

National Aeronautics and
Space Administration



EXPLORESCIENCE

Enabling the Future of Science

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 Future of Science, as applicable to NASA. 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 the principles of open science and open source are critical enablers of successful advances in heliophysics science. These components of a successful research strategy are explicitly identified in the Decadal Survey Statement of Task:

- 3. *Develop a comprehensive ranked research strategy that provides an ambitious, but realistic, approach to address these science goals. The strategy will include consideration of:***
 - b. Data and computing infrastructure needed to support the research strategy and the long-term utility, usability, and accessibility of acquired data*



Overview

NASA has been supporting activities to enable the future of science, including but not limited to:

- Open Science, Open Source
- Data Archiving and Computing
- Artificial Intelligence and Machine Learning (AI/ML)
- Citizen Science

Open Science, Open Source

Heliophysics benefits from the contributions of the open science community and [is committed to promoting open science](#) across its initiatives and funded programs.

The new [Heliophysics Data Policy](#) [Feb 2022] sets two Division policies:

- Codifies “making high-quality, high spatial and temporal resolution data publicly available as soon as practical”
- Prescribes full and open sharing of Heliophysics Division-funded software under permissive license with broad community acceptance and made available in public repositories

HPD participates as an active member in the SMD Open Source Science Working Group and Councils and supports key initiatives including:

- [Transform to Open Science](#) (TOPS), SMD initiative
- HPD funded activities for Python in the Heliophysics Community (PyHC)
- SMD Year of Open Science - Initiative to inspire open science engagement through events and activities



Data Archiving & Computing



The success of the Heliophysics System Observatory depends on the ingestion, cataloging, accessibility, and dissemination of Heliophysics mission and research data.

- Heliophysics Division has created the Heliophysics Digital Resource Library (HDRL) to:
 1. Provision and curate scientific big data
 2. Support data analysis and modeling
 3. Design and implement collaborative open science infrastructure
- HDRL continues rolling out cloud-based operational environment and developing cloud-based research and High-End Computing environments
 - HPCloud – connect cloud services to High Value data
 - NASA Center for Climate Simulation (NCCS) for on-premise High-End Computing (HEC) including GPU processing
 - Support for downloading and hosting data products on the researchers own hardware via APIs and Services

AI/ML Strategy & Objectives

Vision. To fast-track AI/ML capability and capacity to research scientists and infrastructure providers in heliophysics.

Mission. AI requires four main things: suitable data, processing power, AI/ML tooling, expertise

Objectives

People

- Adopt latest techniques and tools to attract talent
- Supercharge innovation with partnerships
- Upskill and educate to make AI/ML literate

Process

- Ethically leverage existing tools and assets
- Partnerships that drive innovation and deploy new capabilities
- Transition research into new AI/ML capability

Platforms

- Democratize AI while protecting assets, privacy, and values
- Streamline AI-ready data for open science
- Reduce barriers to effective management and compute



AI/ML Recent Successes

Amazon Web Services (AWS) Collaboration

NASA Heliophysics is working with AWS Professional Services and the Amazon Machine Learning (ML) Solutions Lab to use unsupervised learning and anomaly detection to explore the extreme conditions associated with superstorms.

- Goal is to understand what turns an average solar storm into a superstorm.
- The more we understand what causes such space weather, the more we can improve our ability to forecast and mitigate the effects.

Center for HelioAnalytics

To create a community and information structure that permits data science tools and techniques to add depth and richness to the scope of scientific questions that can be asked and answered.

SOHO Comet Challenge

Public challenge to develop a new AI/ML algorithm to identify comets.

- Showed AI/ML was effective at tracking known comets
- Discovered two new comets

Citizen Science Strategy

Vision: Leverage public participation in Heliophysics to help drive innovation and diversity in science, society, and education

Mission: Build a robust, dynamic, and engaging Heliophysics citizen science portfolio that fuses natural phenomena, mission opportunities, and the power of people's diverse viewpoints to fuel collective innovation

HELIOPHYSICS

BIG YEAR

*The Sun will have a very Big Year from Fall 2023 through 2024! And we want you to **bring your joy and curiosity to this opportunity of a lifetime** to participate with NASA Heliophysics!*

go.nasa.gov/HelioBigYear



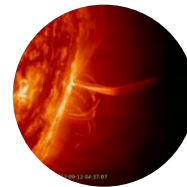
Follow us @nasasun as we journey closer to our star



Join us for eclipses in October 2023 and April 2024



Do real science @doNASAScience with NASA citizen science as we rise to solar max



ATTN: All hands on deck!

Find out how you can participate with event planning activities, outreach, and funding around citizen science projects, contests, and more.



Questions

Contact: Ha-Hoa Hamano,
Presidential Innovation Fellow
@ NASA



Email: ha-hoa.n.hamano@nasa.gov Twitter: @hahoais

The background of the slide is a composite of two cosmic images. The top half features a dark space filled with numerous small stars and a prominent blue nebula on the right side. The bottom half shows a similar starry field but with a large, bright orange and yellow nebula on the left side, transitioning into a greenish-blue nebula on the right. A horizontal light blue band runs across the middle of the image, containing the text.

#HelioRocks