

**National Aeronautics and
Space Administration**

November 26, 1999

NRA-99-OES-08

RESEARCH ANNOUNCEMENT

**ADVANCED INFORMATION SYSTEMS TECHNOLOGY (AIST)
PROGRAM**

**Letters of Intent due December 27, 1999
Proposals due January 25, 2000**

OMB Approval No. 2700-0087

**ADVANCED INFORMATION SYSTEMS
TECHNOLOGY (AIST) PROGRAM**

**NASA Research Announcement
Soliciting Research Proposals
For
Period Ending
January 25, 2000**

**NRA-99-OES-08
Issued November 26, 1999**

**Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546**

**OFFICE OF EARTH SCIENCE (OES)
ADVANCED INFORMATION SYSTEMS TECHNOLOGY (AIST) PROGRAM**

The National Aeronautics and Space Administration (NASA) announces the solicitation of proposals for a new technology development program in support of the Office of Earth Science (OES). The Advanced Information Systems Technology (AIST) Program seeks proposals for information system technologies that will support and enhance the OES science and applications objectives in the 21st century.

I. Executive Summary

This opportunity seeks information systems technologies to be applied to a variety of missions in the mid- (three to six years) and far-term (longer than six years). Five areas of interest are emphasized in this NASA Research Announcement (NRA): 1) On-board Satellite Data Processing and Intelligent Sensor Control; 2) On-board Satellite Data Organization, Analysis and Storage; 3) Data Transmission and Network Configuration; 4) Intelligent Platform Control; and 5) Information Systems Architectures and Standards. Approximately \$6 million per year is expected to be reserved to support the AIST Program, subject to availability of funds. It is anticipated that an average NASA award will be funded in the range of \$150,000 to \$500,000 annually for a period of 2 years, with an optional one-year extension.

Participation in this program is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers, and other U.S. agencies. In accordance with NASA policy, all investigations by foreign participants will be conducted without any exchange of funds, i.e., investigators whose home institution is outside the United States cannot be funded by NASA. Proposals may be submitted at any time during the period ending January 25, 2000. Late proposals will not be considered for review and funding, unless the selecting official deems it to offer NASA a significant technical advantage or cost reduction. Proposals submitted to NASA will be evaluated through peer reviews and/or engineering feasibility reviews. Announcement of selections is expected during March 2000.

All prospective proposers are strongly encouraged to submit a letter of intent (e-mails encouraged) regarding this Research Announcement by December 27, 1999. This letter should contain the information described in Appendix F.

Specific guidelines to proposers are contained in Appendix A and apply to this Research Announcement only. Appendix B contains NASA general guidelines for the preparation of proposals solicited by this Research Announcement.

II. Introduction

(a) Office of Earth Science

NASA's Office of Earth Science (OES) studies Earth as an interconnected system of atmosphere, oceans, continents and life. Using the unique perspective available from space and suborbital platforms, NASA acquires, processes, and delivers very large (gigabyte to terabyte) volumes of remote sensing and related observations and information to public and governmental entities. This information is used by scientists to understand and solve major scientific mysteries, and by the practitioners and policy makers to solve practical, societal problems, and/or establish sound policy decisions. The Office of Earth Science takes advantage of the powerful capabilities of remotely sensed geospatial information and advances in information system technologies to achieve its science and applications objectives, decrease costs, and increase the accessibility and utility of Earth Sciences data. This calls for establishing an Advanced Information Systems Technology initiative.

(b) Advanced Information Systems Technology (AIST) Program

Information technology advances play a critical role in collecting, handling, and managing very large amounts of data and information in space and on the ground. The objectives of the AIST Program are to identify, develop and (where appropriate) demonstrate advanced information system technologies which:

- Reduce the risk, cost, size, and development time of OES space-based and ground-based information systems,
- Increase the accessibility and utility of Earth science data, and
- Enable new Earth observation measurements and information products.

The AIST Program is designed to bring information system technologies to a specific Technology Readiness Level (TRL) in order to allow integration into either existing or future technology development programs, such as the New Millennium Program (NMP), or directly into other programs for infusion into subsystem or system design or planned system enhancements. The TRL scale is used to assess the maturity of a particular technology. (See Appendix G for TRL definitions.)

Critical to this program is the relationship between the various technology development efforts that the OES has available to enable missions, and existing or planned system development or upgrade activities which require Information Technologies (IT). Examples of these efforts include the Earth Science Information Partners (ESIP) Federation and the Instrument Incubator Program (IIP). Within this development environment, the AIST Program will rely upon the IIP for the integration of information technology with instrument systems, and NMP for any information systems technologies that require space flight validation. Figure 1 shows the range of Technology Readiness Levels for each of these programs and future science missions.

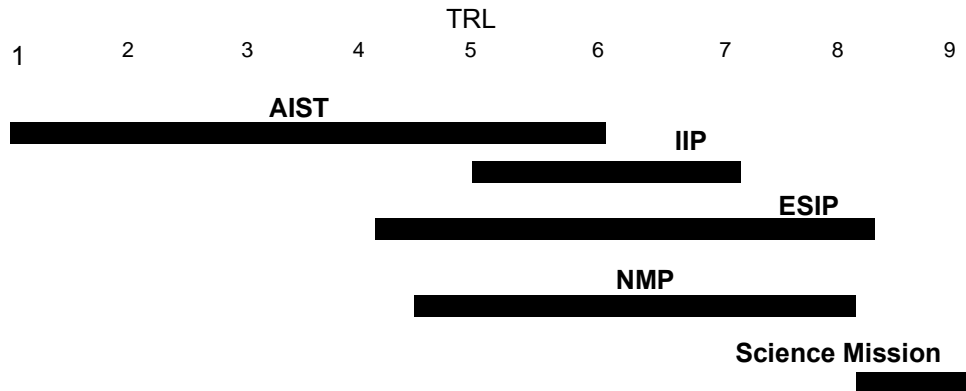


Figure 1 – TRL Ranges for Technology Development Programs

The AIST Program is envisioned to be flexible enough to accept technology developments at various stages of maturity, and through appropriate risk reduction activities (such as requirements analysis, conceptual design, prototypes and proof-of-concept demonstrations), advance the TRL of the subject information technology.

III. NASA Research Announcement:

(a) Goals

This NASA Research Announcement solicits a range of proposals, with emphasis on space based information systems/subsystems technology developments that have the highest potential to meet the goals of the advanced information systems technology requirements of OES. Included in this range are system studies, proof-of-concept developments and demonstrations, and prototype implementations for information system technologies. This solicitation seeks technologies to be applied to a variety of missions in the mid- (three to six years) and far-term (longer than six years). Approximately \$6 million per year is expected to be reserved to support the AIST Program, subject to availability of funds. It is anticipated that an average NASA award will be funded in the range of \$150,000 to \$500,000 annually for a period of 2 years, with an optional one-year extension.

This NRA solicits both hardware and software technology proposals in the five categories of information system activities listed below. Emphasis for this NRA is for on-board, space-based applications. It is anticipated that future NRAs will include end-to-end information system technologies.

(b) Proposal Research Topics

1. *On-board Satellite Data Processing and Intelligent Sensor Control* – Technologies that support the configuration of sensors, satellites, and sensor webs of space based resources. Examples include capabilities which allow the reconfiguration or retargeting of sensors in response to user demand or significant events. Also included

in this category are on-board processing of sensor data through the use of high performance processing architectures and reconfigurable computing environments, as well as technologies that support or enable the generation of data products for direct distribution to users.

2. *On-board Satellite Data Organization, Analysis and Storage* – Technologies that support the storage, handling, analysis and interpretation of data. Examples include innovations in the enhancement, classification or feature extraction processes. Also included are data mining, intelligent agent applications for tracking data, distributed heterogeneous frameworks (including open system interfaces and protocols), and data and/or metadata structures to support autonomous data handling, as well as compaction (lossless) or compression (lossy) of data for storage and transmission.
3. *Data Transmission and Network Configuration* – Technologies that support the transfer of data through high speed wireless (optical or RF) data links connecting satellite to satellite, or satellite to ground including innovations in intelligent communications. Examples include network infrastructure, together with protocols and standards, that integrate the system of sensors into a web.
4. *Intelligent Platform Control* – Technologies that enhance the intelligence and autonomy of on-board systems, including improved spacecraft telemetry and navigation. Examples include agents for autonomous operations for single spacecraft and for sensor webs, and supporting capabilities such as decision support tools, planners, and high level command protocols based on science objectives.
5. *Information Systems Architectures and Standards* – Technologies that support the development of on-board operating systems and procedures and enable intelligence and autonomy. Technologies that create an evolvable computing and operating system environment(s) that are consistent with the heterogeneous and distributed systems described in the Earth Science Vision Initiative are excellent examples.

Testbeds needed for testing, verification, or validation of components, subsystems, and/or systems (both hardware and software) can be included as an integral part of a proposed technology effort.

(c) Reference Source Material

This NRA is to fund development activities that will form part of a technology investment portfolio aimed at reducing the risk, cost, and development time of space-based Earth observing systems, or enabling new Earth observation information products as a direct result of enhanced information technology capabilities. To understand the OES priorities, a review of the following source material is recommended.

(i) Easton Study

In the summer of 1998 the OES conducted a Request for Information (RFI) on Concepts for Science and Applications Missions in the Post-2002 Era. With this RFI, the OES began the implementation of the new paradigm for mission planning for the post-2002 missions. Using the information from the RFI response, the OES has formulated a notional flight mission profile that will guide Earth Science Enterprise activities, drive technology developments, and provide an initial timeline for mission implementation beyond the current series of EOS satellites. This nominal multi-mission profile for Earth observation satellite missions in the 2003-2010 time frame was further refined in a NASA workshop at Easton, MD. The results of the workshop are available on the World Wide Web (WWW) at <http://www.earth.nasa.gov/visions/Easton/index.html>.

(ii) AIST RFI

The OES recently conducted another RFI for Advanced Information Systems Technology (AIST) relevant to Earth Sciences (ES). This activity solicited inputs from both the ES scientific and information technology communities for those information system technologies which would enable the ES Vision, New Data and Information Systems and Services (NewDISS), Digital Earth, and ESIP Partners. View the RFI at <http://www.earth.nasa.gov/nra/current/rfi10-00007/index.html>.

A workshop was held thereafter to cull the resultant white paper submissions for enabling ES Information System technologies. The results of that workshop are located at <http://esto.gsfc.nasa.gov/workshops/aist-rfi.html>. ES Information Technology concepts derived from the workshop have been added to the Capability & Needs Matrix, which is a compilation of the ES scientific community's measurement needs, expressed as technology gaps that address the measurement of Earth system science parameters, ES platform needs, and ES information systems technology needs. This database serves as the top-level technology requirements, planning, and portfolio investment and tracking tool for the Earth Science Technology Office (ESTO). Although all the information is useful in understanding the combined OES Technology Development Program, only the Information Systems Technology section is germane to this NRA. The matrix can be found on the WWW at <http://esto.gsfc.nasa.gov/documentation.html>, under "Capability & Needs Matrix".

(iii) Earth Science Vision Initiative

The Earth Science Vision Initiative began in late 1998. NASA Headquarters requested that NASA Goddard Space Flight Center (GSFC) lead an agency wide effort to look at the role of NASA's ES enterprise in the 2020 time frame. A copy of the ES Vision presentation, which identifies several long-term information technology drivers, is available on the WWW at <http://esto.gsfc.nasa.gov/programs/aist.html>, look under "Earth Science Vision". This has not been formally adopted by OES, but it does provide relevant information on potential technology interests.

Innovative proposals are encouraged for advanced information system technologies that address the OES program needs identified in the source materials, with emphasis on space-based applications. Check Appendix A for the criteria to be applied to evaluate the proposals.

(d) Technology Readiness Level (TRL) Guidance

The proposer must define the starting point TRL, the exit TRL, and success criteria for their proposal activity. Past and ongoing work on the research activity should determine the entry point. Studies or developments within this NRA will be restricted to an exit TRL less than or equal to 6. The proposer should seek an alternate technology program for developments that exceed TRL 6 (see Appendix G). For this solicitation, the entry TRL can be from 1 to 5. Over the duration of the research, the activity must advance by at least one TRL. For example, an activity can enter the technology development activity at TRL 3 and exit at TRL 4 or 5. These limitations naturally preclude end-to-end system testing or space qualification from being performed in the AIST Program.

The results at the exit point should provide convincing evidence that the proposed technology can be integrated into an on-going technology development program, such as NMP, or directly into other flight or ground based validation programs for infusion into design activities.

Each proposed development should include an evaluation of feasibility, requirements analysis, creation of elements, subsystem, or prototypes, and/or development of element or subsystem proof-of-concept demonstrations, as appropriate. All proposed efforts should include evaluation of anticipated performance, an estimate of the entry and exit TRLs, cost and schedule to achieve the next TRL, and documentation of technology dependencies. These items will be documented as contract deliverables.

Laboratory demonstrations may be funded and are expected to produce working elements or subsystems and data documenting performance measured in the laboratory. Testbed facilities to support technology evaluation may be included if needed. However, coordination for the utilization of special purpose equipment, facilities, etc., is the responsibility of the proposer.

(e) Relationship to Other Programs

For technology infusion to take place according to some predetermined timetable, appropriate funding must be applied at each stage or readiness level associated with the development of a specified end item. The OES is responsible for planning technology development activities to ensure that sufficient funding exists in the various development programs so that all technological risk is retired prior to a mission Announcement of Opportunity (AO). OES-specific programs which may be applicable to space-based information system technologies include the New Millennium Program and the Instrument Incubator Program.

(i) New Millennium Program

NASA has created the New Millennium Program (NMP) to enable new missions by the identification, development, and flight validation of emerging technologies. In order to fulfill program goals, affordable missions with highly focused objectives are chosen that also enhance scientific capability. The program encourages revolutionary and breakthrough technologies that traditionally have been difficult to incorporate into a science mission because of the inherently high risk associated with their first use. Key areas include lower mass systems to reduce launch costs, greater autonomy in space and on the ground to cut operations overhead, and shorter project life cycles to increase mission frequency. Information regarding the New Millennium Program can be found on the WWW at <http://nmp.jpl.nasa.gov>.

(ii) Instrument Incubator Program

The objectives of the Instrument Incubator Program (IIP) are to identify, develop and (where appropriate) demonstrate new measurement technologies that reduce the risk, cost, size, and development time of Earth-observing instruments, and enable new Earth-observation measurements. The IIP is designed to bring instrument systems to a demonstrated technology readiness level that is consistent with successful science AO competition in today's fast track (3 year) development environment. The Instrument Incubator will depend on NMP for space flight validation, if necessary, of instruments developed in the IIP. Information regarding the Instrument Incubator Program can be found on the WWW at <http://ntpio.nasa.gov/iip/index.html>.

(f) Funding

The U.S. Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made. Funding of the successful proposals will be through the award of contracts. Interagency agreements will be issued, though grants will not be awarded for this solicitation. Proposers are also encouraged to offer cost-sharing.

Funding for this NRA will limit the number and magnitude of the proposals awarded. The OES expects that 15 to 20 proposals will be awarded, with values in the approximate range of \$150,000 to \$500,000 per year.

(g) Period of Performance

The minimum period of performance is 24 months. The total proposed period of performance must not exceed 36 months. The Government will award contracts for a 2-year base period, with a 1-year option exercisable by the Government. Proposals must define clear, measurable milestones to be achieved in order to warrant exercise of the option.

Bimonthly reports that document technical progress and financial status, and interim annual reports will be required as deliverables for awarded proposals. In addition, a final report will be required to document the detailed element or subsystem designs, performance, and remaining risks.

(h) International Participation

This announcement is open to the international technology community. International cooperative proposals, with co-investigators from U.S. institutions participating in foreign-led proposals or with co-investigators from non-U.S. institutions on the teams of proposals from U.S. institutions, are also encouraged. These proposals must be on a "no-exchange-of-funds" basis for their non-U.S. elements and should identify any requirements for NASA financial support for U.S. participants. Proposals from non-U.S. institutions are encouraged, but only on a "no-exchange-of-funds" basis. Specific instructions for proposals from non-U.S. institutions are included in Appendix C.

(i) Guidance to Proposers; Procedures

Participation in this NRA or a subsequent similar NRA is not a prerequisite to selection in any future OES NRA or AO. Similarly, participation in this NRA does not guarantee continued participation in the AIST Program or success in any future OES NRA or AO competition. Successful participation in this NRA is intended to give innovative information system technologies the technical pedigree they need to compete in future relevant OES solicitations. Solicitations similar to this announcement will be issued periodically to select additional information system technologies for development, and to continue the promotion of promising technological developments.

All prospective proposers are strongly encouraged to submit a letter of intent to propose to NASA in response to this announcement as per the schedule below. This letter will help to scope NASA's planning for the peer review process. The letter of intent should be submitted electronically through the Internet by completing the forms at URL: <http://www.earth.nasa.gov/LOI>, as described in Appendix F.

Proposals should be prepared and submitted in accordance with specific information provided in Appendices A-G of this Announcement. Appendix A provides additional instructions for proposers to this announcement. Appendix B contains the general instructions needed for preparation of solicited proposals in response to NASA Research Announcements. Appendix C provides guidance for international participation. Appendix D provides the list of required declarations, the proposal cover sheet, and information on requisite certifications and disclosures. Appendix E contains a budget summary worksheet with instructions for its use. Appendix F contains format for the Letter of Intent. Appendix G contains a definition of Technology Readiness Levels. All proposals submitted to NASA in response to this announcement must have a completed cover-sheet-form and information on current and pending research support from all other sources (see Appendix D) attached. All proposals from Principal Investigators (PIs) from the U.S. and other countries will be reviewed and evaluated by NASA.

Submit proposals to: AIST Program NRA
Office of Earth Science/Code Y
400 Virginia Avenue, SW
Suite 700
Washington, DC 20024
(For overnight delivery purposes only,
The recipient telephone number is 202-554-2775)

Selecting Official: Associate Administrator
Office of Earth Science
NASA Headquarters

Point of Contact for Program Planning and Solicitation:
Dr. Glenn E. Prescott, Program Coordinator
Office of Earth Science/Code YF
NASA Headquarters
Washington, DC 20546-0001
Tel: (202) 358-0886
Fax:(202) 358-2891
gprescot@hq.nasa.gov

Point of Contact for Implementation:
Steven A. Smith, Program Manager
Earth Science Technology Office
NASA Goddard Space Flight Center
Greenbelt, MD 20771
Tel.: (301) 286-7336
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steven.a.smith@gsfc.nasa.gov

Note: Proposal submitted directly to NASA Headquarters will be delayed in receipt and processing. Therefore, please adhere to the "Submit proposals to:" address provided above.

(k) Selection Schedule

All proposals submitted in response to this announcement are due in accordance with the schedule shown below. Late proposals will not be considered for review and funding, unless the selecting official deems it to offer NASA a significant technical advantage or cost reduction.

A complete proposal schedule is given below:

| | |
|----------------------------------|-----------------------------------|
| Letter of Intent to Propose due | December 27, 1999 |
| Proposals due | January 25, 2000 |
| Peer Review | February 1, 2000 – March 10, 2000 |
| Announcement of Final Selections | March 24, 2000 |

Your interest in participating in this opportunity is heartily welcomed.

Ghassem R. Asrar
Associate Administrator for
Office of Earth Science

Enclosures:

- Appendix A. Specific Guidelines for Proposers
- Appendix B. Instructions for Responding to NASA Research Announcements
- Appendix C. Guidelines for Foreign Proposals and Proposals Including Foreign Participation
- Appendix D. Proposal Cover Sheet, Forms, and Required Declarations, Certifications, Disclosures, and Assurances
- Appendix E. Budget Summary
- Appendix F. Letter of Intent
- Appendix G. Definition of Technology Readiness Levels

APPENDIX A

SPECIFIC GUIDELINES FOR PROPOSERS

I. Evaluation Factors

The following evaluation factors will be used to evaluate the proposals. They replace and supersede those contained in Appendix B, paragraph (i) Evaluation Factors.

A. Factor 1: Relevance to OES Programs as Defined in Source Materials (40% of total value)

1. The element or subsystem's relevance and potential contribution to NASA's scientific and technical areas of emphasis, including the potential to enable new information products and/or measurements.
2. The potential of the element or subsystem to be integrated, once matured, into an operational system.
3. The potential for the element or subsystem to reduce the risk, cost, size, and development time of OES systems. Potential cost reductions should be clearly stated and substantiated to the extent possible, with supporting analysis indicating scalability.

B. Factor 2: Technical Merit (30% of total value)

1. Feasibility and merit of the proposed technical approach to achieve the study or technology development objectives. Discuss any possible commercial benefits.
2. Degree of innovation of the proposed study or technology development concepts and approach.
3. Substantiated justification that the element, subsystem, or system study or technical development is at the appropriate level of readiness (TRL) for the AIST Program.
4. Feasibility of obtaining the reduction in risk, cost, size, and development time with the proposed element, subsystem, or system and measurable TRL increases.

C. Factor 3: Cost and Programmatic Realism (30% of total value)

1. Adequacy and realism of proposed milestones.
2. Cost realism of the proposed budget.
3. Adherence to sound and consistent management practices appropriate to the TRL level of the proposed task.
4. Past performance and related experience in the proposed area of study or technology development.

5. Qualifications of key personnel, and adequacy of facilities, staff, and equipment to support the proposed activity.
6. Commitment of the organization's management to the proposed technology development (evidenced by cost and resource sharing, prior teaming arrangements, etc.). Proposers should identify any previous investment by the organization/program and provide supporting documentation.

II. Proposal Guidance

The technical proposal should address each of the items below, which supplement the guidance provided in Appendix B, Paragraph (c)(4).

- A. Description of Proposed Technology - Provide a description of the proposed element, subsystem, or system technology. Describe the technical approach and include an operational concept or use scenario of the proposed element, subsystem, or system technology that addresses ES needs.
- B. Applicability to OES Missions – Describe the benefit to OES systems and science capabilities, as related to future science measurements, that could utilize the proposed elements, subsystems, or systems. If appropriate, include a discussion of potential technology infusion paths to ES missions for proposed element, subsystem, or system technologies.
- C. Comparative Technology Assessment – Describe the anticipated advantages of this element, subsystem, or system technology compared to those currently in use - e.g., reduction of size, mass, power, volume or cost, improved performance, or enabling of a new capability not previously possible. Review the current state of the art and relate to the current state of the proposed work.
- D. TRL Assessment – Provide the current TRL assessment of the element, subsystem, or system technology, and the anticipated progression of TRL levels throughout the proposed effort. See Appendix G for guidance on Technology Readiness Levels. *Failure to report TRL assessments may be a cause for non-selection.*
- E. Research Management Plan – Provide a statement-of-work that concisely describes each task or milestone to be accomplished in the course of the research and development. Also include a milestone chart that identifies critical dates and deliverables in the research and development program. Identify the roles of key personnel.
- F. Budget – Full cost accounting (FCA) is required in all proposals, including those by submitted by U.S. Government agencies. To assist in the selection process, Government proposals should be submitted with budgets that clearly indicate the costs with and without FCA. Cost sharing or matching arrangements should also be indicated, if applicable.

Each proposal will require a cover sheet as described in Appendix D. In that cover sheet the proposer is required to select a single category to which the proposal responds – Reference Paragraph III (b) of this NRA. This is intended to aid in the evaluation of the proposal, and will not be used to limit the applicability of proposals from related categories.

The maximum length of each proposal is limited to 12 non-reduced, single-space typewritten pages for the total of the project description, management approach, personnel, and facilities and equipment sections (i.e., the whole proposal, excluding the Proposal Cover Sheet and the certifications required by Appendix D and budget information, is limited to 12 pages). Each side of a sheet of paper containing text or figures is considered a page. Use type font 12 point or larger, minimum one-inch margins and standard 8.5 x 11 inch paper.

The proposer shall submit 2 paper copies and one magnetic or optical disk (Macintosh or IBM PC compatible format) with the proposal in acceptable format. Acceptable electronic format consists of documents formatted using Microsoft Word, WordPerfect, Postscript, or Portable Document Format (PDF). Include information on the formats chosen. In order to expedite the review process, please submit the electronic proposal as two documents. That is, on the disk submitted with your proposal, separate the technical proposal (including Proposal Cover Sheet and budget) from the certifications and representations required by Appendix D.

III. Reporting Requirements

The following deliverables will be required of awarded proposals. In cases where subcontract arrangements exist, consolidated project reports, including financial reports, are the responsibility of the PI. In this context “Annual” refers to a calendar year task effort which commences at contract award. All written reports and review presentation material should be submitted in electronic format or paper copy 10 days prior to the review.

A. Bimonthly Reports:

The initial bimonthly report should include a plan for technical, schedule and resource activities for the year. Reports should be submitted every other month on a schedule to be determined by the Earth Science Technology Office (ESTO). A teleconference will be conducted between the ESTO and the awardee to review and discuss each report. These reports must include:

1. Technical status: The awardee must summarize accomplishments for the preceding two months, including technical accomplishments (trade study results, requirements analysis, design, etc.), technology development results, results of tests and/or demonstrations.
2. Schedule status: The awardee must address the status of major tasks and the variance from planned versus actual, including tasks completed, tasks in process and expected to complete later than planned, tasks that are delayed starting with rationale for each, and recovery plans as appropriate.
3. Financial status: The financial status should be monthly actuals and cumulative, and focus on the proceeding two-month’s efforts. The awardee must address:
 - (a) the variance of planned versus actual costs, and include work that has been completed and cost incurred from the project (should be traceable to the schedule),
 - (b) the status of major procurements that have been incurred to date and
 - (c) the amounts obligated to suppliers and subcontractors, including open purchase orders against which materials have not been received nor services rendered.

An initial assessment should be provided of the Technology Readiness Level (TRL) and the basis for that assessment for the critical technology developments of the activity. The first TRL assessment is to be provided with the first report. An updated TRL assessment must be provided with each annual report.

B. Interim Review:

The awardee must provide a report summarizing the work accomplished and results leading up to this mid year milestone review and must:

1. Describe the primary findings, technology development results, and technical status, e.g., status of elements, construction of breadboards or prototype implementations, results of tests and/or proof-of-concept demonstrations, etc. The PI may provide a laboratory demonstration, if appropriate, to show technical results and status.
2. Describe the work planned for the remainder of the year and critical issues that need to be resolved to successfully complete the remaining planned work.
3. Summarize the cost and schedule status of the project, including any schedule slippage/acceleration.
4. Summarize the status of project reserve (if applicable) and planned use to meet critical milestones remaining in the phase.

The ESTO will conduct a one day (approximately) review at the PI's facility, or at a mutually agreed upon location. The presentation at the review will constitute the interim report.

C. Annual Review:

The awardee must provide a report summarizing the work accomplished and anticipated results at the end of each year. This review must include:

1. A description of the work accomplished and the results leading up to this review.
2. A summary of the primary findings, technology development results, and technical status, e.g., status of elements, construction of breadboards or prototype implementations, results of tests and/or demonstrations, etc. The PI may provide a laboratory demonstration, if appropriate, to show technical results and status.

D. Annual Report:

The annual report should be submitted within 10 days following the end of the review, and should include the following:

1. Results of all analyses, element, subsystem, or system designs, breadboards and/or prototype implementations and designs.
2. Performance analysis results of tests and/or demonstrations; estimation of reduction of size, mass, power, volume, cost, improved performance, or description of enabled capability not previously possible; and documentation of technology dependencies.

3. Tables, graphs, diagrams, curves, sketches, photographs and drawings in sufficient detail to explain, comprehensively, the results achieved.

4. An updated TRL assessment, including a rough order of magnitude cost and a description of, and estimate of, the duration of the follow-on activities necessary to achieve TRL 7 for technologies that remain at less than TRL 7 at the completion of the (final) phase.

APPENDIX B

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.

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

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

(l) 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 (1)(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 Number)
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.

APPENDIX C

GUIDELINES FOR FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION

- (a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. 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. The letter of 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. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement, if review and endorsement are not possible before the announced closing date. In such cases, however, the NASA sponsoring office should be advised when a decision on the endorsement is to be expected.
- (b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:
1. An exchange of letters between NASA and the sponsoring governmental agency; or
 2. A formal Agency-to Agency Memorandum of Understanding (MOU).

Revision date 10/25/99

APPENDIX D

PROPOSAL COVER SHEET

NASA Research Announcement 99-OES-08

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

| <u>Name</u> | <u>Institution & email address</u> | <u>Telephone & Address</u> |
|-------------|--|--------------------------------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Budget:
1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Proposal Topic Category - Check one from the five areas below (Ref. Para. III (b)):

- ____ *On-board Data Processing and Intelligent Sensor Control*
- ____ *On-board Satellite Data Organization, Analysis and Storage*
- ____ *Transmission and Network Configuration*
- ____ *Intelligent Platform Control*
- ____ *Architectures and Standards*

PROPOSAL COVER SHEET (Cont.)

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and (ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

**CERTIFICATION OF COMPLIANCE WITH THE NASA REGULATIONS PURSUANT
TO NONDISCRIMINATION IN FEDERALLY ASSISTED PROGRAMS**

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX E

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimate for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

| | A | NASA USE ONLY | |
|---|----------|--------------------------|----------|
| | | B | C |
| 1. <u>Direct Labor</u> (salaries, wages, and fringe benefits) | _____ | _____ | _____ |
| 2. <u>Other Direct Costs:</u> | | | |
| a. Subcontracts | _____ | _____ | _____ |
| b. Consultants | _____ | _____ | _____ |
| c. Equipment | _____ | _____ | _____ |
| d. Supplies | _____ | _____ | _____ |
| e. Travel | _____ | _____ | _____ |
| f. Other | _____ | _____ | _____ |
| 3. <u>Facilities and Administrative Costs</u> | _____ | _____ | _____ |
| 4. <u>Other Applicable Costs:</u> | _____ | _____ | _____ |
| 5. <u>SUBTOTAL--Estimated Costs</u> | _____ | _____ | _____ |
| 6. <u>Less Proposed Cost Sharing</u> (if any) | _____ | _____ | _____ |
| 7. <u>Carryover Funds</u> (if any) | | | |
| a. Anticipated amount : _____ | | | |
| b. Amount used to reduce budget | _____ | _____ | _____ |
| 8. <u>Total Estimated Costs</u> | _____ | _____ | XXXXXXXX |
| 9. APPROVED BUDGET | XXXXXXX | XXXXXXXXX | _____ |

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. Other Direct Costs:
 - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. Other Applicable Costs: Enter total explaining the need for each item.
5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).
8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX F

LETTER OF INTENT

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. This letter of intent is available electronically via the Internet at URL: <http://www.earth.nasa.gov/LOI>. We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose
(Please limit summary to no more than 3000 characters).

APPENDIX G

DEFINITION OF TECHNOLOGY READINESS LEVELS

TRL 1 Basic principles observed and reported

Transition from scientific research to applied research. Essential characteristics and behaviors of systems and architectures. Descriptive tools are mathematical formulations or algorithms.

TRL 2 Technology concept and/or application formulated

Applied research. Theory and scientific principles are focused on specific application area to define the concept. Characteristics of the application are described. Analytical tools are developed for simulation or analysis of the application.

TRL 3 Analytical and experimental critical function and/or characteristic proof-of-concept

Proof of concept validation. Active R&D is initiated with analytical and laboratory studies. Demonstration of technical feasibility using breadboard or brassboard implementations that are exercised with representative data.

TRL 4 Component/subsystem validation in laboratory environment

Standalone prototype implementation and test. Integration of technology elements. Experiments with full-scale problems or data sets.

TRL 5 System/subsystem/component validation in relevant environment

Thorough testing of prototype in representative environment. Basic technology elements integrated with reasonably realistic supporting elements. Prototype implementations conform to target environment and interfaces.

TRL 6 System/subsystem model or prototype demonstration in a relevant end-to-end environment (ground or space)

Prototype implementations on full-scale realistic problems. Partially integrated with existing systems. Limited documentation available. Engineering feasibility fully demonstrated in actual system application.

TRL 7 System prototype demonstration in an operational environment (ground or space)

System prototype demonstration in operational environment. System is at or near scale of the operational system, with most functions available for demonstration and test. Well integrated with collateral and ancillary systems. Limited documentation available.

TRL 8 Actual system completed and "mission qualified" through test and demonstration in an operational environment (ground or space)

End of system development. Fully integrated with operational hardware and software systems. Most user documentation, training documentation, and maintenance documentation completed. All functionality tested in simulated and operational scenarios. V&V completed.

TRL 9 Actual system "mission proven" through successful mission operations (ground or space)

Fully integrated with operational hardware/software systems. Actual system has been thoroughly demonstrated and tested in its operational environment. All documentation completed. Successful operational experience. Sustaining engineering support in place.