

## B.5 HELIOPHYSICS GRAND CHALLENGES RESEARCH-THEORY, MODELING, SIMULATIONS

**NOTICE: Amended August 25, 2016. Use of MMS data is allowed in the TMS element. New text is in bold and deleted text is struck through. Step-1 proposals for this program element are now due October 13, 2016, and Step-2 proposals are now due November 23, 2016.**

**Proposal submission to all calls in Heliophysics, including this one, are performed by a two-step process, in which a Notice of Intent is replaced by a required Step-1 proposal submitted by an Authorized Organizational Representative (AOR). Only proposers who submit a Step-1 proposal are eligible to submit a Step-2 (full) proposal. Step-1 proposals will be checked for compliance but will not be reviewed. See Sections 2.3 and 2.4 for details.**

**Check for NASA spacecraft mission data compliance, as specified in the overview B.1.**

### 1. Scope of Program

The Heliophysics Grand Challenges Research (H-GCR) program is a component of the Heliophysics Research Program. Proposers interested in this program element are encouraged to see the overview of the Heliophysics Research Program in Appendix B.1 of this ROSES NRA.

#### 1.1 Overview

The Heliophysics Grand Challenges Research (H-GCR) program currently includes just one element: the former Heliophysics ROSES element called "Heliophysics Theory Program" (HTP, last competed in ROSES 2013 Appendix B.5). The former HTP is now referred to as the Theory, Modeling, and Simulations (TMS) element in the H-GCR program. A GCR-Science Center program element will be offered later this year by amendment to ROSES-2016 as B.9.

The goals of the Heliophysics Grand Challenges Research program are specifically designed to support investigations of complex problems that fall within the general realm of Heliophysics and whose full resolution has remained elusive. Work on such problems has traditionally been carried out by independent research groups that employ observational, theoretical, and modeling-based approaches. Increasingly, major advances in the field are taking place as a result of the close interactions between observers, theorists, and modelers. Thus, a coherent attack on the most challenging broad problems requires the efforts of a synergistically interacting group of multidisciplinary teams led by a single Principal Investigator, so as to enable deep and transformative science.

#### 1.2 Theory, Modeling, and Simulations (TMS)

The former Heliophysics Theory Program provides the foundation of the TMS element. Increasingly, as computing power becomes more affordable and more available, numerical simulations and modeling become tools that can and have been used synergistically with data analyses and rigorous theory development to solve the fundamental problems of Heliophysics. They lead the way to new understanding and drive science concepts for future strategic missions. The ultimate goal of **TMS** ~~such~~ investigations is to provide a complete chain of reasoning

extending from the basic laws of nature to comparison with observation to the identification of future quantitative tests of the behavior of the environment. NASA acknowledges this and renames the element "Theory, Modeling, and Simulations."

TMS investigations should address one of the four high level science goals from the Heliophysics Decadal survey (*Solar and Space Physics: A Science for a Technological Society* [www.nap.edu/catalog.php?record\\_id=13060](http://www.nap.edu/catalog.php?record_id=13060)) which are:

1. Determine the origins of the Sun's activity and predict the variations in the space environment;
2. Determine the dynamics and coupling of Earth's magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs;
3. Determine the interaction of the Sun with the solar system and the interstellar medium;
4. Discover and characterize fundamental processes that occur both within the heliosphere and throughout the universe.

Proposals that serve only as an umbrella for a variety of separate research tasks, even though they each may be related by a common theme and may each be of high scientific merit, are not appropriate for the TMS element. Efforts of sufficient scope and breadth and focused on those aspects of Heliophysics that directly affect life and society are not appropriate for the TMS element. **Proposals requiring the use of Magnetospheric Multiscale (MMS) data are permitted. [Amended August 25, 2016]**

## 2. Submission and Evaluation Guidelines

### 2.1 General Considerations

Each Principal Investigator (PI) is allowed to submit one and only one Step-1 proposal to this program element. In that proposal, the Principal Investigator is expected to invest a substantial portion of his/her time, 10-30%, to the investigation. Co-Investigators (Co-Is) must each have a specific and defined task in the project, and the task must be essential to the completion of the project. Use of Collaborators is discouraged. Proposals may be declared noncompliant based on either the Step-1 or Step-2 proposal if they are outside the scope of the H-GCR program (see Section 2.2 below) or if they fail to meet submission guidelines specified below (Section 3).

### 2.2 Limitations and Scope

Proposals outside the scope of Heliophysics CGR-TMS include the following:

- Proposals for the same or essentially the same work submitted concurrently to other program elements in Appendix B or E, as specified in B.1 Section 1;
- Work for which the proposing organization (or investigators) are already funded by NASA. Where projects might appear to overlap, proposals must show that the proposed effort does not duplicate other awards.
- ~~Proposals requiring the use of Magnetospheric Multiscale (MMS) data are not solicited.~~

## 2.3 Step-1 Proposals

To streamline the proposal process (submission, evaluation, and administration), this program uses a two-step proposal submission process. For a general overview of the two-step process see Section IV. (b) vii of the *ROSES Summary of Solicitation*.

A Step-1 proposal is required and must be submitted electronically by the Step-1 due date (see below and Tables 2 and 3 in the *ROSES Summary of Solicitation*). The Step-1 proposal must be submitted by the organization Authorized Organizational Representative (AOR). No budget or other elements are required. Only proposers who submit a Step-1 proposal are eligible to submit a full proposal. Step-1 proposals will be checked for compliance, but they will not be evaluated. The Step-1 proposal title, science goals, and investigators (Principal Investigator, Co-Investigators, Collaborators, Consultants, and Other Professionals) cannot be changed between the Step-1 and Step-2 proposals. The expected format and evaluation criteria are described below. Submission of the Step-1 proposal does not obligate the offerors to submit a Step-2 (full) proposal later.

### 2.3.1 *Step-1 Proposal Format*

The Step-1 proposal is restricted to the 4000 character Proposal Summary text box on the NSPIRES web interface cover pages. It should include the following information:

- A description of the science goals and objectives to be addressed by the proposal.
- A brief description of the methodology to be used to address the science goals and objectives.

The NSPIRES system for proposal submission requires that Step-1 proposals include a summary (i.e., abstract) describing the proposed work as outlined above. The proposal summary is entered directly into a text field in NSPIRES. No PDF attachment is required or permitted for Step-1 proposal submission. All information will be entered within the 4000 character Proposal Summary text box on the NSPIRES web interface cover pages. Proposers will be notified by E-mail when they are able to submit their Step-2 proposals.

### 2.3.2 *Step-1 Evaluation Criteria*

Step-1 proposals may be declared noncompliant if outside the scope of the H-GCR program as described in Section 1. PIs of noncompliant proposals will not be eligible to submit the associated Step-2 proposal and will receive a letter to this effect.

## 2.4 Step-2 Proposals

A Step-2 (full) proposal must be submitted electronically by the Step-2 due date (see Tables 2 and 3 in the *ROSES Summary of Solicitation*). The Step-2 proposal must be submitted via NSPIRES by the organization Authorized Organizational Representative (AOR). A budget and other specified information is required. The Step-2 proposal title, Principal Investigator, and all Co-investigators, Collaborators, Consultants, and Other Professionals must be the same as those in the Step-1 proposal. Step-2 proposals must contain the same scientific goals proposed in the Step-1 proposal.

Proposers must have submitted a Step-1 proposal to be eligible to submit a Step-2 proposal. Proposers that received a noncompliant letter are not eligible to submit a Step-2 proposal.

Proposers are strongly encouraged to provide names and contact information of five experts qualified to review their proposal. These experts must not be from the institutions of the PI or Co-Is. This information can be supplied via the SARA web page at <http://science.nasa.gov/researchers/suggested-reviewers/>.

Proposers are expected to provide mail-in reviews for one to three proposals in this competition. Much of the science expertise lies in the PI/Co-I community, because increasingly, nearly the entire Heliophysics community proposes. In order to maintain a high caliber review process, it is important to get the additional mail-in reviews to cover all proposals fairly.

#### *2.4.1 Step-2 Proposal Format*

Guidelines for submitting Step-2 full proposals are specified in Table 1 of the *ROSES Summary of Solicitation* and the *NASA Guidebook for Proposers*.

Owing to the larger scope of the TMS proposals, the page limit for the Science/Technical/Management section is revised from the default standard of 15 pages to 20 pages. Proposals must include the following sections with the preferred order:

- The science objectives and perceived impact of the proposed work to the state of knowledge in the field; references to existing work in the field should be limited to that which is needed to justify the value of the science proposed;
- The methodology to be employed in conducting the proposed research; the proposal must demonstrate that the methodology is both appropriate and feasible to make substantial progress on the science objectives; TMS studies must be substantiated using appropriate data, primarily from NASA missions.
- The relevance of the proposed work to one or more of the four high-level science goals from the most recent Heliophysics Decadal survey listed in Section 1.1 must be demonstrated;
- A general plan of work, the management structure for the proposal personnel, and a description of the expected contribution to the proposed effort by the PI and each person as identified in the proposal whether or not they derive support from the proposed budget. Postdoctorals and students do not need to be named.

Historically, proposals that are focused on a specific compelling science question have been more successful at constructing methodologies that clearly address a single target question than those that propose to address a large number of science questions or that are directed at a broad science topic, rather than a specific question.

#### *2.4.2 Step-2 Evaluation Criteria*

Step-2 proposals that are not compliant with format requirements may be rejected without review. See Section IV (b) ii of the *ROSES Summary of Solicitation* and the *NASA Guidebook for Proposers* for details. Proposals that have changed the scientific scope from that of their Step-1 proposal may be declared noncompliant.

Compliant proposals will be evaluated according to the criteria specified in Section VI (a) of the *ROSES Summary of Solicitation* and C.2 of the *NASA Guidebook for Proposers*. These criteria are intrinsic scientific and technical merit, relevance to NASA’s objectives, and cost realism/reasonableness.

The evaluation of scientific and technical merit will include the following:

- Compelling nature and scientific priority of the proposed investigation's science goals and objectives, including the importance of the problem within the broad field of Heliophysics; the unique value of the investigation to make scientific progress in the context of current understanding in the field, and the importance of carrying out the investigation now.
- Appropriateness and feasibility of the methodology, including the appropriateness of the selected data, models, and analysis for completing the investigation and the feasibility of the methodology for ensuring scientific success.

Based primarily on these two factors within merit, the evaluation will consider the overall potential science impact and probable success of the investigation.

Relevance to and priority within the H-GCR program will be assessed based on criteria discussed in Section 1. Each proposal must demonstrate that the investigation is relevant and of high priority.

Cost realism/reasonableness will be evaluated by considering the amount of work to be accomplished versus the amount of time proposed. Open-ended proposals or those with a large number of science questions to be addressed typically do not fare well in this evaluation. Only necessary Co-investigators and Collaborators should be included, and their specific roles in the investigation must be clearly laid out. Use of Collaborators whose only role is advisory is discouraged.

### 3. Available Funds

Selections for H-GCR TMS from this program element are for three-year periods of performance with annual funding contingent on submission of satisfactory progress reports and available funding. The total annual budget for this program element is about \$4M, and the expected funding award from the last Heliophysics Theory Program call is approximately \$400-450K.

### 4. Summary of Key Information

Expected program budget for first year of new awards	\$4M
Number of new awards pending adequate proposals of merit	8-10
Maximum duration of awards	3 years
Due date for Step-1 Proposal	See Tables 2 and 3 in the <i>ROSES Summary of Solicitation</i> .
Due date for full proposals	See Tables 2 and 3 in the <i>ROSES Summary of Solicitation</i> .

Planning date for start of investigation	6 months after proposal due date.
Page limit for the central Science-Technical-Management section of proposal	20 pp.; see also Chapter 2 of the <i>NASA Guidebook for Proposers</i>
Relevance	This program is relevant to the Heliophysics questions and goals in the NASA Science Plan. Proposals that are relevant to this program are, by definition, relevant to NASA.
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 <i>NASA Guidebook for Proposers</i> at <a href="http://www.hq.nasa.gov/office/procurement/nraguidebook/">http://www.hq.nasa.gov/office/procurement/nraguidebook/</a> .
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 <i>NASA Guidebook for Proposers</i> .
Web site for submission of Step 1 and Step 2 proposal via NSPIRES	<a href="http://nspires.nasaprs.com/">http://nspires.nasaprs.com/</a> (help desk available at <a href="mailto:nspires-help@nasaprs.com">nspires-help@nasaprs.com</a> or (202) 479-9376)
Web site for submission of proposals via Grants.gov	<a href="http://grants.gov">http://grants.gov</a> (help desk available at <a href="mailto:support@grants.gov">support@grants.gov</a> or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH16ZDA001N-GCR
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