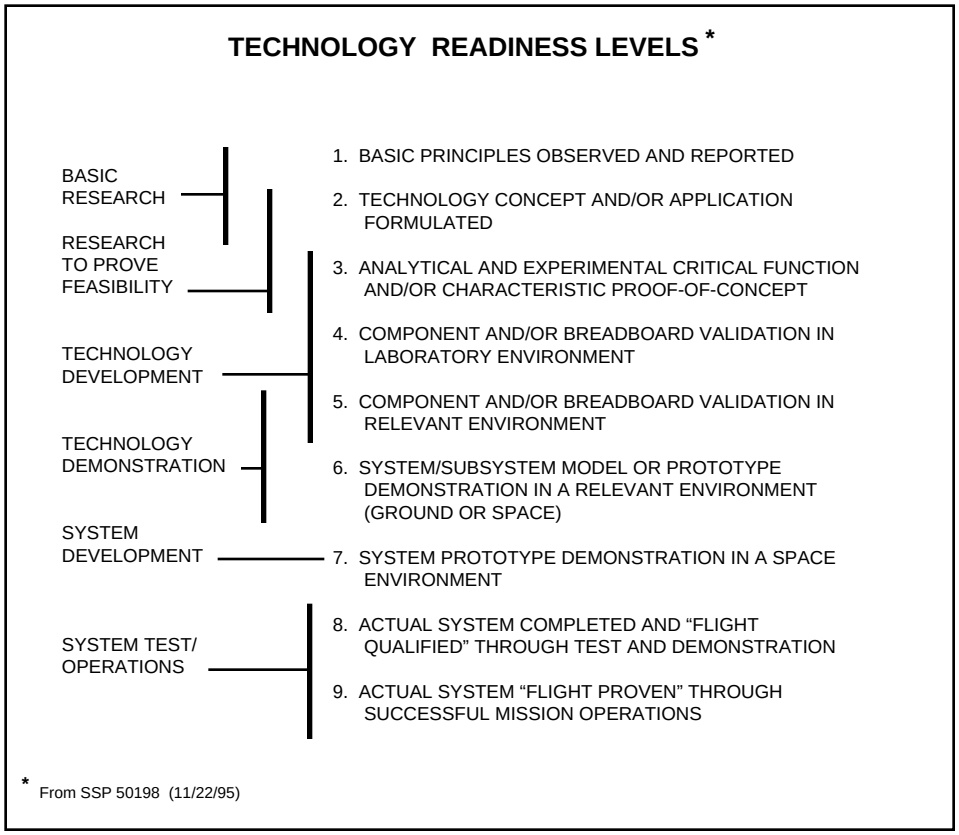

Figure 1. NASA Technology Readiness Levels

III. Areas of Research and Technology Emphasis for FY 2001

A. Advanced Environmental Monitoring and Control

Project Description

The Advanced Environmental Monitoring and Control (AEMC) Project of the AHST Program develops advanced technologies that 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 also develops advanced control systems to maintain these environments in the states necessary for crew health and safety. The goal is to evolve measurement and control capabilities that dramatically reduce risk through precise and rapid evaluation, diagnosis and autonomous response.

Proposals Sought for FY 2001

In general, proposals are sought for sensor technologies and control concepts and implementation that will advance the goal of optimization of mass, power, crew time, reliability, and system response speed. The environments of interest include air, water, surfaces, food supplies, and all life support processing technologies.

Proposals may include the development of new technologies, the refinement and micro-miniaturization of currently available sensors, new control paradigms that clearly demonstrate reduced risk and very high risk, very high payoff new concept 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 or for EVA, as well as for habitat use.

New this year, the Advanced Environmental Monitoring and Control Project is seeking proposals for Pilot Studies - highly innovative new approaches and concepts that will strongly affect monitoring and control technologies, even if they are highly speculative or contain a substantial risk of failure. The goal of this Pilot Study proposal solicitation is the rapid insertion of highly innovative new research ideas into demonstration technologies for ISS and for the BIO-Plex Facility (see BIO-Plex Facility description, Appendix B). Successful proposals should be for limited or start-up funding for one year.

To facilitate the overall goal of rapid insertion, this type of solicitation will emphasize specific review criteria and have unique follow-on requirements. Review criteria are detailed in Section V of this Appendix. For the Pilot Study proposal category, the first year of funding is envisioned to be the first of two phases. While second Phase funding is not guaranteed by first phase funding, first phase funding is a prerequisite. Phase Two will emphasize the integration of Phase One approaches into actual technology development, with a strong emphasis on teaming. Teaming will be encouraged between PIs and between PIs and NASA researchers. Team development for Phase Two will be facilitated through the NASA HQ lead and the NASA Technical Monitor for the Phase One projects, and 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. A. for high TRL proposals (strong emphasis will be placed on probability of a prototype instrument that can be demonstrated in a relevant environment at the end of the three year funding period). Note that

award of a Phase One Pilot Study does not preclude a researcher from proposing within any future normal NRA cycle

For FY 2001, the emphasis of the AEMC Project will be primarily on:

1. **Highly Innovative, High Risk Pilot Studies (typically one year, TRL 0-1 proposals, evaluated as described above and in section V of this Appendix)**
   Technologies or concepts for sample acquisition and preparation that support state-of-the-art sensors, minimize the need for crew time, and meet the overall need for low power consumption and no or greatly minimized waste generation are solicited.

2. **Technology Development**
   Biologically-inspired sensors for *in situ* monitoring of air quality are solicited. Air quality monitors should cover a broad range of the contaminants of interest for Space Flight (see AEMC Requirements for Technology Development, Expert Panel Review of Analytical Technologies and Elements of Spacecraft Cabin Air Quality Control Design, all in Bibliography). It is desirable that these biologically-inspired air quality sensor systems have integrated capability for sample acquisition, detection, and readout.

3. **Virtual Research Center**
   Proposals for a consortium of research efforts in the AEMC area are expected this year to focus on the integration of advanced sensors and advanced controls concepts into highly autonomous decision-making capabilities for life support system maintenance, control and failure recovery.

Proposals in other areas of emphasis may receive lower priority for funding.

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 minimal mass and power consumption.

Space station configurations will be available for testing advanced environmental monitoring technologies onboard.

NASA Technical Contact

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 NASA Advanced Environmental Monitoring and Control personnel. The appropriate Advanced Environmental Monitoring and Control contact persons are:

Dr. Elizabeth Cantwell
Code UL Life Sciences
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
phone: 202-358-2334
email: ecantwel@hq.nasa.gov

Dr. Darrell L. Jan
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)
- EVA Roadmap (1998)

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 2000.

Control of specific subsystem processes is included in System Modeling and Control within the ALS Project of the AHST Program described in Section III, Part B of this Appendix.

B. Advanced Life Support

Project Description

The Advanced Life Support (ALS) Project of the AHST Program was initiated to develop advanced regenerative life support systems to support human missions in space. Such missions, including the International Space Station (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 Advanced Life Support Project, will be NASA's major testbed in the next decade for demonstrating, validating and integrating physical/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 2001

Proposals are sought that will dramatically advance the goals of optimization of mass, power, volume, crew time, and reliability for an Advanced Life Support System. The mass requirement of the life support system serves as a good aggregate indicator of life support system performance, which is critical in determining the cost of human Space Flight. Therefore, proposals that take into consideration equivalent system mass (ESM, refer to ALS Metric on www at **http://peer1.idi.usra.edu/peer_review/prog/prog.html**) are particularly encouraged.

For FY 2001, the Advanced Life Support Project will primarily fund proposals for R&TD in the TRL range of 3-5 (see Figure 1, Section II, this Appendix) with particular emphasis on those proposals that will result in the integration of sufficiently mature technologies into BIO-Plex in the 2002-2003 timeframe. Proposals for R&TD in the lower TRL ranges will be given lower priority in the selection process. The specific areas of primary emphases of the ALS Project are as follows:

- **Resource Recovery Methods**
  Resource recovery methods that are measurably better than currently available technology to extract useful materials from solid wastes generated by a human space exploration mission while minimizing mass, volume, power, thermal control, and crew time requirements are solicited. Specifically, approaches to processing solid wastes to recover useful materials must be lightweight, small, low power, low heating or cooling, and run autonomously. Solid wastes include human metabolic wastes, inedible plant biomass, paper products, uneaten food, and other waste solids likely to be in a space-based vehicle and/or habitat. Research proposals covering all facets of solid waste processing directed at resource recovery are solicited.

- **Food Processing Methods and Technologies**
  Food processing methods and technologies for prepackaged and stored staple foods expected to constitute a major portion of crew diet on later ISS, on space transportation vehicles, and early planetary exploration missions are solicited. Food processing methods for salad machine crops and bulk stored food ingredients are also solicited.

- **Systems Analysis and Modeling Studies**
  Systems Analysis and Modeling studies to support strategic planning and to provide direction for decisions regarding ALS research and technology development are solicited.

Proposals in other areas of emphasis or for work to be done at lower TRL level will likely receive lower priority for funding.

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

Knowledge of the effects of microgravity on life support systems is essential for the success of the HEDS Program. A major technology goal of ALS development 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 Contact

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 NASA Advanced Life Support personnel. The appropriate Advanced Life Support contact persons are:

Dr. Charles Barnes	Dr. Donald Henninger
Code UL Life Sciences	Mail Code EC3
NASA Headquarters	NASA Johnson Space Center
300 E Street, SW	2101 NASA Road One
Washington, DC 20546-0001	Houston, TX 77058
phone: 202-358-2365	phone: 281-483-5034
email: cbarnes@hq.nasa.gov	email: dhennin1@ems.jsc.nasa.gov

Proposers should refer to the Advanced Life Support web site for more information:

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

Supporting Documents

Further information about the Advanced Life Support 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. Space Human Factors Engineering

Project Description

The Space Human Factors Engineering (SHFE) Project of the Advanced Human Support Technology (AHST) Program is designed to integrate knowledge about human capabilities and system engineering methodologies into spacecraft design, mission planning, and related ground operations. The SHFE project also encourages the development of new processes and procedures; draws on human factors expertise in aeronautics to optimize crew training, automated systems design, proficiency, and productivity; and uses relevant analog studies in simulators as well as in extreme and isolated environments. This NRA specifically addresses those SHFE Project activities that are given below. Proposers are encouraged to refer to the SHFE Roadmap and other supporting documents at:

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

Another area essential to Space Human Factors is the Behavior and Performance Research element of the Biomedical Research and Countermeasures Program, which includes research on psychological, psychosocial, and psychiatric studies and their impact on behavior and performance, as well as research on aspects of perception, cognition, human physical performance, and circadian rhythms. This Behavior and Performance aspect should be addressed in a separate NASA Research Announcement to be released in the fall of 2000 by the Biomedical Research and Countermeasures Program.

Proposals Sought for FY 2001

Highest priority in FY 2001 will be given to those technologies or techniques from which NASA can derive the earliest possible benefit. Of special interest to this NRA, the SHFE Project is encouraging ground-based proposals that can demonstrate how their results can advance to a useful state beyond the laboratory, for instance in the BIO-Plex facility (see Appendix B), in analog environments, or during any opportunities that could arise in support of mission training for spaceflight, including any EVA type activities relevant to SHFE. In order for proposals to be considered during this NRA cycle, proposals should focus on one or more of the following mission categories (it should be noted that these research/technology development) topics are <u>not</u> given in any specific priority order):

- **Safety**
  Studies regarding appropriate cautions, warnings, and risk management; design requirement to support safe maintenance, both routine and unusual; and analysis of safe handling of hazardous materials are solicited. Also solicited are studies addressing the

measurement of ‘safe’ environments, and assessing proficiency in detecting and dealing with safety issues.

- **Habitability and Work Environment**
  Studies, to develop personnel (individuals and/or teams) requirements pertaining to privacy, hygiene, etc. issues are solicited. Also solicited are studies to develop strategies for measuring habitability, and/or detecting changes in the habitability state, and/or the impacts on mission performance.

- **Training**
  This Announcement solicits studies that focus on detecting when training is needed (i.e. just in time training), and/or if training at a given time in the mission would be merely beneficial or absolutely essential, prior to the performance of a particular task, planned or unplanned. Strategies to embed training in actual operational equipment, with supporting analyses of risk/error and training benefit, should be compared to traditional methods. Studies to assess team training, and strategies to measure associated learning both at with either group- or individual-levels are also solicited.

- **Mission Support**
  Studies to determine appropriate decomposition of tasks focusing on automated components; and “on-line” documentation of procedures are solicited. Strategies to appropriately communicate trends in mission performance to crews, strategies to appropriately involve crews during the planning options responses using new information or off-nominal situations are also solicited. Strategies and technologies to introduce and verify crew awareness of how activity or performance changes could propagate through the rest of the mission are also solicited.

- **Maintenance and Logistics**
  Studies and technologies for conveying information and confirming awareness of systems health, and the need for having insight on maintenance histories as well as malfunction diagnoses and repairs to plan mission options solicited. Also solicited are studies that address inventory and location aids, and strategies to allow crews quick insight into available materials, equipment, and tools to use for unplanned actions.

- **Crew Performance (and Workforce Characteristics)**
  Studies that allow the crew to determine if their human/machine team is performing within expected ranges are solicited. Also solicited are studies that address strategies to detect changes in crew performance, and studies of how that information could be used to allow the human/machine team to preplan allocation of tasks to improve overall performance.

Proposals that emphasis any of the other SHFE topics may be given a lower funding priority irrespective of the peer review proposal score.

Flight Experiments (see also Flight Experiments, Section IV, this Appendix)

Space-flight missions represent a unique opportunity for researchers to analyze habitability and other human factors issues uniquely associated with long-duration missions. Human factors issues need to be researched and resolved in order to better plan future missions to ensure optimal crew productivity and safety. Some basic goals of SHFE flight proposals are:

- Characterize the ISS environment from a habitability standpoint
- Evaluate crew procedures for supply inventory management, loose equipment tracking/location, etc.
- Perform mental and physical workload measurements on the crew to assess crew interaction with hardware interfaces and to assess adequacy of crew functional responsibilities

NASA Technical Contact

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 NASA Space Human Factors personnel. The appropriate contact persons are:

Ms. June Ellison
Code UL Life Sciences
NASA Headquarters
300 E Street, SW
Washington DC 20546-0001
phone: 202-358-0576
email: jellison@hq.nasa.gov

Ms. Tandi Bagian
Mail Code SF
NASA Johnson Space Center
2101 NASA Road One
Houston, TX 77058
phone: 248-347-6755
e-mail: tbagian@ems.jsc.nasa.gov

Supporting Documents

Further information on this element of the AHST Program can be obtained from the following documents (see Bibliography, Section VII of this Appendix for details):

- Space Human Factors Program Plan (1995)
- Space Human Factors Engineering Roadmap (1998)
- EVA Roadmap (1998)
- Space Human Factors: Critical Research & Technology Definition (1996)

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

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

D. Advanced Extravehicular Activity

Project Description

Extravehicular activity (EVA) is the element of human Space Flight by which astronauts can conduct complex work outside the pressurized volume of a spacecraft. The current space shuttle/ISS EVA system is not suitable for future planetary exploration applications. The Advanced Extravehicular Activity (AEVA) Project supports research and technology development (R&TD) for pressure suits, life support systems, and ancillary robotic vehicles and tools which will enable the future planetary EVA astronaut to accomplish mission objectives safely, comfortably, and expeditiously.

For FY 2001, the AEVA Project focuses on key or pacing technologies which are currently at Low TRLs (Technology Readiness Levels).

Proposals Sought for FY 2001

Please note that AEVA Project funding is expected to be extremely limited for FY 2001.

- **Regenerable Portable Carbon Dioxide (CO_2) Removal Systems**
  Methods are needed to "scrub" CO_2 from the portable life support system (PLSS) during EVAs which do not require the use of disposable filters or other consumables. Preferably this system should be of low power, and low weight impacts to the PLSS design.

- **Portable Cryogenic Oxygen Systems**
  The Martian atmosphere consists primarily of CO_2. Research is in place in the ALS program to develop a capability for converting CO_2 in the Martian atmosphere to liquid oxygen for use both as a propellant fuel and as a breathing consumable for an EVA portable life support system. A lightweight, easy-to-maintain portable liquid oxygen breathing system should be developed for EVA use.

- **Materials Technology**
  The next generation EVA pressure suit will need to be both lightweight and highly mobile. In addition, due to the low temperatures at the Martian surface, a new type of insulating material for the thermal-micrometeroid garment will have to be developed. Current state of the art in materials technology would require a thermal layer of unacceptable additional thickness and weight to the suit.

NASA Contacts

Dr. Guy Fogleman
Code UL Life Sciences
NASA Headquarters
300 E Street, SW
Washington, DC 20546-0001
phone: 202-358-2217
email:gfoglema@hq.nasa.gov

Mr. Mike DeMasie
Mail Code XA
NASA Johnson Space Center
2101 NASA Road One
Houston, TX 77058
phone: 281-483-4383
email:mdemasie@ems.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).

- EVA Roadmap (JSC 1998)
- 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

IV. Flight Experiments

Proposals for spaceflight experiments for the time period between 2003 and 2005 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 <u>not</u> 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 space life sciences for 2001. 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.

Applicants proposing flight experiments are required to provide the information requested on Form C (Appendix C). Flight experiment proposals should emphasize the actual experiment, duration requirements, and experiment conditions. Descriptions of the functional capabilities available to support experiments are available at:

http://peer1.idi.usra.edu/peer_review/nra/00_HEDS_01.html

Some investigators may wish to develop their own unique experiment hardware to work in conjunction with the facilities and functional capabilities described in this Document. Please note that the development of experiment-unique equipment will require additional funding. In the event that such items are proposed, they should be clearly identified as new developments. Proposals for major hardware items or facilities to be developed by the investigator will not be considered.

Flight experiments should be proposed as if the actual flight of the experiment will occur between 2003 and 2005. Experiments that cannot be initiated 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 proposers 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 and 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 NASA Life Sciences Division deselection policy available on the WWW at: http://www.hq.nasa.gov/office/olmsa/lifesci/advhuman.htm. *A summary of this document may also be found 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. ISS Flight Experiments

Research opportunities will be available during the construction phase of the International Space Station. The research will be accomplished during utilization flights when the 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 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 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 Research Mission

It is possible that a 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

A. Compliance with the NRA

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

- Submission of complete proposals on or before the due date specified in this Announcement (see Section VI, Part 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 this Appendix.
- Submission of a complete proposal, including a project description that is not more than 20 pages in length (see Instructions, Appendix C).
- For revised 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 one year for AEMC Pilot Study proposals, five years for Virtual Research Centers or three years in duration for all others (see Section VI, Part 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-compliant proposals may be withdrawn from the review process and returned to the proposer without further review.

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

B. Overall Review Process

The overall review process for proposals submitted in response to this Announcement includes the following:

- **Merit**: Intrinsic technical or scientific merit

A merit review 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 implementation** by NASA
- **Flight feasibility** (where applicable)
- **Relevance/cost**: Relevance to NASA programs and proposed project cost

The most important factor in the evaluation 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.

C. Merit Review

*A **merit** evaluation will be conducted for all proposals that are accepted by NASA for review (see Compliance with the NRA, Section A, this Appendix).*

The merit evaluation 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 not 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. For Virtual Research Centers, panelists will assign an overall score based on consideration of the five criteria as they pertain to the sum of projects, researchers and institutions contained in the proposal.

Exceptions:

- *For the AEMC Pilot Studies proposals only, reviewers will be instructed to give greater emphasis to Innovation over the other criteria. In addition, for these proposals only, evaluation of the proposed Approach will involve consideration the ultimate potential for payoff to NASA programs and the possibility of success, and will de-emphasize the importance of initial design and analysis work.*
- *For High TRL Technology Development proposals submitted to any project area described in this announcement, evaluation of the proposed work's Significance and Approach will include consideration of the likelihood that the proposal will yield a technology that could be field demonstrated in the BIO-Plex at the end of three years.*

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.

All proposals are evaluated for scientific/technical merit using the five criteria listed above and are given a numerical score on a scale from 0 (lowest merit) to 100 (highest merit).

D. Feasibility of Implementation Review

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

The Feasibility of Implementation Review will be conducted by an engineering and technical review team assembled by NASA. All proposals, except for AEMC Pilot Studies proposals, will be evaluated 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. 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 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 Advanced Human Support Technology Program goals.

E. Flight Feasibility Review

*This review will be conducted only for those most highly rated 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 those 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.
- **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)

4. The programmatic relevance and cost of each proposal (when conducted)

These evaluation findings will be presented by NASA program scientists and managers to the Director of the Life Sciences Division. Selection for funding will be made by the Director of the Life Sciences Division. If it becomes necessary to distinguish between two or more proposals that are apparently equal on the basis of all other criteria, the quality of the education/public outreach plan submitted by the proposer may be used as the final delimeter in the selection process.

VI. Program Management Information

A. Type of Awards to be Made

Funding increment:	One year at a time
Funding duration:	One year for AEMC Pilot Studies; Up to Five Years for Virtual Research Centers; One to three years for all others.
Number awarded:	Approximately 16 expected, including 6 AEMC Pilot Study proposals. Actual number awarded depends on number received, review panel(s) recommendation, and available funding
Average funding:	$150,000 per year, except for AEMC Pilot Study proposals, which will average $60,000 per year and Virtual Research Centers, which may be funded up to $500,000 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 Life Sciences 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 technology and science, or in those areas of engineering and science 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

Although foreign entities are not generally eligible for funding from NASA, NASA will accept for review proposals from non-U.S. entities that require use of NASA facilities. Such proposals 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 non-U.S. entities and U.S. proposals that include non-U.S. participation must be endorsed in writing by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. This endorsement must indicate that:

- The proposal merits careful consideration by NASA
- If the proposal is selected, sufficient funds will be made available by that country or agency to undertake the activity as proposed

U.S. co-investigators who are collaborating on non-U.S. proposals must ensure that their scientific role is clearly delineated in the proposal, that their expertise is shown to make a substantial contribution, and that their funding requirements (funding requirements for U.S. Co-I's only) are included in the proposal.

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

NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, 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 (unless otherwise noted in the NRA). 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 non-U.S. participant 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.

When a "Notice of Intent" to propose is required, prospective foreign proposers should write directly to the NASA official designated in the NRA and send a copy of this letter to NASA's Office of External Relations at the address in the paragraph below.

In addition to sending the requested number of copies of the proposal to the designated address, one copy of the proposal, along with the Letter of Endorsement from the sponsoring non-U.S. government agency or funding/sponsoring institution must be forwarded to:

National Aeronautics and Space Administration
Code I
Office of External Relations
NRA 00-HEDS-01
Washington, DC 20546-0001
USA

D. Program Reporting

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

Annual 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
- 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 AEMC Pilot Study Grants will be expected to provide NASA with monthly summary information. This information will consist primarily of:

- a statement of progress, including a comparison with the originally proposed work schedule
- 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 NASA Life Sciences Division publishes a comprehensive annual document titled, Life Sciences Program Tasks and Bibliography (or Life Sciences Task Book), which includes descriptions of all peer-reviewed activities funded by the division during the previous fiscal year. 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

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
- Appendix with bibliography and copies of all publications, reports. Any publications or other public materials containing data are particularly important to include in this section.

Implementation Plan

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, Part E in this Appendix). Please note that AEMC Pilot Study proposers are expected to allocate funds for two trips to a NASA Field Center for discussions during the proposal year.

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 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 by February 18, 2000 by 4:30 PM EST.*** 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. Note that for Virtual Research Centers, the PI will be considered the Center Director
- Names and affiliation of all co-investigators
- Identification of the research emphasis described in this Announcement that is most closely aligned with your 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

NOIs should be submitted via the WWW at:

http://peer1.idi.usra.edu/expro/noi/00_HEDS_01_noi.cfn

If you do not have access to the WWW, you may submit an NOI via email to:

noi@hq.nasa.gov

The subject heading of the e-mail message should read "NOI NRA 00-HEDS-01." If you do not have access to e-mail, you may submit an NOI by U.S. Postal Service or commercial delivery in the same manner as proposals.

Proposals

An original signed proposal, plus twenty (20) complete copies (double-sided encouraged) of that proposal and a 3.5-inch computer disk (containing an electronic copy of the Principal Investigator's name, address, telephone and fax numbers, e-mail address and the complete project title and abstract, as provided on Form B) in either Macintosh or PC format ***must be received by April 18, 2000 by 4:30 PM Eastern Time*.**

Proposals and Letters of Intent mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA c/o InDyne, Inc.
SUBJECT: NASA Life Sciences Research Proposal
300 D Street, SW
Suite 801
Washington, DC 20024

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

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

G. Proposal Schedule

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

Notice of intent to Propose Due	February 18, 2000
Proposal Due	April 18, 2000
Selection Announcement	September 2000
Initial Funding Available	October - December 2000

VII. Bibliography

NASA Top Level Strategic Plans and Reviews:

- **National Aeronautics and Space Administration Strategic Plan. (1998)** NASA, Washington, DC **http://www.hq.nasa.gov/office/nsp/**

- **NASA's Enterprise for the Human Exploration and Development of Space: The Strategic Plan. (2000)** NASA, Washington, DC http://peer1.idi.usra.edu/peer_review/prog/prog.html

- **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**

- **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 Life Support Project Plan (1999)**
- **Advanced Life Support Program Requirements (1998)**
- **Space Human Factors Program Plan (1995)**
- **Space Human Factors: Critical Research & Technology Definition (1996)**
- **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)**
- **EVA Roadmap (1998)**
- **SHFE Roadmap (1998)**

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:

- **Space Human Factors Publications: 1980-1990. (1991)** K.J. Dickson (Ed.). NASA Contractor Report 4351. *(NTIS # N9120620 - $22.00).*
- **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 for the 1980s and 1990s. (1987)** National Academy of Sciences, National Research Council, Committee on Space Biology and Medicine; Jay M. Goldberg, Committee Chairperson; National Academy Press, Washington, DC *(NTIS #N8924024 - $46.50).*
- **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

APPENDIX B
NRA 00-HEDS-01

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 m^2 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.

Also see ALS website at 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/00_HEDS_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 proposers 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. Project Description Preface (Revised Proposals only)
5. Project Description
6. Space Flight Experiment Preliminary Description Form (required for Flight Experiments only) (Form C)
7. Management Approach
8. Letter of Assurance of Foreign Support (if applicable)
9. Biographical Sketch (Form D)
10. Other Support (Form E)
11. Facilities and Equipment
12. Special Matters (specific information on animal or human subjects protocol approval required, if applicable)*
13. Detailed Budget, 12 Month (Form F)
14. Detailed Budget, Entire Project Period (Form G)
15. Supporting Budgetary Information
16. Checklist for Proposers (Form H)
17. Appendices, if any
18. 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 memo 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 Life and Microgravity Sciences and Applications.

(3) Proposal Title Page

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

NOTICE

Restriction on Use and Disclosure of Proposal Information

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

(4) Project Description 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 unresponsive and will be returned without review.

(5) Project Description

The length of the Project Description section of the proposal should not exceed 20 pages using regular (12 point) type. **Pages beyond 20 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.

(6) 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.

(7) 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.

(8) 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, Part C of this Announcement for details).

(9) 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.

(10) 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.

(11) 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.

(12) Special Matters

The Special Matters section must contain a statement from the proposer's institution which states that the proposed work will meet all Federal and local human subject requirements and animal care and use requirements, if applicable. Note that no animal subjects may be utilized unless specific information justifying and describing their use is included in the proposal. Policies regarding the protection of human research subjects in NASA-sponsored research are detailed in NASA Management Instruction (NMI) 7100.8B (Protection of Human Research Subjects), and animal care and use requirements are detailed in the NASA Code of Federal Regulations (CFR) 1232 (Care and Use of Animals in the Conduct of NASA Activities), both of which are available from the Office of Life and Microgravity Sciences and Applications, 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.

(13) Detailed Budget, 12 Month (Form F) and (14) 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.

(15) 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:

- Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
- Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase

requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.

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

Indirect Costs

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

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

(16) Checklist for Proposers (Form H)

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

(17) Appendices, if Any

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

(18) 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/00_HEDS_01.html

APPENDIX D
NRA 00-HEDS-01

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(SEPTEMBER 1999)

(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 proposers' most favorable terms.

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

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required;

and sources for more information. Items included in these instructions may be supplemented by the NRA.

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

(d) Renewal Proposals.

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

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

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

(f) Joint Proposals.

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

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

(g) Late Proposals. 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.

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

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

(l) 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, 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 (unless otherwise noted in the NRA). 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 non-U.S. participant 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) When a "Notice of Intent" to propose is required, prospective foreign proposers should write directly to the NASA official designated in the NRA and send a copy of this letter to NASA's Office of External Relations at the address in paragraph (l)(3) of this provision.

(3) In addition to sending the requested number of copies of the proposal to the designated address, one copy of the proposal, along with the Letter of Endorsement from the sponsoring non-U.S. government agency or funding/sponsoring institution must be forwarded to:

National Aeronautics and Space Administration
Code I
Office of External Relations
NRA 00-HEDS-01
Washington, DC 20546-0001
USA

(4) 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 to the above address if endorsement is not possible before the announced closing date. In such cases, NASA's Office of External Relations should be advised when a decision on endorsement can be expected.

(5) Successful and unsuccessful non-U.S. proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency or funding institution. 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 sponsoring agency or funding institution 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.

(6) Depending on the nature and extent of the proposed cooperation, this arrangement may entail:

(i) A letter of notification by NASA;

(ii) An exchange of letters between NASA and the sponsoring foreign governmental agency; or

(iii) 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.