NOTICE: Amended March 25, 2020. This Amendment presents final text for this program element. Step-1 proposals are due December 16, 2020, and Step-2 proposals are due February 17, 2021.

The requirement to address relevance of the Step-2 proposal to this program element is provided in Sections 1.3 and 2.4.2. Please note that the response to this requirement must be provided in a 4000-character text box on the NSPIRES cover page, not in the 10-page main body of the proposal. Section 2.5 explains how the evaluation criteria explicitly include assessment of the proposal relevance.

New this year is the requirement for a data management plan (DMP). The DMP will be evaluated as part of the Intrinsic Merit of the proposal. DMPs will not be collected via the NSPIRES web pages. Instead, the DMP must be included in the proposal (see Section 2.4.1).

1. **Scope of Program**

The primary goal of the Space Weather Science Application Operations-to-Research (SWO2R) program is to support research to improve numerical models and/or data utilization techniques that could advance specification and/or forecasting capabilities and which could also lead to improved scientific understanding.

SWO2R is a component of the Heliophysics Research Program and proposers interested in this program element are encouraged to read B.1, The Heliophysics Research Program Overview, for Heliophysics-specific requirements. Common requirements for all ROSES elements and proposals are found in the ROSES *Summary of Solicitation* and *The Proposer's Guidebook* and the order of precedence for proposers is the following: This document takes precedence followed by B.1, The Heliophysics Research Program Overview, followed by this year’s ROSES *Summary of Solicitation* and, finally, the *Proposer’s Guidebook*. Proposers should be familiar with all of these resources.

1.1 **Solicited Investigations**

There are two focus areas for this opportunity:

- **Satellite Drag:** Improve the specification and forecast of neutral density in the thermosphere as it pertains to satellite drag and orbital operations.
- **Ionospheric Disturbances:** Improve forecasts and/or specifications of ionospheric disturbances that impact: 1. positioning, navigation, and timing (PNT) derived from the Global Navigation Satellite System, and/or 2. radio communication.

The primary goal of this solicitation is to support research to improve numerical models and/or data utilization techniques that could advance forecasting and/or specification capabilities and which could also lead to improved scientific understanding. Effective utilization of available data is encouraged. Employing advanced techniques for data assimilation, ensemble, and/or machine-learning is also encouraged. Improved neutral density specification and forecast capabilities could include, for example, effects of forcing from below, effects of variations in solar EUV flux, effects of heating from particle
precipitation and joule dissipation, assimilation of satellite drag data, and regional variations in density. Improved neutral density specification and forecasts can support numerous applications, including satellite drag and orbit propagation, meeting Orbital Debris Mitigation Standard Practices (ODMSP), and planning satellite mega-constellation operations. Improved forecasting and specification of the ionosphere could include the dynamics of total electron content, ionospheric scintillation, and electron density structure.

1.2 Background

In March 2019 the National Science and Technology Council (NSTC) in the Executive Office of the President released the National Space Weather Strategy and Action Plan (NSW-SAP). The objectives of the actions described in the NSW-SAP are to improve the understanding of, forecasting of, and preparedness for space weather events, recognizing the need for close cooperation among the federal agencies.

The NSW-SAP call for NASA, National Science Foundation (NSF), and Department of Defense (DOD) to identify and support basic research on space weather. They also direct NASA, Department of Commerce (DOC), and DOD to identify and support research opportunities that address targeted operational space-weather needs. Furthermore, they direct NASA, NSF, DOC, and DOD to facilitate the transition of space weather information and prediction capabilities to the Nation’s space weather service providers (research-to-operations and operations-to-research).

In response to the need to advance and coordinate the Nation’s space weather research and operations capabilities, NASA established the Heliophysics Space Weather Science Application (SWxSA) program, of which this operations-to-research (O2R) call is a part. NASA is supporting this funding opportunity in coordination with DOC/National Oceanic and Atmospheric Administration (NOAA) to promote O2R activities. The objective of O2R efforts is broadly defined as the joint pursuit of improvements of operational capabilities and advancements in related fundamental research.

NASA’s role as codified in its SWxSA program is to implement and support a national research program to understand the Sun and its interactions with Earth and the Solar System to advance space weather modeling and prediction capabilities applicable to space weather forecasting; develop and operate space-weather-related research missions, develop instrument capabilities, and models; and support the transition of space weather models and technology from research to operations and from operations to research.

NOAA’s role is to provide timely and accurate operational space weather forecasts, watches, warnings, alerts, and real-time space weather monitoring for the government, civilian, and commercial sectors, exclusive of the responsibilities of the Secretary of Defense; and to ensure the continuous improvement of operational space weather services, utilizing partnerships, as appropriate, with the research community, including academia and the private sector, and relevant agencies to develop, validate, test, and transition space weather observation platforms and models from research to operations and from operations to research.
1.3 Relevance

Work proposed in response to this call must be in support of one or more NASA and/or NOAA goals and objectives described above, with attention to transitioning from science research to application driven by the expressed need of the users. To demonstrate the relevance of the research, the proposal must address how the research will directly improve the ability of the user community to utilize space weather information in the proposed topical area. See Section 2.4.2 for additional information.

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. Within the proposing team, the PI and Co-Investigators (Co-Is) must each have specific and defined tasks in the project, and the tasks must be essential to the completion of the project. Collaborators must show outside support for any defined tasks which must be essential to completion of the project. Proposers are strongly encouraged to include industry participants on their teams.

Proposals may be declared noncompliant based on either the Step-1 or Step-2 proposal if they are outside the scope of the SWO2R program (see Section 1 above) or if they fail to meet submission guidelines specified below (Section 2.2-2.4).

2.2 Two-Step Submission Process

To provide adequate notice to potential reviewers, this program uses a two-step proposal submission process. The overall description of a two-step process can be found in Section IV(b)vii of the ROSES Summary of Solicitation.

In the two-step process a Step-1 proposal is required. Potential reviewers are solicited based on the Step-1 proposal. The proposal team members may not be changed between the Step-1 and Step-2 proposals, unless prior approval is obtained from the Program Officer of the element. The title and broad science goals of the proposal may not be changed such that they would significantly affect the scientific or technical expertise required to properly evaluate a proposal. Changes in a proposal that impact the review will result in a proposal being declared non-compliant.

2.3 Step-1 Proposals

A Step-1 proposal is required and must be submitted electronically by the Step-1 due date (see Table 2 and Table 3 of ROSES). The Step-1 proposal must be submitted by the organization’s 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 expected content is 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 Content

The Step-1 proposal is restricted to the 4000-character Proposal Summary text box on the NSPIRES web interface cover pages. References and any other supporting material are not required, but, if included, must fit within the limit.

The Step-1 proposal must include the following information:

- Identification of which science topic, Satellite Drag or Ionospheric Disturbances, is being addressed;
- The science goals and objectives to be addressed by the proposal;
- The expected forecast/specification/observation capabilities, and/or O2R enhancements that will be developed;
- The expected metrics and validation methods that will be applied;
- A brief statement of the relevance of the problem to the focus area of this SWO2R announcement.

No PDF attachment is required or permitted for Step-1 proposal submission. Proposers will be invited by NSPIRES when they are able to submit their Step-2 proposals.

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 in response to NSPIRES cover page questions at the time of submission of the Step-1 proposal.

2.4 Step-2 Proposals

A Step-2 (full) proposal of no more than 10 pages must be submitted electronically by the Step-2 due date (see Table 2 and Table 3 of ROSES). The Step-2 proposal must be submitted via NSPIRES or Grants.gov by the organization’s Authorized Organizational Representative (AOR). A budget and other specified information is required.

Because potential reviewers are solicited based on the Step-1 proposal, the investigators cannot be changed between the Step-1 and Step-2 proposals, unless prior approval is obtained from the Program Officer of the element. The title and broad science goals of the proposal cannot be changed such that they would significantly affect the scientific or technical expertise required to properly evaluate a proposal. Changes in a step-2 proposal that impact the review will result in a proposal being declared non-compliant.

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.

2.4.1 Step-2 Proposal Content

The process for preparation and submission of the Step-2 (full) proposals is the same as that for any other ROSES proposal. Guidelines for content and formatting Step-2 full proposals are specified in the NASA Guidebook for Proposers and the ROSES Summary of Solicitation. Proposals must adhere to formatting requirements (e.g., margins, font sizes, line spacing).
Proposals are restricted to ten (10) pages for the Scientific/Technical/Management section and must include the following sections:

1. The Space Weather O2R goals this proposal will enable and the appropriateness of the currently existing data sets (ground-based and/or space-based), models (Community Coordinated Modeling Center (CCMC) hosted or other accessible resource), and/or other publicly available and utilized resource;
2. The existing O2R need that is being addressed and its importance relative to current operational and forecasting capabilities;
3. A full description of the methods and validation, resources needed, and the technical approach to providing the proposed forecast products, specification capability, and/or O2R-enabling enhancement;
4. Plans to provide public access to the models, tools, and value-added products developed;
5. The forecast/specification/observation capabilities, and/or O2R-enabling enhancement that will be developed, the timetable for producing them;
6. The metrics and validation methods that will be used to evaluate forecast products, specification capability, and/or O2R-enabling enhancement.
7. A Data Management Plan (DMP) must be included in the body of the proposal and not as a separate document. For the required content, please consult the ROSES Appendix B.1, section 1.5.

Proposers contemplating software development are strongly encouraged to read Section 1.5 of B.1 the Heliophysics Division Research Program Overview.

2.4.2 Required Additional Section in Step-2 Proposal Front Pages: Proposed Relevance to the Program Element.

Proposals to this program element must address the relevance of the proposal, as described in Section 1, in a 4000-character plain text box on the NSPIRES cover pages and this will be peer reviewed as part of the evaluation (see Section 2.5). Since it is not included in the main body of the proposal, this text does not count against the 10-page limit for the Scientific/Technical/Management section. Proposals that fail to address relevance will typically be declined despite any merits that may have been found by peer review.

2.5 Evaluation Criteria

Compliant proposals will be evaluated according to the criteria specified in the ROSES Summary of Solicitation Section VI (a) and the NASA Guidebook for Proposers. These criteria are Relevance, Merit, and Cost reasonableness. Clarifications and additions specific to this program element are listed below.

The assessment of relevance will be based on the goals and objectives of the agencies and the O2R objective, as summarized in this program element. Please note that the review panel will consider only the response to this NSPIRES cover page question (described in Section 2.4.2) in the evaluation of this criterion.

The evaluation of the scientific and technical merit will include:

- The potential for improving specifications and/or forecasts of space weather phenomena;
The potential value of the proposed metrics to establishing the state-of-the-art and to measuring progress in specifying/forecasting space weather, and;

The degree to which the resulting product can be ingested into an operational environment in a timely manner.

Moreover, part of the assessment of the impact of the proposed work (which is part of Merit) will include consideration of whether and how software will be made available for non-commercial use (e.g., as described in Section 2 of this program element and Section 1.5 of B.1 the Heliophysics Research Program Overview Overview), as well as whether or not industry participation is included in the team. Participants of the team must be listed in the standard Summary Table of Work Effort described in Section IV(b)iii of the ROSES Summary of Solicitation. As these aspects of the proposed effort are encouraged, rather than required, their inclusion may result in strengths in the proposal evaluation, but their absence will not result in weaknesses.

Cost reasonableness will include assessing the amount of work to be accomplished versus the amount of time proposed.

2.6 Joint Agency/Community Evaluation

Given the unique nature of this opportunity to support the Space Weather Science Application program, proposal reviewers will include both scientific peers and knowledgeable representatives from the space weather operations community. Proposals must discuss the relationship of the proposed effort to the advancement of the Space Weather O2R objective.

NASA (on behalf of NASA and NOAA) will review the proposals in accordance with NASA's processes/criteria connected to the O2R objective. The final award recommendations will be made in consultation with both agencies' program officers. Final selections will be made by the NASA Selecting Official.

3. Available Funds

The total funding available for the first year of new proposals submitted in response to this solicitation is expected to be about $2.0M. This funding is expected to support at approximately six awards depending upon funds available. Awards will not be more than two years in duration. It is expected that combined 2-year budgets of most proposals will not exceed $500K.

4. Summary of Key Information

<table>
<thead>
<tr>
<th>Expected program budget for first year of new awards</th>
<th>$2.0M</th>
</tr>
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<tbody>
<tr>
<td>Number of new awards pending adequate proposals of merit</td>
<td>~6</td>
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<tr>
<td>Maximum duration of awards</td>
<td>2 years</td>
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<tr>
<td>Due date for Step-1 proposals</td>
<td>See Tables 2 and 3 of this ROSES NRA</td>
</tr>
<tr>
<td>Due date for Step-2 proposals</td>
<td>See Tables 2 and 3 of this ROSES NRA</td>
</tr>
<tr>
<td>Planning date for start of investigation</td>
<td>6 months after proposal due date</td>
</tr>
<tr>
<td>Page limit for the central Science-Technical-Management section of proposal</td>
<td>10 pages; see also Table 1 of the <a href="#">ROSES Summary of Solicitation</a> and Section 3.7 of the <a href="#">NASA Guidebook for Proposers</a></td>
</tr>
<tr>
<td>Relevance</td>
<td>This program is relevant to Heliophysics Space Weather Operations-to-Research in NASA and NOAA. Proposals that are relevant to this program are, by definition, relevant to one or more of the supporting agencies.</td>
</tr>
<tr>
<td>General information and overview of this solicitation</td>
<td>See the <a href="#">ROSES Summary of Solicitation</a></td>
</tr>
<tr>
<td>General requirements for content of proposals</td>
<td>See Section 3 of the <a href="#">NASA Guidebook for Proposers</a> and Section IV and Table 1 of the <a href="#">ROSES Summary of Solicitation</a>.</td>
</tr>
<tr>
<td>Detailed instructions for the submission of proposals</td>
<td>See <a href="#">https://nspires.nasaprs.com/tutorials/</a>, the <a href="#">NASA Guidebook for Proposers</a> and Section IV(b) of the <a href="#">ROSES Summary of Solicitation</a>.</td>
</tr>
<tr>
<td>Submission medium</td>
<td>Electronic proposal submission is required; no hard copy is permitted</td>
</tr>
<tr>
<td>Web site for submission of full proposal via NSPIRES</td>
<td><a href="#">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)</td>
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<td>Web site for submission of proposals via Grants.gov</td>
<td><a href="#">http://grants.gov</a> (help desk available at <a href="mailto:support@grants.gov">support@grants.gov</a> or (800) 518-4726)</td>
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<td>Funding opportunity number for downloading an application package from Grants.gov</td>
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</tbody>
</table>
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