

# NASA LWS Institutes Concept Committee

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## *Final Report*

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### Membership

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### Participants in the first telecon (March 3, 2014)

Tamas Gombosi, Mike Hapgood, Karel Schryver, Doug Biesecker, Kent Tobiska, Jill Dahlburg, Caspar Ammann, Lika Guhathakurta, Kendra Greb

### Participants in the second telecon (March 28, 2014)

Tamas Gombosi, Mike Hapgood, Bill Murtagh, Karel Schryver, Kent Tobiska, Jill Dahlburg, Lika Guhathakurta, Kendra Greb

### Implementation

An LWS Institute (LWSI) is envisioned to facilitate Working Groups (WG) to develop a bridge between current productive heliophysics research and a societally-important technology area that is affected by space weather and hence requires targeted heliophysics investigations in order to advance, by bringing together key members of the research and forecast communities to define and scope needed new research that will make a critical difference to this technology. An LWS Institute working group proposals should

- (1) focus on a particular technology area that will be positively affected by space weather research advances,

- (2) identify a team that is composed of members who perform heliophysics research that is relevant to the affected technology, who forecast or model space weather for this technology, and who use (or who will use) this technology (when it is successfully improved),
- (3) describe how the team will quantify and parameterize the magnitude and pathways of the impacts on the affected technology and will scope the new ranges of targeted research that accordingly will be needed, and
- (4) articulate the impacts of this targeted research by envisioning the resulting, improved operational capability that will make a positive difference to society.

At the conclusion of each LWS Institute/Working Group, the team must – as a final report – jointly submit a peer-reviewed study that provides an integrated view of the space weather impacts on the selected technology area, a quantification of the magnitude of the impact for space weather of different magnitudes, a description of the impact pathways and of the scientific understanding achieved during the course of the WG, either a method to positively impact the technology or a research plan by which positive impact to the technology could be quantifiably achieved through space weather research advances, and a high-level graphical and textual vision of the resulting operational technology solution. The team will also provide a Working Group Report for the benefit of the LWS community.

## Potential Topics

For the first round of LWSI WG proposals are expected to focus on the effects of geomagnetically induced currents (GICs) during CME-driven geomagnetic disturbances (GMDs). Proposals may focus on particular historical GMDs or on a statistical analysis of many such events. The impacted technological infrastructure may be (all or part of) the US high-voltage power distribution network or its components (e.g., transformers, generators, power lines, etc.), or may be equipment powered by the low-voltage distribution network or societal functions enabled by that (e.g., communication systems, transportation-navigation systems, or systems related to safety and security). Proposals should focus on improving understanding of the process and/or magnitude of the impacts of space weather on the selected system, on identifying the science needed to improve our forecast ability for that system, and on outlining if not (partly) executing research that may develop abilities to reduce the impacts of space weather on that system.

Additional potential topics can be based on the SWPC Customer Requirements list:

- Nowcasts of radiation storms (proton events) at energy levels that could create a radiation hazard for aircrew and passengers,
- Forecasts and specification of HF outage areas at low and middle latitudes,
- TEC and ionospheric scintillation for GPS applications,

- Spatially resolved forecasts of large geomagnetically induced currents, to allow mitigation measures to be taken.
- Now-casts of atmospheric drag for LEO spacecraft,
- Prediction and specification of  $>10$  MeV proton flux.

## Attachment

# Living With a Star Institutes: A Concept Paper

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### **Purpose:**

The concept of the LWS Institute – small working group-style meetings focused on well-defined problems that demand intense, direct interactions between colleagues in neighboring disciplines – has been created to encourage and facilitate a deeper understanding of the variety of processes that link the Sun’s magnetic variability (radiation, solar wind, energetic particles) to Earth’s environment and atmosphere. The goal of NASA Living With a Star program is to “Develop the scientific understanding necessary to enable the U.S. to effectively address those aspects of the connected Sun-Earth system that directly affects life and society.” Thus, the LWS program with its focus on the basic science underlying all aspects of space weather and climate, acts as a catalyst to bring the many research disciplines and applications communities together to deepen the understanding of the system of systems created by the Sun-Earth connection. To that end, the LWS Institute Working Groups will provide an opportunity for scientists from all over the world to contribute to the evolution of heliophysics.

### **How the Program will work:**

Up to twice a year, a call for applications will be released for international teams of scientists to address specific topic areas related to the broad theme of Living With a Star, including pure and applied research into the nature of space weather and space climate phenomena and their impacts on society and its infrastructure. Teams may be made up of approximately 8 to 15 scientists from different research labs, universities, and industry, from different countries and with complimentary expertise. The teams will meet approximately twice in a 12-month period for about a one-week duration each time. Meeting locations may vary depending upon cost and home institution locations of the participating scientists.

The team leader will be responsible for submission of the proposal and for organizing the execution of the project. The team leader should also identify a co-team lead who would provide complimentary expertise from the engineering/user community. The primary goal of the projects is to result in a comprehensive report of the outcome of the study and at least one refereed team publication. One or two postdoctoral or early career

scientists may be included in the proposal to work alongside the team.

A science committee selected by the LWS Program Scientist and appointed by UCAR evaluates proposals and makes recommendations for support to LWS Institutes' sponsors. UCAR Visiting Scientist Programs administers these Working Groups and provides support for travel expenses, per diem, lodging and local areas transportation costs during the weeklong meetings.

## **Applications Materials**

- Cover letter from team leader
- 1-page abstract of project
- 5-page proposal including timeline, with one page of references (page 6).
- Vitae for all project participants

## **Submit Proposals to:**

LWS Institute Oversight Panel

[Insert electronic submission guidelines here]

Deadline date

## **Program sponsorship:**

NASA Living With a Star

Scientific fields of research tend to split into parallel sub disciplines as our understanding deepens. The successful increase in knowledge of the workings of the Sun's magnetic activity, the recognition of the many physical processes that couple throughout the heliosphere, and the insights into the interaction of the solar wind and radiation with the Earth's magnetic field and climate system, have tended to differentiate and insularize the solar, heliospheric, and geospace subdisciplines of the physics of the local cosmos. Technical jargons, publication channels, and meeting venues have also been subject to this tendency, hampering communication between the various subdisciplines.

The NASA Living With a Star program aims to reverse this trend. The recognition that the many connections within the Sun-Earth system require a systems approach, led to the development of an integrated strategic mission plan and a comprehensive research program encompassing all branches of solar, heliospheric, and space physics. This has raised awareness and appreciation of the research priorities and difficulties among LWS scientists, and has led to observational and modeling capabilities that span traditional discipline boundaries, and increased cross-publication in technical journals as well as the number of multi-disciplinary meetings.

### **Program Administration:**

The **University Corporation for Atmospheric Research** is a consortium of more than 100 member colleges and universities focused on research and training in the atmospheric and related Earth system sciences. **The UCAR Visiting Scientist Programs** office partners with federal agencies and universities across the nation to recruit, hire, and provide administrative management to scientists who are working on cutting-edge research of benefit to society.