

NASA Living with a Star Program Analysis Group (LPAG)

LPAG: Community-based interdisciplinary forum for soliciting and coordinating community analysis and input for Living with a Star objectives and their implications for architecture planning and activity prioritization and for future exploration.

<https://lwstrt.gsfc.nasa.gov/lpag>

Executive Committee (EC) Co-Chairs:

Anthea Coster, *MIT Haystack Observatory*

Mark Linton, *NRL*

EC Members:

Joe Borovsky, *Space Science Institute*

Richard Collins, *University of Alaska*

Seebany Datta-Barua,

Illinois Institute of Technology

Matina Gkioulidou, *JHU / APL*

Fan Guo, *Los Alamos National Laboratory*

Jorg-Micha Jahn, *Southwest Research Institute*

Enrico Landi, *University of Michigan*

John Leibacher, *National Solar Observatory*

Sabrina Savage, *NASA / MSFC*

Brian Walsh, *Boston University*

Living with a Star LPAG, continued

Liaison Members:

Charles N. Arge, *NASA GSFC*

Barbara Giles, *NASA GSFC*

Terry Onsager, *NOAA*

Vyacheslav Lukin, *NSF*

Michael Wiltberger, *NSF*

Ghee Fry, *NASA MSFC*

Ekaterina M. Verner, *NASA HQ*

James Spann, *NASA HQ*

Janet Kozyra, *NASA HQ*

Maria Kuznetsova, *NASA GSFC*

LWS Program Ex Officio:

Jeff Morrill, LWS Program Scientist, *NASA HQ*

Simon Plunkett, LWS Science Lead, *NASA HQ*

Shing Fung, LWS Website Manager, *NASA GSFC*

2018 Review:

Development of LWS Focused Science Topics

Solicited community input to TR&T science topics (5/7/2018 – 7/2/2018).

46 distinct community inputs submitted.

July-October 2018: Executive Committee drafted topics, solicited community feedback, then finalized topics, for a total of 20 draft FSTs, for 2018 LPAG EC report to NASA HQ.

NASA HQ used this input to develop four FSTs for ROSES 2019 (due February of 2020):

- The Variable Radiation Environment in the Dynamical Solar and Heliospheric System
- Fast Reconnection Onset
- Magnetospheric and Ionospheric Processes Responsible for Rapid Geomagnetic Changes
- Causes and Consequences of Hemispherical Asymmetries in the Magnetosphere – Ionosphere – Thermosphere System

Note: a fifth FST is being developed by NASA HQ and will be added to ROSES 2019 shortly.

15 draft topics remain as input for NASA HQ development of ROSES 2020 FSTs.

2019 LPAG Activity:

Revisit Strategic Science Areas Developed in 2014

Review: Strategic Science Areas (SSAs) for LWS Targeted Research and Technology (TR&T) program articulated in the LWS Ten Year Vision.

SSAs are long-term targeted areas of system science to guide LWS activities.

Physics–Based Understanding to Enable Forecasting of

- SSA-0:** Solar electromagnetic, energetic particle, and plasma outputs driving the solar system environment and inputs to Earth's atmosphere
- SSA-1:** Geomagnetic Variability
- SSA-2:** Satellite Drag
- SSA-3:** Solar Energetic Particles
- SSA-4:** Total Electron Content (TEC)
- SSA-5:** Ionospheric Scintillation
- SSA-6:** Radiation Environment

Reexamining Strategic Science Areas

At April 22-24 meeting, LPAG Executive Committee reexamined SSAs, keeping in mind

- The overall Living with a Star goals
- The ways in which these SSAs are now used by the community to develop new draft Focused Science Topics
- The ways in which the LWS program can complement the Space Weather Action Plan and NASA's new Space Weather Science and Applications (SWxSA) program

Reexamining Strategic Science Areas

Based on this reexamination, LPAG EC expanded, reordered, and refocused the SSAs

- June 1 – July 14, 2019: draft SSAs released to community for feedback.
- 29 community inputs submitted.
- These drafts and the community comments on them are archived at LPAG website: <https://lwstrt.gsfc.nasa.gov/lpag>
- Town halls held, garnering additional community input, at:
 TESS, CEDAR, GEM, and SHINE (though SHINE was after July 14 deadline).
- LPAG EC meeting July 15-17: EC incorporated community feedback into revised SSAs.

Now finalizing these SSAs writeups for LPAG EC report to NASA, to be submitted by end of November.

One SSA (IX: Solar Impacts on Climate) will be opened to the community for comment through Nov 15, as it was added after original comment period this past summer. 6

Strategic Science Areas

SSA-I: Origins and Variability of Global Solar Processes

Key Elements: Solar Cycle, Dynamo, Irradiance, Solar Wind

(revised from original SSA-0, Solar Electromagnetic, Energetic Particle, and Plasma Outputs)

SSA-II: Solar Eruptive and Transient Heliospheric Phenomena

Key Elements: Flares, Coronal Mass Ejections, Corotating Interaction Regions

(extracted from numerous original SSAs)

SSA-III: Acceleration and Transport of Energetic Particles in the Heliosphere

Key Elements: Energetic Particle Production, Particle Transport, Shocks, Seed Particles, Magnetic Connectivity

(revised from original SSA-3, Solar Energetic Particle Forecasting)

Strategic Science Areas

SSA-IV: Variability of the Geomagnetic Environment

Key Elements: Geomagnetically Induced Currents (GIC), Substorms, Geomagnetic Storms

(revised from original SSA-1, Geomagnetic Variability Forecasting)

SSA-V: Dynamics of the Global Ionosphere and Plasmasphere

Key Elements: Electron Density Profile, Total Electron Content, Storm Time Dynamics, Traveling Ionospheric Disturbances, Plasmasphere Refilling

(revised from original SSA-4, TEC Forecasting)

SSA-VI: Ionospheric Irregularities

Key Elements: Plasma Instabilities, Radio Wave Propagation, Scintillation, Polar Cap Absorption

(revised from original SSA-5, Ionospheric Scintillation Forecasting)

Strategic Science Areas

SSA-VII: Composition and Energetics of the Upper Neutral Atmosphere

Key Elements: Atmospheric Drag, Heating and Cooling, Waves and Tides, Composition

(revised from original SSA-2, Satellite Drag Forecasting)

SSA-VIII: Radiation and Particle Environment from Near Earth to Deep Space

Key Elements: Radiation Damage, Human Exposure, Spacecraft Charging, Radiation Belts, Plasma Sheet, Heliospheric Energetic Particles

(revised from original SSA-6, Radiation Environment Forecasting; extended to deep space)

Strategic Science Areas

SSA-IX: Solar Impacts on Climate

Key Elements: Solar Irradiance, Energetic Particle Precipitation, Coupled Chemical and Dynamical Response of Atmosphere, Ozone Layer

(revised from original Sun-Climate Theme – was formerly separate from SSAs)

(available for comment through November 15)

SSA-X: Stellar Impacts on Planetary Habitability

Key Elements: Atmospheric Depletion and Stripping, Magnetospheric Shielding, Stellar Winds, Stellar Activity and Evolution

(new topic)

2019 LPAG Activity:

Discuss Methods for Assessing Progress of FSTs

The LPAG Executive Committee held a wide-ranging discussion of possible methods for measuring progress of FST teams in achieving their specific FST goals and for advancing LWS science.

Informal notes of the full discussion were passed on to LWS leads.

More formal notes of key ideas will be summarized in the annual report, as follows:

Methods for Assessing Progress of FSTs

Start of FST Project:

- Objective and Milestones document to HQ for newly developed Team Plan from Meeting 1, develop measures of success for team.

During FST Project:

- 1+ annual publicly releasable Team Research Highlight for NASA HQ and TR&T website - e.g., team decides at one of two annual meetings what that year's research highlights will be - make this part of annual reporting requirement.
- Annual team progress report. Detail progress towards measures of success, and updates to objectives and milestones (1-3 pp).

At Conclusion of FST Project:

- Publicly releasable Extended and Brief Summary
- Exit survey to team members - evaluation of program, team organization
- Team lead meeting with LWS Program Scientists to discuss program

Activities for LPAG 2020

LPAG Executive Committee Membership:

- Sabrina Savage to replace Mark Linton as Co-Chair.
- Anthea Coster to continue as Co-Chair.
- Four current members will retire at end of 2019.
- Dear Colleague Letter (DCL) soliciting new membership to be sent out in Fall of 2019.
- Co-Chairs will recommend replacements to HDD from responses to DCL.

Solicit and develop new set of draft FSTs:

- Remaining draft FSTs from 2018 LPAG EC report will serve as input for NASA HQ
- Primary focus for LPAG Executive Committee in 2020 will be solicitation of community new draft FSTs for ROSES 2021 and beyond.

Assess progress of FST teams:

- Periodically revisit discussion on assessing progress of FST teams, as NASA implements