

A.3.9 RESEARCH ON THE STRUCTURE OF THE SOLAR WIND AT 1 AU (RSSW@1AU)

1. Scope of Program

The RSSW@1AU program element solicits proposals to: (a) improve our understanding of the detailed structure of the solar wind in the vicinity of 1 AU, particularly those structures that effect the Earth's magnetosphere; and (b) to enhance the data environment of heliospheric fields and particles data that will be used in the research performed in pursuit of objective (a). For both objectives the emphasis of the program is the study of simultaneous measurements in the heliosphere from two or more spacecraft.

The research selected for this RSSW@1AU is expected to help resolve some of the key uncertainties in the propagation of the solar wind and solar disturbances to the Earth by investigating the structure of the solar wind and embedded magnetic field, the evolution of perturbations as they propagate in the heliosphere near Earth, the generation of shocks and associated energetic particles, and their interactions with the Earth's magnetosphere. Hydromagnetic turbulence and energetic particle acceleration and transport are processes of fundamental importance to many areas of space physics and astrophysics. Such understanding is central for understanding the Sun's influence of the near-Earth space environment.

Upon selection, the investigators will organize a RSSW@1AU research team to coordinate their efforts and facilitate collaborations. Proposers shall indicate how they plan to contribute to this team.

The importance of this research is underscored by the recent National Research Council (NRC) study : *The Sun to the Earth – and Beyond, A Decadal Research Strategy in solar and Space Physics* [<http://www.nationalacademies.org/ssb/sspsuntoearth.html>] and the report of the 2002 Sun-Earth Connection (SEC) Roadmapping Committee: *Sun-Earth Connection Roadmap 2003-2028* [http://sec.gsfc.nasa.gov/sec_roadmap.htm]. Both recommend mission concepts for constellations of spacecraft in the L1 vicinity to measure and investigate multidimensional and temporal features of the solar wind. Results from this RSSW@1AU research program will provide scientific guidance for future studies of these L1 multispacecraft concepts, as well mission concepts for monitoring space weather conditions.

(a) This part of the RSSW@1AU program is expected to result in a collaborative team of investigators that, for the next three years, will concentrate on science topics such as:

- measurements of turbulence and other statistical properties of the solar wind;
- the potential for testing results based upon single spacecraft studies with multispacecraft observations;
- the evolution of geoeffective disturbances in the region of 1 AU and their interactions with the Earth's magnetosphere;
- solar wind structures and the uniformity of energetic particle events across scale lengths of 200 - 500 Earth radii (R_E) and their impact on the Earth's magnetosphere;

- new concepts for the remote sensing of interplanetary shocks;
- the acceleration of particles in shocks observed at L1;
- the nature of time-varying tilted phase fronts in the solar wind;
- the coherency of short time scale variations in the solar wind over large spatial distances; and
- the spatial variations in the solar wind across the bow shock of the Earth's magnetosphere.

The science investigations selected for this program must show how they will make use of data from two or more existing missions that measure the interplanetary fields and particles in the vicinity of 1 AU and the fleet of spacecraft monitoring the Earth's response to variations in the solar wind. The selected investigators are to take advantage of the current configuration of spacecraft in the vicinity of the L1 libration point and employ multispacecraft, multisensor data that are either in NASA data archives or in data repositories of currently operating spacecraft. These missions include, but are not limited to ACE, Wind, SOHO, Genesis, IMP-8, Geotail, Polar, IMAGE, GOES, and LANL. These data are to be found in existing data pools and archives that include the National Space Science Data Center (NSSDC) and the Solar Data Analysis Center (SDAC), and mission science centers such as the ACE Science Center. This ensemble of data should permit a direct multispacecraft examination of the interplanetary fields and particles, as well as simultaneous measurements of magnetic turbulence properties. Since the data from these existing plasma, magnetic field, and energetic particle instruments have been collected over a variety of spacecraft separations, they will provide valuable insight into the spatial structures of specific phenomena. In addition, temporally propagated measurements at each spacecraft are expected to provide information about the evolution of structures between the sensors. Finally, the complex coupling between magnetohydrodynamic parameters and subsequent particle acceleration studies suggest that an integral theoretical component throughout the research program is appropriate and may be proposed.

Various topics in this research area have been studied by the individual mission science teams and others who have published key findings. However, by forming the research team solicited by this program, NASA anticipates that the concentrated efforts will provide new insights into the geo-effectiveness of the fine scale structure and dynamics of the interplanetary fields and particles. Achievements of this research program should advance the understanding of solar wind phenomena that will lead to better forecasting of the effects of space weather.

(b) The second part of this RSSW@1AU research program is to provide to the research team selected for objective (a) and others an ensemble of enhanced tools for accessing, querying, and extracting data from the available data pools. Therefore, the second type of proposal solicited should focus on the adaptation and/or development of advanced Information Technology (IT) tools that enable or enhance the collaborative science research activities described above and that could be applied more generally within the research community for other science investigations. To make the best use of limited resources, it is anticipated that proposals of this second type will adapt and tailor existing

tools and capabilities for locating, accessing, mining, analyzing, and visualizing data to support the science investigations of the first type. Tools that demonstrate progress toward frameworks for collaborative science, middleware for interoperability, metadata brokering, distributed data services, etc., i.e. proof of concept for a "virtual heliospheric observatory," are especially encouraged.

Proposals directed at this second objective are required, as part of the funded activity, to make the resulting IT tool publicly available, preferably linked through a NASA data center such as the National Space Science Data Center or the Solar Data Analysis Center. The proposal should describe the plan for supporting the research team selected under part (a), archiving the IT tool(s), and making it(them) generally available.

2. Programmatic Information

This RSSW@IAU program solicitation is not expected to be repeated. The proposals can be for small teams of researchers or for individual investigators. In all cases, the proposers must agree to participate in the larger collaborative endeavor envisioned above.

Approximately \$800K per year for each of three years is available for this research program, which is expected to be sufficient for the support of four to seven awards for the science research described in part (a) and two to three awards for part (b). Proposals may be for either part (a) or (b) alone or may be for both parts combined. In the latter (combined) case, the proposal must clearly and separately identify work and budgets proposed for each part in case NASA chooses to offer only a partial selection (see Section C.5.2 of Appendix C in the *NASA Guidebook for Proposers*).

The proposals should assume that the RSSW@IAU research team will meet at least once per year in a workshop setting of 1-2 days in addition to 'tag ups' by teleconference and at community meetings such as AGU or COSPAR.

After selection of proposals, the NASA Headquarters Program Scientist (see below) will request one of the selected PI's to take on the additional responsibility for leading the collaborative research team. This funded activity will involve, among other things, organizing team meetings and 'tagups,' reporting on progress of the research collaboration, and coordinating publications resulting from the research activities.

The schedule for proposals for this opportunity is as follows:

Notice of Intent to Propose Due Date	<i>January 15, 2003</i>
Proposal Due Date	<i>March 5, 2003</i>

The evaluation criteria contained in Appendix C, Section C.2, of the *NASA Guidebook for Proposers* (see Section 5 of the Summary of Solicitation for this NRA) shall be used to evaluate submitted proposals, where it is understood that the scientific and technical merit of a proposal will include judgment of the following additional factors:

- The degree to which the proposed research will contribute to the success of the RSSW@IAU research team; and
- The likelihood that the proposed research is likely to produce significant and lasting benefits to the LWS program by the end of the three-year award period.

IMPORTANT INFORMATION

As discussed in the Summary of Solicitation of this NRA, the Office of Space Science (OSS) is now using a single, unified set of instructions for the submission of proposals. This material is contained in the document entitled *NASA Guidebook for Proposers Responding to NASA Research Announcement-2001* (or NASA Guidebook for Proposers for short) that is accessible at <http://research.hq.nasa.gov/>, and linking through the menu item "Helpful References," or it may be directly accessed online at URL <http://www.hq.nasa.gov/office/procurement/nraguidebook/>. This NRA's Summary of Solicitation also contains instructions for the electronic submission of a Notice of Intent (NOI) to propose and a Proposal Cover Page, which now also includes the required Budget Summary and the mailing address for the submission of a proposal.

A Notice of Intent (NOI) to propose and the Cover Page/Budget Summary for a proposal are submitted through the Web site <http://proposals.hq.nasa.gov>. (Note: In order to be listed on an NOI or on the Cover Page of a proposal, all personnel participating in any capacity as a Team Member, as well as the identified Authorizing Official of the proposing institution, must preregister in this data base.) Once entry to the site is achieved, select the "Office of Space Science" from the menu entitled Division Specific Opportunities in order to gain access to the site for this research opportunity. Help in using this site may be found at <http://proposals.hq.nasa.gov/help.html>, or may be requested by E-mail at proposals@hq.nasa.gov or by telephone (8AM- 6PM Eastern Time, Monday through Friday) at 202/479-9376.

Questions concerning this program element may be directed to the NASA Headquarters Program Scientist for the RSSW@IAU program:

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