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EXPLORESCIENCE

Distinguishing Solar Terrestrial Probes and Living With a Star Programs

Jared Leisner

Program Scientist
Heliophysics Division

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Introduction

- The Heliophysics Division has two strategic mission lines: Solar Terrestrial Probes (STP) and Living With a Star (LWS)
  - STP: “the fundamental processes leading to evolutionary and future changes”
  - LWS: “those aspects of the sun and space environment that most directly affect life and society”
  - STP and LWS both support investigations that cover the full scope of heliophysics

- Historically, STP and LWS projects were “directed” (NASA project management, community competed instruments) and tended towards bigger missions.

- 2013 Decadal Survey for Solar and Space Physics recommended defining STP and LWS mission lines by 1) cost cap, 2) project management paradigm, and 3) cadence.
  - STP: Lower cost cap, PI-managed project, three prescribed missions in a dictated order
  - LWS: Higher cost cap, directed project, one prescribed mission

Decadal Survey Midterm Assessment

- In the 2013 Decadal Survey Midterm Assessment (Section 6.2, “Considerations for the Next Decadal Survey Process”), the National Academies discussed the implementation issues that had arisen from this formulation and suggested a revision of the program definitions.

- Current program implementation “is not an effective long-term scenario to maintain two distinct programs, nor for planning a regular cadence for strategic missions that comparably advance the different heliophysics sub-disciplines.” [2013 Decadal Survey Midterm Assessment, p. 6-4]
  - *Finding 6.5:* The next decadal survey committee may want to consider how to best distinguish the NASA Heliophysics LWS and STP strategic mission lines, both in terms of critical science goals and implementation strategies. Without distinct goals for these two programs, there is a risk to limit effective planning for larger strategic missions.

Decadal Survey Midterm Assessment

- In the 2013 Decadal Survey Midterm Assessment (Section 6.2, “Considerations for the Next Decadal Survey Process”), the National Academies discussed the implementation issues that had arisen from this formulation and suggested a revision of the program definitions.
  - *Recommendation 6.3:* [...] To address the evolving needs for science-driven strategic plans, the agency sponsors should ensure the following items are included as tasks for the next decadal survey committee:
    - Definition of distinct science goals and implementation strategies for NASA’s Solar Terrestrial Probes and Living With a Star programs[.]
  - *NASA response:* NASA agrees that it is important for programs to have distinct science goals and implementation plans, and is currently conducting internal discussions to distinguish the scopes and boundaries of the Solar Terrestrial Probes and Living With a Star programs. These discussions are based upon the referenced need for a scientific basis that is able to evolve with the Heliophysics Division’s, the Agency’s, and the Nation’s needs. NASA's intention is to produce a plan for those programs, after which NASA would seek comments and input from the science community. **A final plan for the two programs would then be published in time for the next decadal survey.**

STP-LWS Strategy Formulation

- In May 2019, internal Division working group stood up to consider STP and LWS
  - Better distinguish the two programs
  - Optimize their response to Agency needs

- Examined previous and current STP and LWS guiding documents, program intents, programmatic needs

- Considered multiple program implementations based upon different factors
  - Science topic, science target, science maturity
  - Mission implementation details
  - Programmatic structure

- The strategy here is the one that was deemed the best option by the Division
  - Implementation issues, including Midterm Assessment's comments
  - Programmatic alignment with Agency programs, activities

STP-LWS Strategy, Desired Attributes

- Clear definitions that…
  - …flow from and to program goals and objectives;
  - …do not overlap with one another;
  - …are objectively distinguishable; and
  - …permit immediate, exclusive assignment of missions to a mission line.

- Programmatic structure that is…
  - …mature (e.g. well documented, follows set processes, provides accountability);
  - …agile and responsive; and
  - …accessible to stakeholders.

- Programmatic content that has…
  - …a basis in science goals and objectives and not specific mission implementations;
  - …a clear role in larger Agency activities; and
  - …a clear link to a multi-decadal science strategy.

STP-LWS Strategy, Heritage

- Living With a Star
  - Focus on interconnected space environment's impact on life and society
    - "…specific questions needed to understand the linkages among the interconnected systems that impact us." [Heliophysics Roadmap 2009-2030]
    - "LWS flight missions will provide unprecedented new data sets and new insights into the physical mechanisms that underlie the Sun-Earth connected system." [Living With a Star TR&T Definition Team Report]
  - Living With a Star Science (TR&T)
    - Strategic Science Areas (very broad, long-term)
    - Focused Science Topic (moderately broad, short-term)
    - Investigations (narrow, short-term)

STP-LWS Strategy, Heritage

- Solar Terrestrial Probes
  - Focus on significant scientific progress for the entire heliophysics field
    - Advance by “target[ing] ‘weakest links’ in the chain of understanding” [Sun-Solar System Connection Roadmap 2005-2035, Roadmap 2009-2030]

- All Heliophysics Science, Missions
  - “Research Focus Areas” identified as key heliophysics science, missions post hoc mapping [Roadmap 2005-2035]
  - Two to three launches per decade for LWS and STP each [Roadmap 2009-2030]

STP-LWS Strategy, Heritage

- Living With a Star
  - Focus on interconnected space environment's impact on life and society
  - Program structure where science focus flows from particular system aspects to narrow science objectives
- Solar Terrestrial Probes
  - Focus on significant scientific progress for the entire heliophysics field
  - Focus on short-, medium-, and long-term strategic needs
- Both programs
  - Multiple missions in development at a time, enable an active program executing a coordinated study of the interconnected physical system

- The community has already been having significant discussions
  - Key concepts
  - Naturally combine to form a strategy to implement the STP and LWS programs
  - Inherently address the Midterm Assessment

STP-LWS Strategy, Solution

- Living With a Star: Focus on specific knowledge gaps relevant to life and society
  - Mission line adopts a modified version of the LWS Science structure
    - A limited number of fairly focused Strategic Mission Areas (SMAs)
    - Each SMA contains specific, closeable mission objectives
    - Missions address some combination of objectives within and/or across SMAs
  - SMAs defined via programmatic needs (e.g. Division contribution to Agency activities and) and scientific needs

- LWS and STP
  - Variety of mission sizes, project management paradigms (PI-led vs. directed)
  - Medium- and long-term strategies addressed (e.g. technology development, pathfinder missions)
  - Agile response to unanticipated results, opportunities, synergies

STP-LWS Strategy, Solution

- Solar Terrestrial Probe: Focus on broad-based advance of heliophysics
  - Support missions that address general knowledge gaps that inhibit advancement of the entire scientific field
  - Explicitly addresses a multi-decadal strategy, inter-disciplinary science, cross-mission synergies

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STP-LWS Strategy, Roles

- Decadal survey…
  - …science objectives for completion in the next decade;
  - …likely science objectives for future decades that require preparation in the next decade;
  - …science prioritization;
  - …any science-based timing considerations for particular objectives without prescribing a mission order; and
  - …decision rules, process for accommodation of
    - budget realities
    - mid-decade emerging science and/or programmatic needs

- Heliophysics Division…
  - …programmatic input on LWS SMAs;
  - …the project management for each mission; and
  - …the solicitation structure.

STP-LWS Solution, Implementation

- Solar Terrestrial Probes
  - Community conversations to assess progress and new scientific needs
    - Starts with the Heliophysics 2050 Workshop
  - Decadal survey multi-decadal strategy, explicit links between science objectives

- Living With a Star
  - Before next decadal survey
    - Division outlines this programmatic structure and process needs
    - Division-assembled group produces program-defined SMAs
      - Strongly informed by community expertise
      - SMA-responsive reference mission concept(s)
  - Decadal survey
    - Consideration of the program implementations
      - Improvements to the framework
      - Additional high-priority LWS SMAs, prioritization

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Questions? Conversation?