B.7 LIVING WITH A STAR TARGETED RESEARCH AND TECHNOLOGY

Amended July 19, 2007

This final version of Appendix B.7: Living With a Star Targeted Research and Technology replaces in its entirety the Draft version that was released with the ROSES-2007 NASA Research Announcement. The due dates remain the same. Notices of Intent to propose are due September 19, 2007. Proposals are due October 19, 2007.

1. Scope of Program

1.1 Overview

The goal of NASA’s Living With a Star (LWS) program is to develop the scientific understanding needed for the United States to effectively address those aspects of Heliophysics science that may affect life and society. The LWS Targeted Research and Technology (TR&T) program element solicits proposals leading to a physics-based understanding of the integral system linking the Sun to the Solar System both directly and via the heliosphere, planetary magnetospheres, and ionospheres. The TR&T program’s objectives can be achieved by data analysis, theory, and modeling, and the development of tools and methods (e.g., software for data handling). LWS is a crosscutting initiative whose strategic goals relate to all aspects of NASA’s Mission, namely (in no priority order):

1. Solar energetic particles and galactic cosmic rays pose major radiation hazards for space hardware and astronauts. Penetrating particle radiation adversely affects aircraft avionics and potentially the health of airline crews and passengers on polar flights. Communication and navigation systems are directly affected by impulsive changes in the solar particle and electromagnetic output leading to re-routed polar flights and GPS outages. In support of NASA's Vision for Space Exploration and the national communication, navigation, and transportation infrastructure, the TR&T needs to deliver the understanding and modeling required for useful prediction of the variable solar particulate and radiative environment at the Earth, Moon, Mars, and throughout the solar system.

2. One of the major challenges facing humanity is global climate change. In order to gauge the response of the terrestrial climate system to natural and anthropogenic forcings, NASA through the TR&T and Earth Science Division in conjunction with other national agencies such as NOAA and NSF needs to deliver the understanding of how and to what degree variations in the solar radiative and particulate output contribute to changes in global and regional climate over a wide range of time scales.

3. National infrastructures are increasingly dependent on satellites orbiting Earth. With increasing miniaturization these systems are ever more sensitive to variations in the near-Earth space environment. To protect these assets, the TR&T needs to deliver the understanding and modeling required for effective forecasting/specification of magnetospheric radiation and plasma environments.

4. The upper atmosphere and ionosphere is central to a host of space weather effects, including anomalous satellite drag, GPS position error, radio blackouts, radar clutter, and geomagnetically induced currents. In order to mitigate space weather's impact on life and society, NASA through the TR&T in conjunction with other national agencies such as NSF and DoD needs to deliver understanding and predictive models of upper atmospheric and ionospheric responses to changes in solar electromagnetic radiation and to coupling above and below.

These strategic goals and the selection of strategic capabilities will guide the selection of focused science topics for this solicitation. The primary goal of the LWS program is to make progress in understanding this complex system, focusing on the most critical interconnections.

The *Final Report of the LWS TR&T Science Definition Team (SDT)* (December 2003), located on the LWS TR&T homepage at http://lws-trt.gsfc.nasa.gov/trt_resources.htm, identified TR&T as a systematic, goal-oriented research program. The TR&T component of the LWS program provides the theory, modeling, and data analysis necessary to enable an integrated system-wide picture of Heliophysics[1] science with emphasis on societal relevance.

Significant progress toward quantitative understanding and predictive capability with respect to these problems will require large-scale, integrated modeling activities. Recognizing the need for activities that would be broader and more sustained than those that can be supported by a traditional NASA grants program, the *Final Report of the LWS TR&T Science Definition Team* recommended that "…large modeling activities that address coupling across traditional science domains in the Sun-Earth chain specifically be included as strategic capabilities." The TR&T SDT also recommended the formation of a TR&T Steering Committee in order to update periodically the designated strategic capabilities for future solicitations. The most recent report of this Steering Committee is available on the LWS TR&T homepage at http://lws-trt.gsfc.nasa.gov.

As a result of these studies and recommendations, the LWS TR&T program has defined a strategy with three program elements, namely, Strategic Capabilities, Targeted Investigations, and Cross-Disciplinary Infrastructure Building programs.

Further background material concerning relevant research objectives can be found in the following documents:

[1] Heliophysics: To understand and predict the causes of space weather by studying the Sun, the heliosphere, and the planetary environment as a single connected system.

- The National Academy of Sciences Web tutorial, entitled "*Space Weather: A Research Perspective*" (http://www7.national-academies.org/ssb/SSB_Space_weather97.pdf);
- The Sun Earth Connection LWS web site (http://lws.gsfc.nasa.gov/);
- The LWS Science Architecture Team report to SECAS (http://lws.gsfc.nasa.gov/documents/sat/sat_report2.pdf);
- *The Sun-Earth Connection Roadmap Report* (http://sec.gsfc.nasa.gov/sec_2002_roadmap.pdf);
- *The NRC Decadal Survey Report* (http://www.nap.edu/books/0309089727/html/);
- *The Heliophysics Roadmap* (http://heliophysics.gsfc.nasa.gov/sec_roadmap.htm);
- *The TR&T Science Definition Team Report* (http://lws-trt.gsfc.nasa.gov/TRT_SDT_Report.pdf); and
- *The latest TR&T Steering Committee Team Report* http://lws-trt.gsfc.nasa.gov/trt_resources.htm).

1.2 Targeted Investigations

The stated goal of LWS, that of achieving an understanding of those aspects of the Sun-Solar System that have direct impact on life and society, poses two great challenges for the TR&T program. First, the TR&T must tackle large-scale problems that cross discipline and technique boundaries (e.g., data analysis, theory, modeling, etc.); and second, the TR&T must identify how this new understanding will have a direct impact on life and society.

This Targeted Investigations program element is subdivided into the three components described below: Focused Science Topics (75%), Tools & Methods, and Independent Investigations (25%). Focused Science proposals must show relevance to the specific topic to which the proposal is submitted. Tools & Methods and Independent Investigations must include a one-half to one page description showing relevance to LWS goals and objectives; the tool(s) or science result(s) must be shown to satisfy LWS goals and objectives over some time scale (not necessarily within three years). Pending the submission of proposals of adequate merit, the approximate portion of resources allocated for each is given in parentheses.

1.2.1. Focused Science Topics

A set of Focused Science Topics as further identified below have been chosen for emphasis in this solicitation (for further detail, also see the latest TR&T Steering Committee Report at http://lws-trt.gsfc.nasa.gov/trt_resources.htm). While the primary evaluation criteria remain unchanged (see this NRA's *Summary of Solicitation*, Section V(a), and the *NASA Guidebook for Proposers*, Appendix C.2), the criterion for relevance includes relevance to one of the Focused Science Topics as an essential requirement for selection within this component. In addition, NASA desires a balance of research investigation techniques for each Topic, including theory, modeling, data analysis, observations, and simulations. Given the submission of proposals of adequate number and merit, up to eight selections will be made for each Focused Science Topic. Once selected, these investigators will form a team in order to coordinate their research programs (similar to the PIs selected for a NASA hardware mission who form a coordinated science working group). These teams will define a plan for structuring their work into an integrated research program that ideally will address the Focused Science Topic in a much more complete way than any one investigation could by itself. These teams will also define success measures and deliverables for their integrated program, develop strategies for disseminating their results to the science community and NASA, and prepare an integrated final Team Report at the end of the three-year duration of the selected investigations.

Based in part on the peer review, one of the PIs will be identified and asked to serve as the Team Coordinator for the Focused Science Topic for which he/she proposed. These Team Coordinators will take the lead role in organizing their teams, setting up appropriate meetings and interactions, and generally ensuring the success of the project as a whole. The Team Coordinators will also serve as the lead liaison with the LWS Project Office at NASA's Goddard Space Flight Center (GSFC) and LWS Program Office at NASA Headquarters, which together will monitor and assist the progress of each team. The Team Coordinator will receive supplemental funding as necessary to support costs associated with these duties. Proposers are encouraged to propose to act as a Team Coordinator and if they do so, should include a brief section in their proposal describing how they would lead the team effort. Up to one extra page in the proposal is allowed for this proposed effort. All proposers for Focused Science Topics should include sufficient travel funds in their proposed budgets to cover two team meetings per year to be held on the U.S. coast furthest from their home institutions.

The *NASA Guidebook for Proposers* at http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2007.pdf states that "NASA strongly encourages PIs to specify only the most critically important personnel to aid in the execution of their proposals." LWS further emphasizes that Focus Teams will be formed from individual proposals selected in a Focus Topic. Therefore, individual proposals do not need to tackle the whole problem, but can instead seek to solve a piece of the problem.

The Focused Science Topics appropriate as the objectives for proposals to this LWS TR&T solicitation are as follows (linked to the four goals above):

a. Focused science topic for Strategic Goal 1 (Solar storms): Exploring the magnetic connection between the photosphere and low corona

Target Description

Many LWS models of the corona and heliosphere depend on boundary conditions at the coronal base (the lowest altitude where the plasma beta is small), yet observations of the magnetic field come mostly from the photosphere below. It is therefore vital to understand how the magnetic field maps from the photosphere, through the chromosphere and transition region, and into the corona. This region of the atmosphere is also important for other reasons. For example, much of the UV radiation that drives the ionosphere/thermosphere system originates in the chromosphere and is determined by the chromospheric heating and structure.

It has also been proposed that the waves that accelerate and heat the solar wind may be generated by magnetic reconnection events in this region. A host of new observational sources of the solar atmosphere (including high resolution and high cadence photospheric vector magnetograms) are coming on line, which promise to promote real progress in the predictive qualities of these LWS coronal and heliospheric models. To realize this progress, we need to understand the implications of these new observations for the structure and dynamic behavior of the intervening chromosphere and transition region. Therefore we invite proposals with the goal of improving our ability to model this critical region with the explicit long-term goal of improving the predictive capabilities of coronal and heliospheric models, and the ionospheric/thermospheric models which depend upon solar UV emissions.

Goals and Measures of Success

The measures of success for this topic are the impact of the science advances made by the team in improving the predictive capabilities of our current models.

Types of Investigations

This group will include theoreticians, numerical modelers, and observers. Proposals which address this topic should use high resolution magnetograms directly or couple with other team models which do so. Examples of investigations which are encouraged include:

- Determine improved boundary conditions at the inner boundary of coronal models;
- Through modeling, provide a physical interpretation of UV data and images; or
- Increase understanding of the source of chromospherically generated waves which heat and accelerate the solar wind.

b. Focused science topics for Strategic Goal 2 (Sun-Climate): Solar Modulation of the galactic cosmic rays and the production of cosmogenic isotope archives of long-term solar activity, used to interpret past climate changes.

Target Description:

This topic addresses the physical processes that relate variations in solar radiative output to the variable flux of cosmic rays that produce cosmogenic isotopes. Cosmogenic isotopes (^{14}C and ^{10}Be) archived in tree-rings and ice-cores, respectively, provide unique information about levels of solar activity over many thousands of years prior to the early seventeenth century, when sunspot observations commenced. Correlations of many paleoclimate variables (e.g., ^{18}O indicators of temperature or precipitation) with the cosmogenic isotopes suggest that climate has been responding to solar forcing throughout the Holocene. Even though cosmogenic isotopes vary in response to the flux of galactic cosmic rays at Earth, and thus to modulation of the heliosphere by open magnetic flux, the correlations are typically attributed to variations in solar radiative output, which arise from changes in the closed magnetic flux that produces features in the solar atmosphere such as sunspots and faculae.

Needed for reliable interpretation of paleo Sun-climate relationships is a physics-based understanding of the relationship between radiative output and cosmogenic isotopes that takes into account the quite different processes within the entire Sun-Earth system that produce their variations.

Goals and Measures of Success:

The goal is to identify and characterize the respective solar-driven processes that simultaneously, but by distinctly different processes, modulate both solar radiative output and heliospheric structure, composition and hence the flux of galactic cosmic rays. A measure of success is a quantitative relationship between time series of solar radiative output and cosmogenic isotopes, on multiple time scales. Other measures of success include improved specification of cosmic ray transport/ attenuation in the heliosphere, and/or deposition/transport in the Earth's atmosphere as functions of solar activity.

Types of investigations:

Relevant investigations include empirical and model investigations of the organization of solar magnetic fields into closed and open flux, as a result of transport by solar differential rotation, diffusion and meridional flow. Quantitative determinations of the solar-driven heliospheric modulation of galactic cosmic rays by transport, attenuation and interactive processes are also relevant, as are investigations of other physical processes within the Sun-Earth system needed to quantitatively relate electromagnetic radiation and cosmogenic isotopes. Studies of the deposition and transport of the cosmic ray fluxes in the Earth's atmosphere are also solicited.

c. Focused science topics for Strategic Goal 3 (Near Earth Radiation): Toward combined models of acceleration, loss and transport of energetic electrons and protons in the magnetosphere

Target description:

Radiation belt electrons and protons create a hazardous environment for spacecraft operating in Earth orbit. In recent years we have significantly advanced our understanding of loss, source and transport mechanisms operating in the magnetosphere. A global understanding of the influence of the plasmasphere, plasmaspheric plumes, magnetopause location, ULF and VLF plasmawaves, and ring current particles and electric and magnetic fields is required for prediction of the dynamics of the radiation belts. Two complementary modeling approaches are used in radiation particle studies – Global MHD and particle transport. It is necessary and now possible to combine studies of various magnetospheric processes that populate the ring current, electron and proton radiation belts and to identify the important missing ingredients of both physics and measurements. This includes the critical transition region in the near-Earth (6-12R_E) magnetotail. This research is timely for preparation of the Radiation Belt Storm Probes (RBSP) and would leverage the complementary GEM focus group on "Space Radiation Climatology" and "Near-Earth magnetosphere: plasma, fields, and coupling." As an added note, new observations from the THEMIS spacecraft will be highly relevant to many of the topics described above.

Goals and measures of success:

The research objectives include: (1) development of models of the dynamics of the radiation belt electrons and protons and the transition regions; (2) determining how transition region fluxes, ring current particles, plasmasphere, plasmaspheric plumes, electromagnetic waves, and variations of the magnetospheric electric and magnetic fields affect the radiation belt electrons and protons; and (3) an assessment of the importance of the individual constituents and their controlling parameters (inputs) in the overall evolution of the radiation belt system. The measure of success is the improvement of our capabilities to predict the dynamics of radiation belt fluxes.

Types of Solicited Investigations:

Proposals that address this topic should address multiple components of mechanisms by which radiation belt particles are accelerated, lost and transported. The research objectives of proposals include: (1) modeling dynamics of the radiation belt and transition particles (2) determining conditions in the magnetospheric environment under which one or several mechanisms dominate; (3) coupling magnetospheric codes (4) developing models with data-assimilative capabilities or combining models with data (performing reanalysis); and (5) model based sensitivity studies to establish the importance of model input parameters (data / boundary conditions / assumptions).

d. Focused science topics for Strategic Goal 4 (Ionosphere-Thermosphere): Determine the sources of daily variability in the thermosphere and ionosphere

Target Description:

Understanding the day-to-day variability of the ionosphere and thermosphere remains an outstanding problem. It is a key to unraveling the relative strengths of two primary forcing mechanisms of the I-T system: photon-driven versus particle/plasma driven solar energy input changes. The responses of the I-T system to each mechanism are strongly inhomogeneous, depending for example, on altitude and geographical location (photons are input primarily at low-mid latitudes whereas geomagnetic effects commence at higher latitudes and propagate to lower latitudes). Forcing from below must be considered also. Understanding inter-day variability will improve space weather predictions under nominal conditions. It will also improve storm-time predictions by providing an accurate baseline prior to the initiation of geomagnetic disturbances.

Goals and Measures of Success:

The goal of this topic is improved understanding of the observed day-to-day variability of the ionosphere-thermosphere including thermospheric densities, composition, winds, and ionospheric electron densities. Successful investigations will use observations and modeling to quantify the causes of variability. Improved predictive models of short-term space weather effects are an expected outcome. Multi-disciplinary perspectives are especially encouraged that account for temporal variability of the drivers such as solar photons and the solar wind.

Types of Investigations:

We solicit empirical characterizations of day-to-day variability using recent data and observational methods. Observations, models and combinations that identify the relative roles of solar forcing and internal dynamics in creating observed daily variability. Multi-disciplinary investigations that characterize how the broader heliospheric environment affects daily variability are especially encouraged.

e. Prediction of the Interplanetary Magnetic Field Vector Bz at L1

Target description:

There has been significant progress in recent years in our ability to observe Coronal Mass Ejections (CMEs) from space. However, the net effect of CMEs on the geomagnetic field is a function of both CME speed and the embedded Interplanetary Magnetic Field (IMF) vector Bz. It would be valuable to the operations community if highly reliable forecasts were available of the vector Bz prior to the passage of the CME at L1.Reliable forecasts of the Bx and By components are also desirable, but of secondary importance. A time series prediction of Bz is fundamentally important in the provision of space weather forecasts because:

- It allows for a prediction of the intensity of the ensuing geomagnetic storm
- It affords a much better-than-climatological prediction of the duration of the storm
- It would minimize false alarms

Given that Solar-B, STEREO, and SDO will be delivering revolutionary new observations of the photospheric magnetic and velocity fields and of the coronal structures that give rise to CMEs, it is now timely to mount a coordinated attack on the problem of identifying the characteristics of the magnetic field embedded in the CME. It is only when Bz can be well predicted that significant advances in space weather services can occur.

Goals and measures of success:

The goal of this Focused Science Topic is to quantify accurately the polarity and magnitude of the IMF Bz for the next 12-24 hours. The prime measure of success for this work would be a good agreement in the time series of predicted and observed BZ values at L1. An added bonus would be the ability to predict all three components of magnetic field, especially if either Bx or By are significantly larger than Bz.

Types of Solicited Investigations:

It is expected that the focus team will include, but certainly not be limited to, the following types of investigations:

- observational and theoretical/modeling investigations relating to identification of characteristics of Bz (Bx, By) that relate to real-time photospheric magnetograms, and perhaps sub-surface flows from ground and space-based observations.
- observational and theoretical/modeling investigations relating to identification of characteristics of the inner heliosphere that affect the magnetic field topology – specifically, Bz (Bx, By) at L1
- observational and theoretical/modeling investigations of CMEs to include the embedded magnetic field vector Bz (Bx, By)

f. Joint Focus Topics with Planetary Science: Extreme Space Weather Events in the Solar System

Target description:

The quest to understand extreme space weather events and their effects throughout the solar system presents a broad range of challenges in heliophysics and the planetary sciences. Some involve the challenge of figuring out how the Sun creates such extreme activity in the form of very major flares and coronal mass ejections, and their related large Solar Energetic Protons (SEPs). This includes the question of the limits of extreme heliospheric space weather: Just how bad can it get? And how frequently can extreme space weather occur? From a planetary perspective the challenges involve the understanding of the long-term consequences of the interaction of extreme solar wind events at each solar system body since they each present themselves differently to the solar wind (with/without atmospheres and magnetospheres with distance from the sun).

Goals and measures of success:

This program seeks broadly interdisciplinary, first-cut modeling efforts that can contribute toward initiating future more detailed research in this subject area. It is anticipated that these studies will lead to a better understanding for the potential for life elsewhere in the solar system and the hazards and resources present as humans explore space.

Types of Solicited Investigations:

While the study of extreme solar wind events at each planetary body could in itself represent a complete research project, this program seeks to obtain a first overall look at the problem. Its goals are to 1) demonstrate the major issues in modeling solar system-wide response to extreme space weather events from the Sun to the orbit of Neptune, and 2) consider some first-order planetary responses that are of potential importance to present, past and future planetary characteristics, and 3) obtain some initial insights as to what solar conditions give rise to extreme effects, and what may determine the limits of their effects.

1.2.2 Tools and Methods

The Tools and Methods component supports studies that, by themselves, may not deliver significant new science understanding, but instead deliver tools and/or methods that enable critically needed science advances. Examples include (1) the development of new empirical methods or analysis techniques, such as local helioseismology, that can be used to forecast solar, interplanetary, and geospace activity, (2) the development of new feature recognition or artificial intelligence (AI) algorithms that can advance predictive capabilities for the LWS system, and (3) the development of software tools that can identify, retrieve, assimilate, and/or portray data in order to model results from different sources for LWS research and forecasting objectives. Tools that address the four LWS TR&T strategic goals will be especially welcome.

A deliverable product(s) must be specified along with a delivery date. The deliverable product can be, for example, a stand-alone product or a web application, and must be delivered to a LWS approved repository/server such as the Community Coordinated Modeling Center (CCMC; http://ccmc.gsfc.nasa.gov/) or an existing Heliophysics virtual observatory (VxO). The delivery date must be during the final year of work with enough time left to support appropriate documentation and handover to the CCMC/VxOs to insure longevity and to enable its independent use by the scientific community. All tools will be listed with links from the LWS TR&T web site (http://lws-trt.gsfc.nasa.gov).

1.2.3 Independent Investigations

The Independent Investigations component supports studies that can be a test bed for future focus topics or fill gaps or deficiencies in fundamental understanding. The Independent Investigations component allows flexibility for cutting edge ideas that may be immature or too tightly focused to form a focus team, or lacking tools that could lead to rapid closure. The criteria that determine whether a proposed study should be submitted to this component are its urgency and impact to the LWS strategic goals listed above; proposals should demonstrate potential societal benefits and be the result of variations in some form of the Sun's energy output.

Examples of possible investigations include (1) the magnetospheric and ionospheric impact of SEPs, in particular their spatial and spectral distribution, (2) thermospheric wind dynamics and their influence on the coupled ionosphere-thermosphere system, (3) responses of atmospheric composition and climate to solar spectral variability and the energetic particle environment, and (4) conditions leading to CME onset, (5) estimation of irradiances through times of extreme solar activity as well as during times of minimal activity.

1.3 Cross-Discipline Infrastructure Building Programs

One of the major challenges facing the LWS program is the development of a research community that can cross traditional discipline boundaries and attack the system-wide problems that are central to understanding and modeling the Sun-Solar System connection. In order to address this challenge, proposals to this LWS TR&T program may include one or more of these infrastructure-building elements: cross-disciplinary workshops, and/or summer schools. Most of these activities will be supported through formal proposals to the TR&T as part of the regular proposal cycle. In all cases, an extra two pages will be allowed to the page limit for the Science/Technical/Management section of the proposal (see Section 2.2 below) for each of these activities.

a. Support of LWS Workshops/Campaigns: Given the goals of the Infrastructure Building Program, there are several guidelines that successful requests for *workshop/campaign* support must satisfy:

1. The workshop must address a science or technology topic that is both timely and important to the goals of LWS.
2. Workshops that focus on comparing and validating tools that have already been developed. Examples of possible workshops include 1) predicting all clear forecasting, 2) comparison of helioseismic techniques and velocity estimation methods.
3. Other workshop topic must be cross-disciplinary in nature and bring together researchers from different disciplines in LWS science.
4. Although there are no restrictions as to where the workshop will be held, it will clearly be advantageous to hold it at a location that is convenient and cost-effective for LWS researchers and students.
5. Workshops that encourage the training of new researchers in LWS system science are strongly encouraged.
6. Workshops that leverage funding from other institutions and agencies are strongly encouraged.

b. Support of LWS Summer Schools for Graduate Students: The details of the summer school (e.g., format, location, duration, etc.) are left to the proposer to define. However, proposals should provide convincing evidence concerning the breadth of the topics to be considered, the means to be taken to assure participation by recognized research/education authorities, and any institutional support that may be forthcoming (note: shared support of this activity is strongly encouraged). One or two such proposal may be selected for summer school activities not to exceed more than two years during the nominal three-year period of performance for the parent research proposal.

2. Programmatic Information

2.1 Demonstration of Relevance to LWS Objectives

Proposers are reminded that the evaluation criteria for this solicitation are given in the *NASA Guidebook for Proposers* (see below for reference). These criteria are intrinsic merit, relevance to NASA's strategic goals and objectives, and cost realism and reasonableness. In addition to the factors given in the *NASA Guidebook for Proposers*, the evaluation criterion "intrinsic merit" specifically includes the following factor:

- Proposals will be evaluated on the basis of their feasibility, intrinsic scientific merit, and compliance with requirements to provide public access to any tools and value-added products developed.

Proposals should provide a detailed (~1/2-1 page) description of how the proposed work will benefit the goals and objectives of the LWS program described above, and the timetable over which these benefits will accrue. To this end, the LWS program will provide a web site (http://lwstrt.gsfc.nasa.gov/trt_proposals.htm) that provides links to the abstracts of all selected proposals and their annual progress reports, including developed and tested software and/or refined data products.

In addition to the factors given in the *NASA Guidebook for Proposers*, the evaluation criterion "relevance to NASA's strategic goals and objectives" specifically includes the following factor:

- The degree to which the proposed investigation is relevant to one of the Focused Science Topics described in Section 1.2.1.

2.2 Summary of Key Information

Expected annual program budget for new awards	~ $5 M
Number of new awards pending adequate proposals of merit	~ 40
Maximum duration of awards	3 years
Due date for Notice of Intent to propose (NOI)	September 19, 2007
Due date for proposals	October 19, 2007

NASA strategic objective(s) which proposals must state and demonstrate relevance to	Every proposal must address one or more strategic goal or strategic outcome from Table 1. See also Sections I(a) and IV(e) in the *Summary of Solicitation* of this NRA.
General information and overview of this solicitation	See the *Summary of Solicitation* of this NRA.
Detailed instructions for the preparation and submission of proposals	See the *NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2006* at http://www.hq.nasa.gov/office/procurement/nraguidebook/.
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the *Guidebook for Proposers*; 2 additional pages are allowed for Cross-Discipline Infrastructure Building Programs (see Section 1.3 above)
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the *Summary of Solicitation* of this NRA and Chapter 3 of the *NASA Guidebook for Proposers*.
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 proposal 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	NNH07ZDA001N-LWSTRT
NASA point of contact concerning this program	Dr. Madhulika Guhathakurta Heliophysics Division Science Mission Directorate National Aeronautics and Space Administration Washington, DC 20546-0001 Telephone: (202) 358-1992 E-mail: lws.trt@nasa.gov