

A.21 ADVANCED COMPONENT TECHNOLOGY

Amended May 2, 2008

This final version of Appendix A.21: Advanced Component Technology replaces in its entirety the placeholder version that was released with the ROSES-2008 NASA Research Announcement. The due date for Notices of Intent to propose (NOIs) is May 30, 2008. The due date for proposals is July 30, 2008.

1. Scope of Program

1.1 Introduction

NASA's Earth Science Technology Office (ESTO) manages the development of a range of advanced technologies to meet future Earth science measurements and operational requirements. ESTO technology investments attempt to address the full science measurement process: from instruments needed to make observations, to data systems and information products that make those observations useful.

The Advanced Component Technology (ACT) program seeks proposals for technology development activities leading to new component- and subsystem-level airborne and space-based measurement techniques to be developed in support of the Science Mission Directorate's Earth Science Division. The objectives of the ACT program are to research, develop, and demonstrate component- and subsystem-level technology development that:

- Reduce the risk, cost, size, volume, mass, and development time of Earth observing instruments and platforms, and
- Enable new Earth observation measurements.

The ACT program brings instrument components to a maturity level that allows their integration into other NASA technology programs such as the Instrument Incubator Program (IIP; see Appendix A.22 of ROSES-2008). Some of these components are directly infused into mission designs by NASA flight projects and others "graduate" to other technology development programs for further development.

NASA's Technology Readiness Level (TRL) is an ordinal classification system that allows comparison of the degree of maturity of technologies under development. TRLs range from 1 to 9 (see section 2.1.2.2, Table 1 for TRL definitions), and these indicate completion of increasingly demanding proof-of-performance criteria at various stages of a technology development. Figure 1 shows the progression of TRL goals for two ESTO programs, for flight validation, and for future science missions.

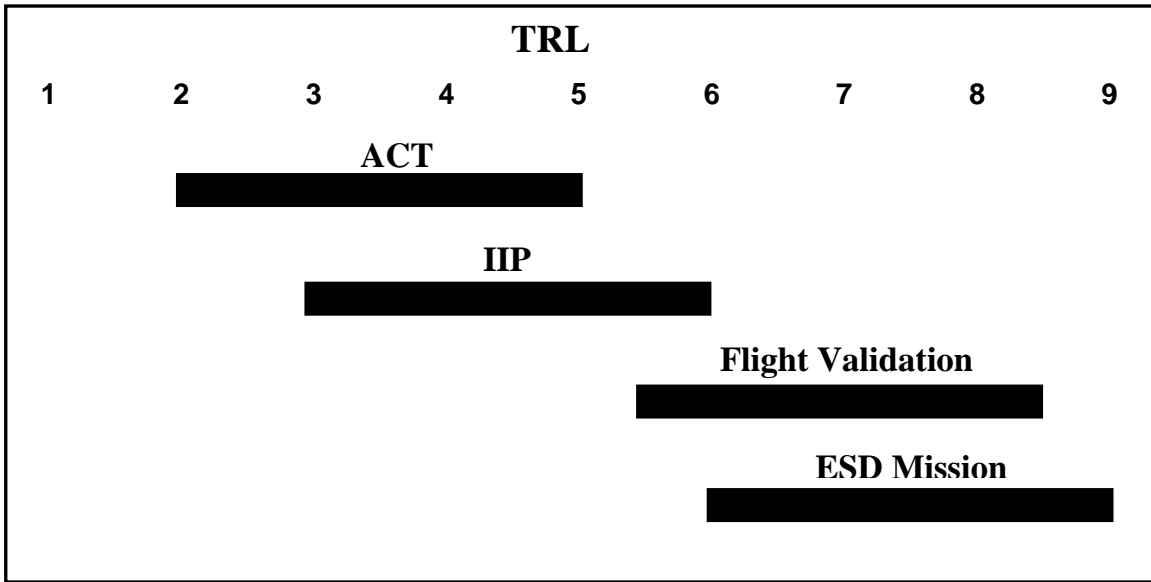


Figure 1. TRL Ranges for Technology Development Programs and Science Missions

1.2 Background and Solicitation Justification

A series of future Earth Science mission concepts have been recommended by the National Research Council (NRC) in response to a request from NASA’s Office of Earth Science, the National Oceanic and Atmospheric Administration (NOAA) National Environment Satellite Data and Information Services, and the U.S. Geological Survey (USGS) Geography Division. The full NRC report entitled, “Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond” may be accessed on the web at <http://www.nap.edu/catalog/11820.html>. This report is referred to as the “Decadal Survey.”

New technology will play a key role in enabling many of the NRC recommended measurements and helping to reduce the cost of other measurements. This ACT solicitation will facilitate the implementation of the recommended measurements by carefully choosing where to invest in component and/or subsystem technologies for future instrumentation to get the greatest benefit from NASA’s technology development funds.

1.3 Proposal Research Topics

Priority for selection will be given to those proposals that most clearly demonstrate the potential for making significant contributions to the technology readiness of the Earth science measurements recommended by the Decadal Survey.

In particular, priority for selection is given to those proposals that most clearly demonstrate the potential for making significant contributions in the following component and subsystem technology areas (n.b., mission names and acronyms in parentheses are from the Decadal Survey):

- In the area of **active optical technologies** for Earth science instruments, space-qualifiable laser transmitters that meet power, stability, pulse width, and line width requirements for land surface topography for landslide hazards, water runoff measurement, vegetation structure, and troposphere winds (LIST, DESDnyI, and 3D-Winds) and day/night, all-latitude, all season CO₂ column integrals for climate emissions (ASCENDS) including the ancillary O₂ measurement. Also, optical detectors with improved sensitivity and detection efficiency, including solid state photon counting detectors, for land surface topography for landslide hazards and water runoff measurement (LIST) and Satellite Laser Ranging. Supporting technologies such as high speed ranging and digitizing electronics, as well as low mass, high reliability scanning systems for LIST and Satellite Laser Ranging.
- In the area of **passive optical technologies** for Earth science instruments, stray light control and detectors for use in UV-VIS and SWIR/IR spectrometer for daytime measurements of O₃, NO₂, SO₂, CH₂O, and for daytime column measurement of CO in SWIR (GACM). In addition, components for increasing the system-level performance of passive optical instruments needed to measure ocean color and atmospheric chemistry from Geo-Synchronous orbit (Geo-CAPE).
- In the area of **microwave technologies** for Earth science instruments, electronically steerable Ku- and X-band antenna technologies for snow accumulation for fresh water availability measurement (SCLP). Also, RF hybrid chips for miniaturization of RF electronics, low power millimeter wave receivers, ultra low power digital correlators, and technologies enabling large deployable Ka-band or higher spaceborne reflectors for Decadal Survey missions/measurements. Support for very long baseline interferometry (VLBI) is sought in the areas of broadband, dual polarization feeds for 1-15 and 15-36 GHz, external phase reference, analog down converters, and low temperature coefficient 5/10 MHz frequency distribution amplifiers. Also, continuous, reliable co-location monitoring of geodetic observatory instruments to better than 1 mm is desired. In addition, advanced antenna design including feeds and digital beam forming and filtering processors that would allow simultaneous reception of SAR and all GNSS signal within the L-Band spectrum.
- In the area of **calibration**, low mass and small size SI-traceable calibration sources for measurement of Solar and Earth radiation (CLARREO).

ESTO encourages proposers to investigate teaming and leveraging of emerging technologies, such as current and recent Small Business Innovative Research awards (<http://sbir.gsfc.nasa.gov/SBIR/awards.htm>).

2. Programmatic Information

This solicitation provides additional details governing the proposed activities that expand or supersede the general guidelines announced in the *NASA Guidebook for Proposers Responding to a NASA Research Announcement - 2008*. The most current edition of the Guidebook may be accessed on the web at:

<http://www.hq.nasa.gov/office/procurement/nraguidebook/>.

2.1 Proposal Content and Submission

2.1.1 Notice of Intent to Propose

A Notice of Intent (NOI) to propose is encouraged, but not required, for submission of proposals to this solicitation. The information contained in the NOI is used to help expedite proposal review activities and, therefore, is of considerable value to both NASA and the proposer. NOIs shall be submitted electronically via NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) by the due date given in Section 2.5. Since NOIs submitted after the deadline may still be useful to NASA, late NOIs, as well as indications of intent NOT to propose on an earlier NOI submission, may be submitted by Email to the point of contact for this solicitation (see Section 2.5).

2.1.2 Proposal Content

2.1.2.1 Proposal Summary

Each proposal shall include a proposal summary that describes the proposed work in no more than 300 words. The proposal summary shall include: (a) objectives and benefits; (b) an outline of the proposed work and methodology; (c) the period of performance; and (d) entry and planned exit TRL.

2.1.2.2 Scientific/Technical/Management Section

This section completely replaces Section 2.3.5 of the *Guidebook for Proposers*.

This section of the proposal must include the following content information in subsections that use the same titles. Failure to provide any of this material may be cause for the proposal to be judged as noncompliant and returned without further review. The Project Description shall be limited to 12 nonreduced, single-spaced typewritten pages. Standard proposal style formats shall be in accordance with Section 2.2 of the *Guidebook for Proposers*. Proposals that exceed the 12-page limit will be truncated at 12 pages.

1. Applicability to Earth Science Measurements in the NRC Decadal Survey – Describe the benefits to future Earth science missions that utilize the proposed technology. Proposers shall include a one-page relevancy scenario showing how the proposed technology contributes to one or more Earth science

Decadal Survey measurements. Proposals that fail to include a relevancy scenario will be considered noncompliant and will be returned without review.

2. Description of Proposed Technology – Provide a description of the proposed component or subsystem level technology. Describe the technical approach and include an operational concept for the proposed technology that shows how it addresses Earth science needs. Discuss any possible cross cutting or commercial benefits.
3. Comparative Technology Assessment – Describe anticipated advantages of this technology compared to those currently in use - e.g., reduction of size, mass, power, volume, cost, improved performance, or enabling of a new capability not previously possible. Reference the current state of the art and relate it to the proposed work.
4. TRL Assessment – Proposers must define the starting point for the component and subsystem technology or measurement technique and the exit or success criteria for the proposed activity. The results at the exit point must provide convincing evidence that the component or subsystem is a candidate for continued development or can meet the proposed success criteria and can be integrated into an on-going technology development program for infusion into an instrument design. The TRL shall advance by at least one level during the period of performance of the activity. If the proposed activity duration is for multiple years, advancement of one TRL per year is desirable.

For this solicitation, the entry TRL shall be 2 or greater. Table 1 provides high-level definitions for instrument system technology TRLs. More detailed TRL definitions can be found at <http://esto.nasa.gov/files/TRL.doc>. The proposer shall identify the entry TRL, the planned exit TRL, and success criteria in their proposal. The proposer shall substantiate the entry TRL in the proposal. Proposals that fail to include and substantiate the entry TRL will be considered noncompliant and will be returned without review.

Table 1. TRL Definitions Summary

TRL	Definition
1	Basic principles observed and reported
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof-of-concept
4	Component and/or breadboard validation in laboratory environment
5	Component and/or breadboard validation in relevant environment
6	System/subsystem model or prototyping demonstration in a operational environment
7	System prototyping demonstration in a operational environment
8	Actual system completed and "flight qualified" through test and demonstration
9	Actual system flight proven through successful mission operations

5. Research Management Plan – Provide a statement of work that concisely describes each task and milestone to be accomplished in the course of the research and development. Define the success criteria associated with each task or milestone. Also include a schedule chart that identifies critical milestones. At least two milestones per twelve-month period must be defined.

Subcontracting portions of the research project is acceptable, but overall management and reporting are the responsibility of the proposing organization.

6. Personnel – Include a list of key personnel and identify experience related to the proposed activity. Proposers should be sure to demonstrate technology development and instrument development skills on the team. The key personnel list is included in the overall page count and must include, as a minimum, the Principal Investigator (PI). Optionally, one-page resumes for Key Personnel may be supplied; these resumes are not included in the overall page count.
7. Facilities and Equipment – Describe significant facilities and equipment required to complete the work. Before requesting funding to purchase a major item of capital equipment, the proposer should determine if sharing or loan of equipment already available within the proposing organization is a feasible alternative.

8. Special Matters – Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal.
9. Quad Chart – Provide a quad chart that shall contain the following information:
 - Upper Right Quadrant: A visual, graphic, or other pertinent information
 - Upper Left Quadrant: “Description and Objectives”
 - Lower Left Quadrant: “Approach” and “Co-Is/Partners”
 - Lower Right Quadrant: “Milestone Schedule” and “Entry TRL.”

A template and example of the quad chart can be downloaded from http://esto.nasa.gov/files/EntryQuad_instructions_template.ppt. This quad chart is not included in the overall page count.

2.1.3 Proposal Submission

Proposals shall be submitted electronically via NSPIRES, as described in the *Guidebook for Proposers* (see Chapter 3 for details). Proposals submitted after the due date will not be evaluated or selected.

2.2 Award Information

2.2.1 Funding

The Government’s obligation to make award(s) is contingent upon both the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this solicitation. No additional funds beyond the negotiated award value will be available. NASA does not allow for payment of profit or fee to commercial firms under grant awards (see section 2.2.3).

The funding available for this solicitation will limit the number and magnitude of the proposals awarded. The ESTO expects that a total of 10 to 12 proposals will be selected and awards issued with values not to exceed \$360K per year per award.

Proposers are encouraged to offer cost sharing. If a cost sharing arrangement is proposed, appropriate data rights that recognize the proposer’s contributions, as well as the Government’s rights to access, will be negotiated prior to award.

2.2.2 Period of Performance

The minimum period of performance is 12 months. The total proposed period of performance must not exceed 36 months. Grants may be awarded for up to a three-year performance period. Annual reviews will be held according to the criteria specified in the *NASA Grants and Cooperative Agreement Handbook* (14 CFR 1260). Proposals must

define clear, measurable milestones to be achieved for each year of performance in order to warrant continuation in the second and third years.

2.2.3 Type of Award

All selected proposals will result in the award of grants, cooperative agreements, or intra- or inter-Government transfers, as appropriate. Contracts are specifically excluded as an award vehicle for this solicitation. Grants and cooperative agreements will be subject to the provisions of the *NASA Grants and Cooperative Agreement Handbook*. If a commercial organization wants to receive a grant or cooperative agreement, cost sharing is required, unless the commercial organization can demonstrate that it does not expect to receive substantial compensating benefits for performance of the work. If this demonstration is made, cost sharing is not required but may be offered voluntarily (see also Section D, Provision 1274.204, of the *Grants Handbook*).

2.3 Evaluation Criteria

The first criterion, intrinsic merit, includes the technical merit of the proposed investigation and specifically includes the following factors:

1. Feasibility and merit of the proposed technical approach to achieve the technology development objectives;
2. Degree of innovation of the proposed technology development concepts and approach;
3. Substantiated justification and appropriateness of the entry and exit technology readiness level (TRL); and
4. Feasibility of obtaining the potential reduction in risk, cost, size, and development time, or making the newly enabled measurement, with the proposed component or subsystem; and feasibility of making a demonstrable TRL increase. The TRL must advance by at least one (1) level during the performance period of the project.

The second criterion, relevance to NASA's objectives, includes the applicability of the proposed investigation for technology needs in support of Decadal Survey science measurements and specifically includes the following factors:

1. The proposal's relevance and potential contribution to NASA's scientific and technical areas of emphasis, including the potential to contribute to future Earth science instruments to make measurements which are part of the Decadal Survey measurements concepts;
2. The potential for component or subsystem level technology development to reduce the risk, cost, size, and development time of Earth science instruments or to enable new Earth science measurements. Potential cost reductions should be clearly stated and substantiated to the extent possible, with supporting analysis that indicates scalability;

3. The potential of the component or subsystem level technology to be integrated, once matured, into an Earth science instrument system; and
4. The potential for the component or subsystem technology development to have commercial benefits.

The third criterion, cost realism and reasonableness, specifically includes the following factors:

1. Adequacy and realism of proposed milestones and associated success criteria;
2. Realism and reasonableness of the proposed cost and comparison of costs to available funds;
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 technology development;
5. Qualifications of key personnel and adequacy of facilities, staff, and equipment to support the proposed activity. This factor includes evaluation to ensure that the team has strong technology development and instrument development skills, as well as any leveraging/teaming such as recent SBIR awardees; and
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.

2.4 Technical Reporting Requirements

All status information, presentation material, and report deliverables applicable to this ACT solicitation shall be submitted to the web-based ESTO ACT-08 Award Administration e-Book located at <http://esto.reisys.com/esto/>. A user account on the ESTO e-Book will be provided to the PI upon award. All submissions shall be made in PDF (preferred), Microsoft Word, Microsoft Excel, or Microsoft PowerPoint.

The following deliverables will be required of awarded proposals. In cases where subcontract arrangements exist, consolidated project reports are the responsibility of the PI. The proposed budget should provide for these reporting requirements. In this context, "Annual" refers to a twelve-month task effort that commences at award.

2.4.1 Initial Plans and Reports

Within 15 days of award, the PI shall update a Project Plan, initial Quad Chart, and initial TRL assessment. The project plan, initial (entry) Quad Chart, and initial TRL assessment (and supporting data) shall be uploaded to the appropriate locations in the ESTO e-Book for this solicitation.

The project plan shall identify plans for all technical, schedule, and resource activities for the proposed life of the project.

The Quad Chart shall contain the following information:

- Upper Right Quadrant: A visual, graphic, or other pertinent information
- Upper Left Quadrant: “Description and Objectives”
- Lower Left Quadrant: “Approach” and “Co-Is/Partners”
- Lower Right Quadrant: “Milestone Schedule” and “Entry TRL.”

The Quad Chart shall be updated at least annually and more often if appropriate. A template is available in the ESTO e-Book under “Information” and “File Templates.”

An initial TRL assessment, and the basis for that assessment, shall be provided within 15 days of award for the critical technology developments of the activity. The TRL assessment shall be updated at least annually, more often if appropriate.

2.4.2 Quarterly Technical Reports

The quarterly technical report shall focus on the preceding three month’s efforts. Each report shall address:

1. Technical status: The PI shall summarize accomplishments for the preceding two months, including technical accomplishments (trade study results, requirements analysis, design, etc.), technology development results, and results of tests and/or demonstrations.
2. Schedule status: The PI shall address the status of major tasks and the variance from planned versus actual schedule, including tasks completed, tasks in process, tasks expected to complete later than planned, and tasks that are delayed in starting, with rationale for each and recovery plans as appropriate.

Quarterly Technical Reports shall be uploaded to the appropriate location in the ESTO e-Book at two-month intervals, starting on the second-month anniversary date of the signing of the award vehicle.

In months for which the PI is providing interim or annual review, the requirement for a quarterly report is superseded by the interim or annual review requirements discussed in the next two sections.

Reports shall be submitted in PDF, Microsoft Word, or Microsoft PowerPoint compatible file formats by the required due date, or by close of business of the first workday following the due date if the due date falls on a weekend or a holiday. A teleconference or brief meeting may be conducted between the ESTO and the PI to review and discuss each report.

2.4.3 Interim Reviews

The PI shall provide an Interim Review at the end of the first six-month calendar period commencing from the date of award and at twelve-month intervals thereafter. The PI must provide a presentation summarizing the work accomplished and results leading up to this Interim Review and must:

1. Describe the primary findings, technology development results, and technical status, e.g., status of design, construction of breadboards or prototype implementations, results of tests and/or proof-of-concept demonstrations, etc;
2. Describe the work planned for the remainder of the project 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. A schedule milestone chart of all major task activities shall be created and maintained and shown at all reviews. A cost data sheet shall be created and maintained, showing total project costs committed, obligated, and costed, along with a graphical representation of the project cost profile to completion;
4. Provide a summary of anticipated results at the end of the task; and
5. At the second review and subsequent reviews, address the comments and recommendations prepared by the reviewers participating in the most recent review.

The ESTO will conduct the Interim Review via teleconference. The presentation shall be uploaded to the appropriate location in the ESTO e-Book at least two (2) working days prior to the review. Following the review, the presentation, updated in accordance with comments and discussion resulting from the review, will constitute the Interim Report and shall be uploaded to the appropriate location in the ESTO e-Book within ten days after the review.

2.4.4 Annual Review

The PI shall provide an Annual Review at the end of each twelve-month calendar period commencing from the date of award. The Annual Reviews are similar to the Interim Reviews and include all of the products required at an Interim Review with the following exceptions:

1. The review is held at the PI's facility or a mutually agreed to location.
2. The review is attended by an independent technical reviewer from an organization separately funded by ESTO.
3. Hardcopy handouts shall be provided by the PI at the review.

4. The PI may provide a laboratory demonstration, if appropriate, to show technical results and status.
5. Report any educational and outreach components of the project, e.g., graduate degrees, educational activities; technology infusion or patents applied for or granted; journal or conference publications; presentations at professional conferences, seminars and symposia; demonstrations; media exposure; and, other activities that contributed to the overall success of the research project.
6. The Annual Review should be comprehensive, and should include a discussion of the planned content of the written report.

The review package shall be uploaded to the appropriate location in the ESTO e-Book at least two (2) working days prior to the review. The presentation, updated in accordance with comments and discussion resulting from the review, together with the separate Annual Report, shall constitute the Annual Report deliverable, and shall be uploaded to the appropriate location in the ESTO e-Book within ten days after the review.

2.4.5 Final Review

The PI shall provide a Final Review at the completion of the activity. The Final Review is similar to the Annual Reviews and includes all of the products required at an Annual Review with the following exceptions:

1. The Final Review must provide conclusions of the work performed and make recommendations for follow-on activities that should be pursued, with estimates of the cost and schedule to achieve TRL 7.
2. As this is the Final Review, there is no need to present future work plans or a cost profile.

The written Final Report shall include the following:

1. Background of the project, including the science rationale for conducting this technology development;
2. Results of all analyses, element, subsystem, or system designs, breadboards and/or prototyping implementations and designs;
3. Performance analysis results of tests and/or demonstrations; estimation of reduction(s) in size, mass, power, volume and/or cost; improved performance; description of newly enabled capability; and documentation of technology dependencies;
4. Tables, graphs, diagrams, curves, sketches, photographs, and drawings in sufficient detail to comprehensively explain the results achieved;
5. An updated TRL assessment, including a rough order of magnitude cost and a description and estimate of the duration of the follow-on activities necessary to achieve TRL 7; and
6. Updated Quad Chart;

7. At the end of the period of performance, the PI shall provide a final Accomplishments Chart which contains the following information (a template is available in the e-Book):
 - Upper Right: A visual, graphic, or other pertinent information.
 - Upper Left: “Description and Objectives.”
 - Middle: “Accomplishments.”
 - Bottom: “Co-Is” (name and affiliation), “Entry TRL” and “Exit TRL.”

The Final Report, updated Quad Chart or Accomplishments Chart, and updated TRL assessment shall be uploaded with the updated Final Review presentation to the appropriate locations in the ESTO e-Book within ten days of the final review.

2.4.6 Earth Science Technology Conference and Workshops

The awardee is encouraged to participate in the annual Earth Science Technology Conference (ESTC). The ESTC is an opportunity for NASA planners, managers, technologists, and scientists to review the research funded by the ESTO. It is also an opportunity for researchers from NASA, academia, and industry to meet with their peers and to better understand NASA Earth science requirements.

Travel expenses will be provided for non-Government awardees selected to participate in the ESTC. A travel charge number will be provided to NASA awardees selected to participate; an invitational travel order will be issued to other (non-NASA) Government awardees selected to participate. Therefore, no travel costs for participation in ESTC should be included in the proposal. If selected for participation in the ESTC, the awardee should be prepared to make a presentation, provide a paper, or create a poster providing a description of the project, the objectives, approach, technical status, and schedule information.

2.5 Summary of Key Information

Expected total program budget for new awards	Up to \$360K per year per award
Number of new awards pending adequate proposals of merit	~ 10-12
Maximum duration of awards	Minimum 1-year / Maximum 3-year awards
Due Date for Notice of Intent to Propose (NOI)	May 30, 2008
Due date for delivery of proposals	July 30, 2008
Page length for the central Science-Technical-Management section of proposal	12 pp; see also Chapter 2 of the <i>NASA Guidebook for Proposers</i>

NASA strategic objective(s) which proposals must state and demonstrate relevance to	Every proposal must address one or more strategic goal or research objectives from Table 1 in the <i>ROSES Summary of Solicitation</i> . See also Sections I(a) and IV (e) of the <i>ROSES Summary of Solicitation</i> .
General information and overview of this solicitation	See the <i>ROSES Summary of Solicitation</i> .
Detailed instructions for the preparation and submission of proposals	See the 2008 <i>NASA Guidebook for Proposers</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/ .
Submission medium	Electronic proposal submission is required; no hard copy is required or permitted. See also Section IV of the <i>ROSES Summary of Solicitation</i> and Chapter 3 of the 2008 <i>NASA Guideline for Proposers</i> .
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposals via Grants.gov	http://grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH08ZDA001N-ACT
NASA point of contact concerning this program	Mr. Parminder Ghuman Earth Science Technology Office Code 407 NASA Goddard Space Flight Center Greenbelt, MD 20771 Telephone: (301) 286-8001 E-mail: Parminder.S.Ghuman@nasa.gov