

National Aeronautics and  
Space Administration



# EXPLORESCIENCE

**Heliophysics Technology**

*Decadal Survey Supplemental Presentation*

**Dr. Nicola Fox**

Heliophysics Division Director  
Science Mission Directorate



# Introduction

This input to the Decadal Survey presents high-level information on the current Heliophysics Division Technology Program and strategy. The intent of these slides is to assist the Committee in the beginning of their deliberations, and NASA welcomes the opportunity to speak further to the Committee on this topic.

The final slide of this presentation includes specific requests from NASA for the Decadal Survey Committee.

## Decadal Survey Statement of Task, Study Approach

*NASA recognizes that establishing a long-term strategy requires early investments in a range of technologies and techniques that may open up paths for future scientific endeavors. The survey is encouraged to, as part of a long-term strategy, make recommendations on the early development of technologies and techniques that would enable specific science investigations in and beyond the next decade.*



# Overview

- Heliophysics Division has developed and begun implementation of technology strategy in order to:
  - Demonstrate capacity to develop technologies to expand the scope of the next decadal survey science objectives,
  - Utilize a strategy to develop and mature technologies over full range of Heliophysics Science, and
  - Develop technologies now to enable both smaller and strategic missions in the next decade and beyond.
- In FY2022, the Heliophysics Division established the Heliophysics Technology Program
  - Coordinate Division technology efforts
  - Manage current and future technology demonstration projects
  - Supported by Heliophysics Strategic Technology Office (HESTO)

The background of the slide is a composite of two cosmic images. The top half features a dark blue and black space filled with numerous small white stars and a prominent, bright blue nebula on the right side. The bottom half shows a similar starry field but with a warm, golden-yellow and greenish glow, suggesting a different spectral filter or a different region of space. The text 'Heliophysics Technology Strategy' is centered in a white horizontal band across the middle.

# Heliophysics Technology Strategy

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## Vision

*To enable New Realms of Heliophysics Knowledge and Capability*

## Mission

*Enable novel and transformative capabilities and mission concepts. Advance science by expanding the limits of what is measurable, observable and achievable in Heliophysics. Set the tone for the future of the field, enabling science and missions that are not conceivable or achievable today.*

**To fulfill our Vision and Mission, the Heliophysics Division identified three Strategic Goals:**

### 1. Advance

- **Advance** technology to expand heliophysics science

### 2. Improve

- **Improve** likelihood of technological and scientific success

### 3. Optimize

- **Optimize** the return of technology investment

Strategic Goal	Strategic Objectives
<p>1. Advance technology to expand heliophysics science</p>	<p><b>1.1 Assess:</b> Conduct periodic assessment of existing technologies and technology gaps to identify opportunities for strategic investment</p> <ul style="list-style-type: none"> <li>a. Perform periodic gap analyses</li> <li>b. Perform mission and concept studies</li> <li>c. Track trends in technology development/advancement</li> <li>d. Identify technologies to fill technology gaps and mission needs</li> <li>e. Periodically assess the progress made and advancement in technologies</li> </ul>
	<p><b>1.2 Catalyze:</b> Catalyze the novel and transformative technologies for Heliophysics Science (push)</p> <ul style="list-style-type: none"> <li>a. Evolutionary</li> <li>b. Transformational (high risk/high reward)</li> </ul>
	<p><b>1.3 Cultivate:</b> Work with Strategic Mission leads to cultivate technologies to meet heliophysics mission needs (pull)</p> <ul style="list-style-type: none"> <li>a. Mission Enhancing (e.g. MMS Hot Plasma Composition Analyzer)</li> <li>b. Mission Critical (e.g. heat shields for Parker Solar Probe)</li> </ul>
	<p><b>1.4 Expand:</b> Tap into the technologists from outside the heliophysics community to infuse cross-disciplinary technology perspectives</p>

Strategic Goal	Strategic Objectives
<p>2. Improve Likelihood of Technological and Scientific Success</p>	<p><b>2.1 Incubate:</b> Technology and Instrument Incubator Project</p> <ul style="list-style-type: none"> <li>a. Establish an incubator process for promising technologies to proactively nurture and advance such technologies</li> </ul> <p><b>2.2 Advance:</b> Shepard technologies through maturation and demonstration to enable infusion into missions</p> <ul style="list-style-type: none"> <li>a. Mature transformational technologies from early-stage concept to flight demonstrations (TRL 3 to 6)</li> <li>b. Demonstrate technologies in flight to effectively transition them for NASA missions and for use by other government agencies and industries</li> </ul> <p><b>2.3 Infuse</b></p> <ul style="list-style-type: none"> <li>a. Create deliberate access of matured technologies and databases to future PIs</li> <li>b. Work with mission leads to bolster infusion of advanced technologies into heliophysics missions</li> <li>c. Promote infusion into other NASA missions</li> <li>d. Evaluate opportunities for infusion with external NASA partners</li> </ul>



Strategic Goal	Strategic Objectives
<b>3. Optimize the Return of Technology Investment</b>	<b>3.1 Leverage:</b> Facilitate the use of NASA-developed heliophysics technology for broader usability
	<b>3.2. Partner</b> <ul style="list-style-type: none"><li>a. Collaborate internally with other NASA stakeholders</li><li>b. Collaborate with external domestic stakeholders (Gov, Nonprofit, Non-Gov)</li><li>c. Collaborate with international organizations and foreign researchers</li></ul>
	<b>3.3. Transfer</b> <ul style="list-style-type: none"><li>a. Expand publication of results of technology investments</li><li>b. Increase patents for technologies developed/funded by NASA</li><li>c. License technologies developed/funded by NASA to external stakeholders</li></ul>



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# Heliophysics Division Technology Efforts

# Technology Program Efforts

- Technology Strategy splits technologies between “push” and “pull” categories
  - Push: Enabling or enhancing of multiple types of projects, initiated outside of any one project’s needs
  - Pull: Enabling or enhancing of a particular project, initiated due to one project’s needs
- Heliophysics Technology Program makes strategic investments in technologies, for both push and pull technologies
  - Needed development is identified by
    - Top-down activities (e.g. Decadal Survey, Division-led gap analysis)
    - Bottom-up offerings (i.e. open competitions)
  - Development is supported by
    - Directed funding, for top-down identifications
    - Open competitions, for both top-down and bottom-up identifications
- Technology Program transitions “pull” technologies to a directed mission’s (Pre-)Project Office once the latter is established
  - Continued support for and maturation of that technology is the responsibility of the new project
- Technologies are matured using ground-based facilities, rideshare payload, low-cost access to space

# HESTO

- Heliophysics Strategic Technology Office (HESTO), HPD support office
  - *History:* Established in 2022, full implementation planned by 2025
  - *Purpose:* Supports HPD's development, management, and infusion of technologies
    - Gap and trend analyses
    - Solicitation development, management of funded projects
      - HPD releases solicitations, makes selections
    - Infusion into Heliophysics science missions
    - External-facing website of NASA-supported technologies available to community PIs
      - *Note:* Policies and processes currently in-development by HPD
  - *Structure:* Wallops Flight Facility-located office, Goddard Space Flight Center Lead Scientist
    - HESTO staff are firewalled from Center proposal activities
- HESTO Technology Working Group
  - Internal NASA group (HQ, Centers, JPL)
  - Support HPD on technology matters (e.g., long-term investments and development)
  - Incorporates strategic guidance from Decadal Survey and Mid-term Assessment





# Role of HESTO

In 2022, the Heliophysics Strategic Technology Office (HESTO) was put in place. HESTO will support HPD as follows:

- Conduct the technology gap and trend analyses, building off of Decadal Survey and other strategic sources
- Support NASA HQ on Heliophysics technology solicitations (e.g., HTIDeS, HFOS), and on the management of resulting awards
- Identify gaps in technology investment needing to be directly funded
- Provide active management of NASA Heliophysics technology investments to nurture, advance, and infuse matured technologies into future science missions
- Collaborate with the Sounding Rocket Payload Office (SRPO) and Small Satellite Payload Office (SSPO) to identify flight opportunities for maturation of technologies and manage technologies proposed to H-LCAS and HFORT
- Develop an external Heliophysics Technology website to establish access of matured technologies and databases to the Heliophysics PI community



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# Charge to Decadal Survey



# Request for the Decadal Survey

Charge to the Decadal Survey Committee: *NASA recognizes that establishing a long-term strategy requires early investments in a range of technologies and techniques that may open up paths for future scientific endeavors. The survey is encouraged to, as part of a long-term strategy, make recommendations on the early development of technologies and techniques that would enable specific science investigations in and beyond the next decade.*

- Identify technology developments recommended for the next decade
  - Enabling, enhancing technologies for recommended projects
  - Early-stage investments to enable new science beyond the next decade
- Prioritize recommended technology investments, including strategic guidance for the Technology Program
- Prioritize technology demonstration activities within the Heliophysics portfolio, including Technology Demonstration Opportunities and Technology Demonstration Missions of Opportunity
- Clearly incorporate budgetary requirements for investments and projects
  - Including transition of budgetary responsibility to recommended projects during Phase A



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Questions?