

National Aeronautics and
Space Administration



Heliophysics Division

Heliophysics Advisory Committee Spring Meeting

Dr. Nicky Fox
Heliophysics Division Director
May 5, 2022



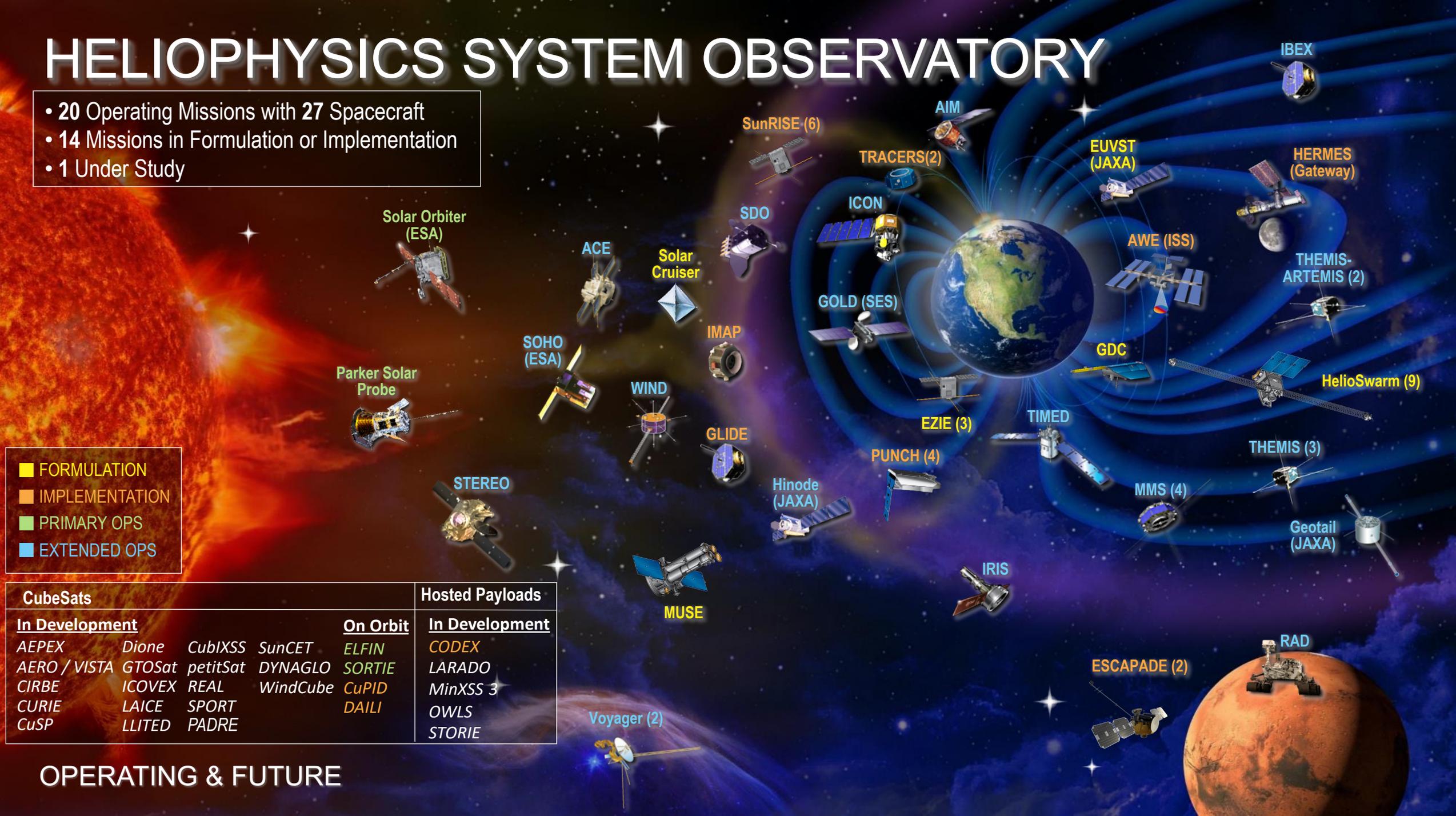
Remembering Dr. Eugene Parker



Credit: University of Chicago

HELIOPHYSICS SYSTEM OBSERVATORY

- 20 Operating Missions with 27 Spacecraft
- 14 Missions in Formulation or Implementation
- 1 Under Study

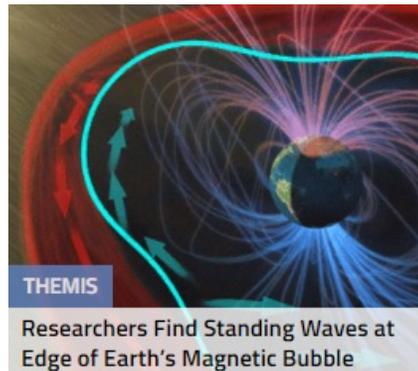
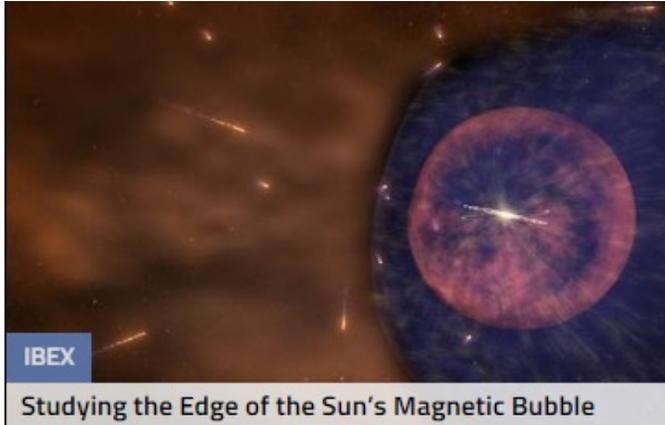


- FORMULATION
- IMPLEMENTATION
- PRIMARY OPS
- EXTENDED OPS

CubeSats				Hosted Payloads			
In Development				On Orbit			
AEPEX	Dione	CubIXSS	SunCET	ELFIN	CODEX		
AERO / VISTA	GTOsat	petitSat	DYNAGLO	SORTIE	LARADO		
CIRBE	ICOVEX	REAL	WindCube	CuPID	MinXSS 3		
CURIE	LAICE	SPORT		DAILI	OWLS		
CuSP	LLITED	PADRE			STORIE		

OPERATING & FUTURE

Recent Accomplishments



Advanced priorities of 2013 Decadal and initiated planning for 2023 Decadal

- Selected three investigation teams to join the GDC mission science team
- Down selected 2 MIDEX-19 missions (MUSE and HelioSwarm) and released SMEX-22 Community Announcement to maintain Decadal-recommended cadence of PI-led missions (SMEX, MIDEX, MoOs)
- Supported “Helio 2050” and finalized Statement of Task for 2023 Decadal with National Academies
- Selected DRIVE Science Centers

Supported multiple missions through key milestones to bolster the future Heliophysics System Observatory

- Confirmed 7 missions for implementation: IMAP, PUNCH, SunRISE, ESCAPEDE, GLIDE, HERMES, TRACERS
- Advanced 3 missions in formulation towards KDP C: Solar Cruiser, EZIE, and EUVST

Invested in multiple high-priority, cross-cutting programs and initiatives

- Selected Heliophysics Technology Office (HESTO) Implementation Center to enable more focused, impactful, and innovative technology investments
- Initiated investments in Space Situational Awareness/Orbital Debris technology maturation
- Space Weather Centers of Excellence (ROSES-22)
- Solicited community input via RFI for modernization of archives and enabled breakthrough heliophysics science via investments in AI/ML, theory, data analysis, and modeling

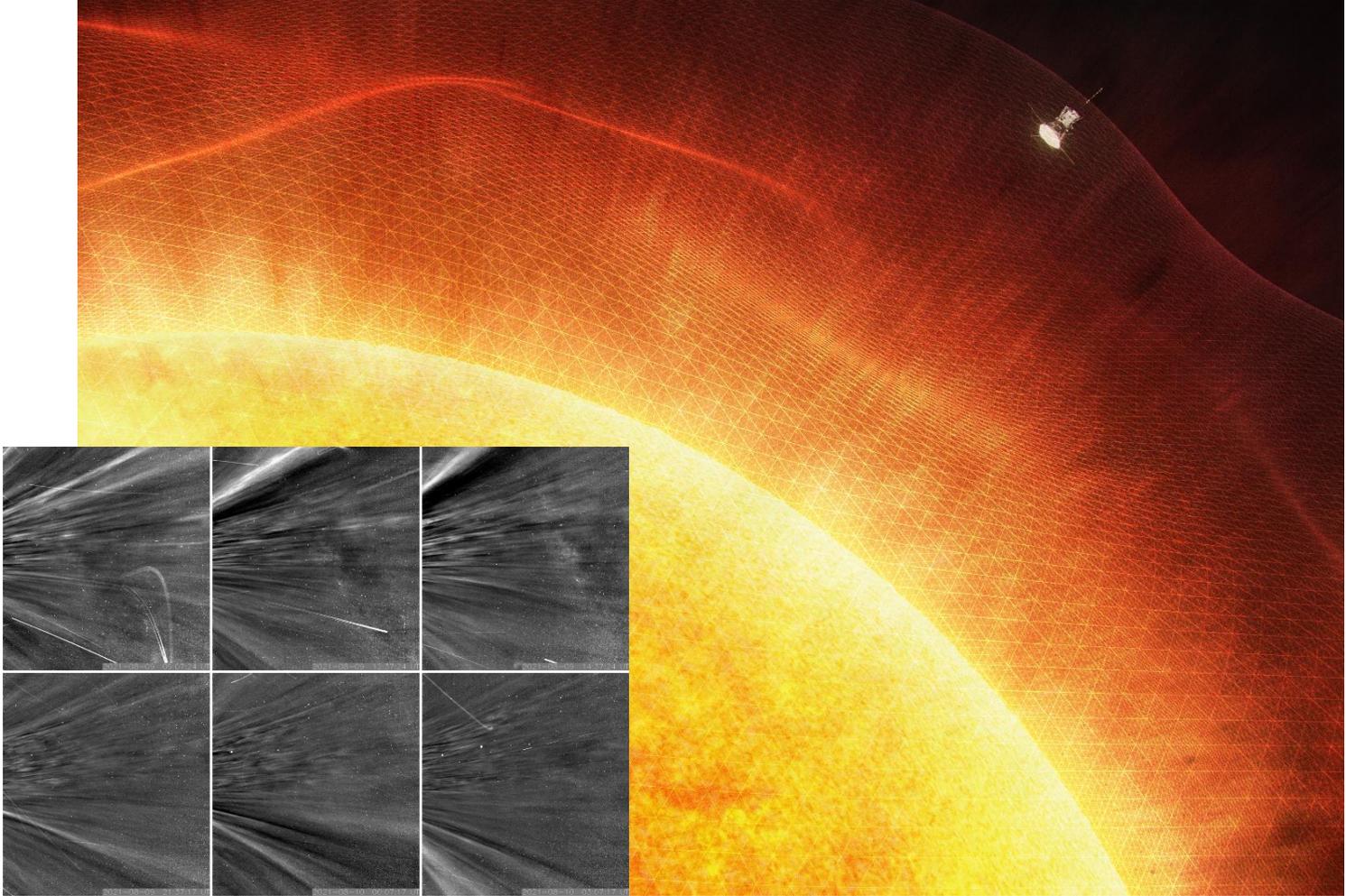
Parker Solar Probe enters the Solar Atmosphere for the first time, and heralds the dawn of new science

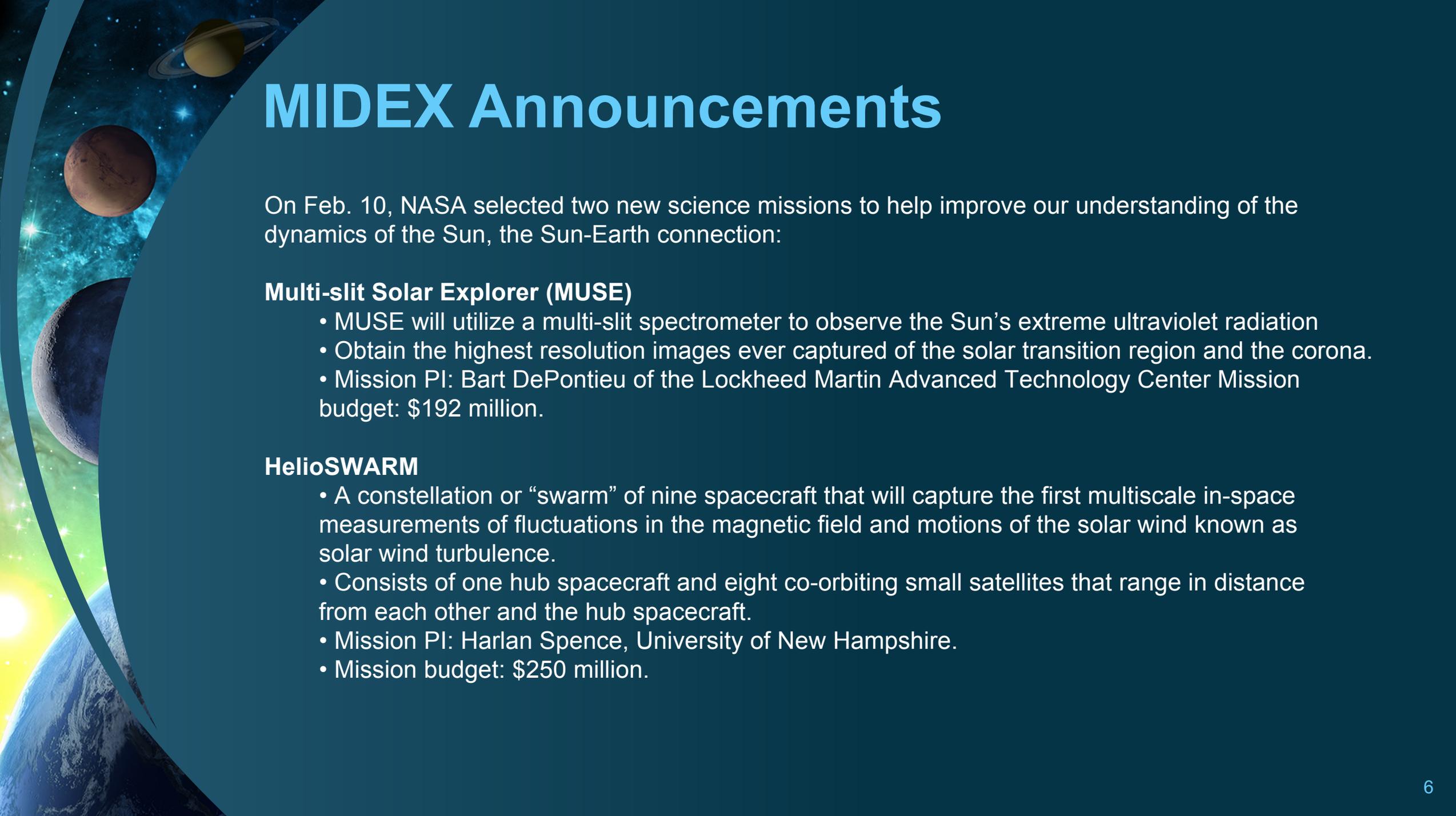
Touching the Sun

Parker has traveled so close to the Sun that it has entered a totally uncharted region where intertwined particles and fields are still bound to the Sun's atmosphere



Dr. Eugene N. Parker
1927 - 2022



A vibrant space-themed background featuring a curved blue arc on the left side. The background is filled with a starry field, a bright yellow sun in the bottom left corner, and several celestial bodies: Saturn with its rings at the top, Mars in the middle, and the Earth's horizon at the bottom left. The overall color palette is dominated by blues, greens, and yellows.

MIDEX Announcements

On Feb. 10, NASA selected two new science missions to help improve our understanding of the dynamics of the Sun, the Sun-Earth connection:

Multi-slit Solar Explorer (MUSE)

- MUSE will utilize a multi-slit spectrometer to observe the Sun's extreme ultraviolet radiation
- Obtain the highest resolution images ever captured of the solar transition region and the corona.
- Mission PI: Bart DePontieu of the Lockheed Martin Advanced Technology Center Mission budget: \$192 million.

HelioSWARM

- A constellation or "swarm" of nine spacecraft that will capture the first multiscale in-space measurements of fluctuations in the magnetic field and motions of the solar wind known as solar wind turbulence.
- Consists of one hub spacecraft and eight co-orbiting small satellites that range in distance from each other and the hub spacecraft.
- Mission PI: Harlan Spence, University of New Hampshire.
- Mission budget: \$250 million.

DRIVE Science Center Selections

DRIVE Science Centers, implemented as a NASA-NSF partnership, are part of an integrated multi-agency initiative, DRIVE (Diversity, Realize, Integrate, Venture, Educate), put forward as a high priority recommendation of the 2013 Solar and Space Physics Decadal Survey. DRIVE Science Centers are focused on grand challenge goals that are both ambitious and focused enough to be achievable within the lifetime of the center.

On March 17th, NASA selected three DRIVE Centers:

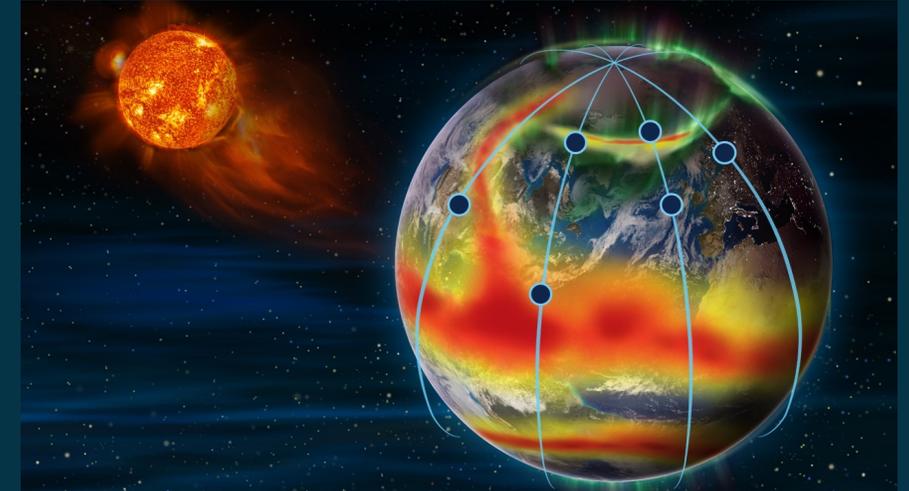
Title, Pls, and Institutions

- Consequences of Flows and Fields in the Interior and Exterior of the Sun (COFFIES)
 - Hoeksema / Stanford
- Center for Geospace Storms (CGS)
 - Merkin / JHU/APL
- Our Heliospheric Shield
 - Opher / Boston University



Geospace Dynamics Constellation (GDC) Selections

- NASA is thrilled to announce the start of the GDC mission science team!
 - Interdisciplinary Scientists (selected Nov 2021)
 - Dr. Rebecca Bishop (The Aerospace Corp.)
 - Prof. Yue Deng (Univ. Texas, Arlington)
 - Prof. Jeffrey Thayer (CU Boulder)
 - Investigations, delivering science instruments (selected Apr 2022)
 - *MoSAIC*: Dr. Mehdi Benna (UMBC)
 - *CAPE*: Dr. Daniel Gershman (GSFC)
 - *AETHER*: Dr. Laila Andersson (CU Boulder)
- NASA has selected a competitive Phase A (downselection exp. Nov/Dec 2022)
 - *MAG*: Dr. Guan Le (GSFC)
 - *NEMISIS*: Prof. Mark Moldwin (Univ. Mich)
 - *MAG*: Prof. David Miles (Univ. Iowa)
 - *TPS*: Prof. Phil Anderson (Univ. Texas, Dallas)
 - *3DI*: Dr. Keiichi Ogasawra (SwRI)

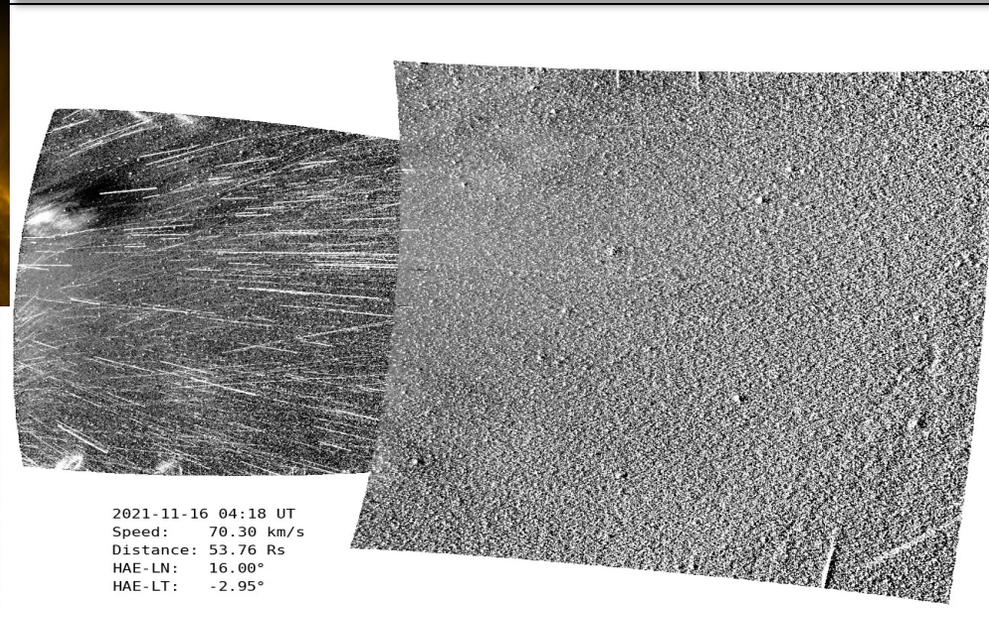
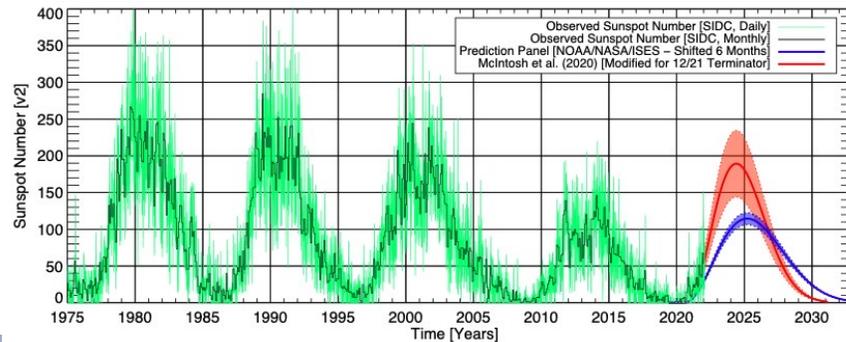
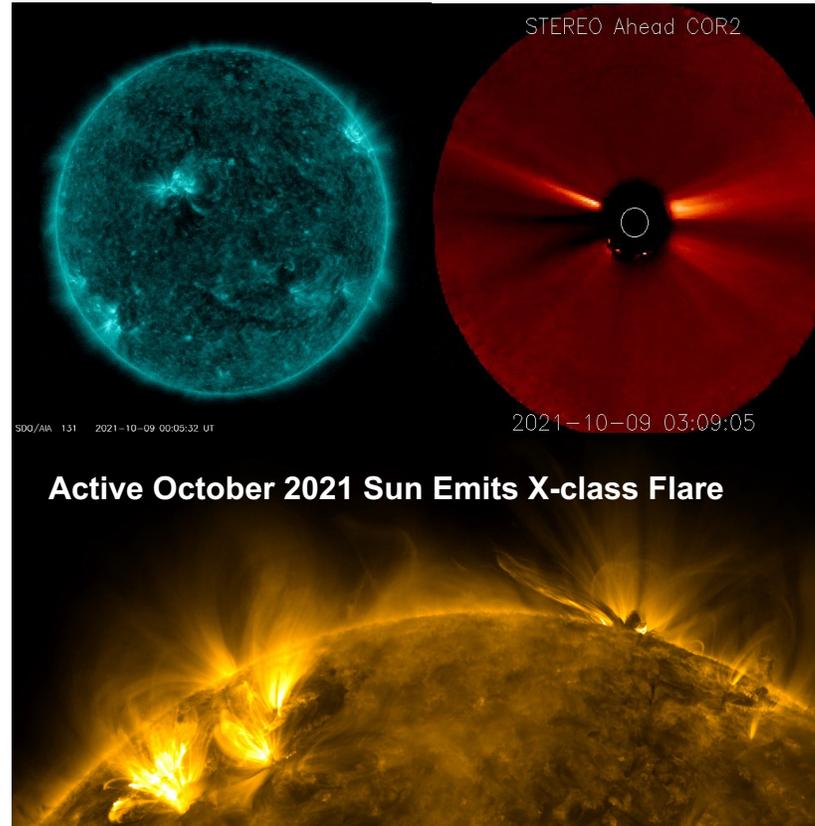


The Sun Wakes Up: Solar Cycle 25 Is Here

December 2019 marked the beginning of Solar Cycle 25, and the Sun's activity will once again ramp up until solar maximum, predicted for 2025.

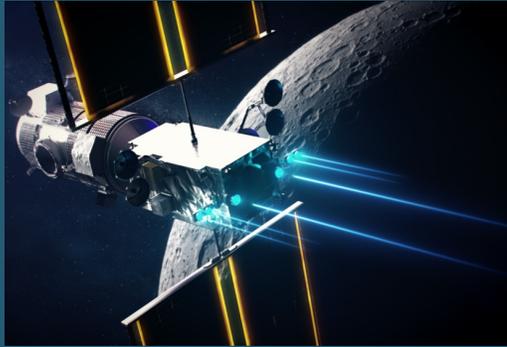
This new solar cycle, and anticipated increase in space weather events, will impact our lives and technology on Earth, as well as astronauts in space.

This is the first solar cycle that many new commercial and government stakeholders will navigate.

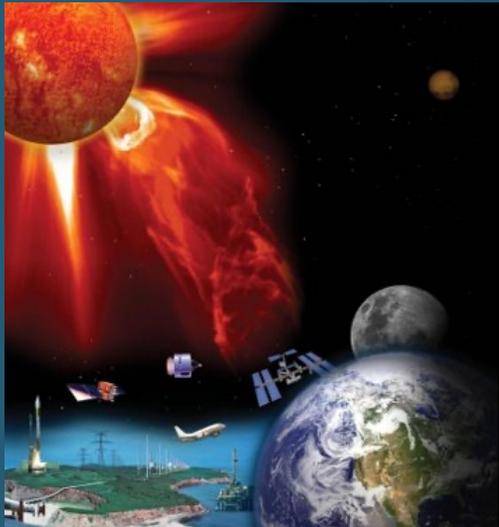


NASA Space Weather

Recent Accomplishments

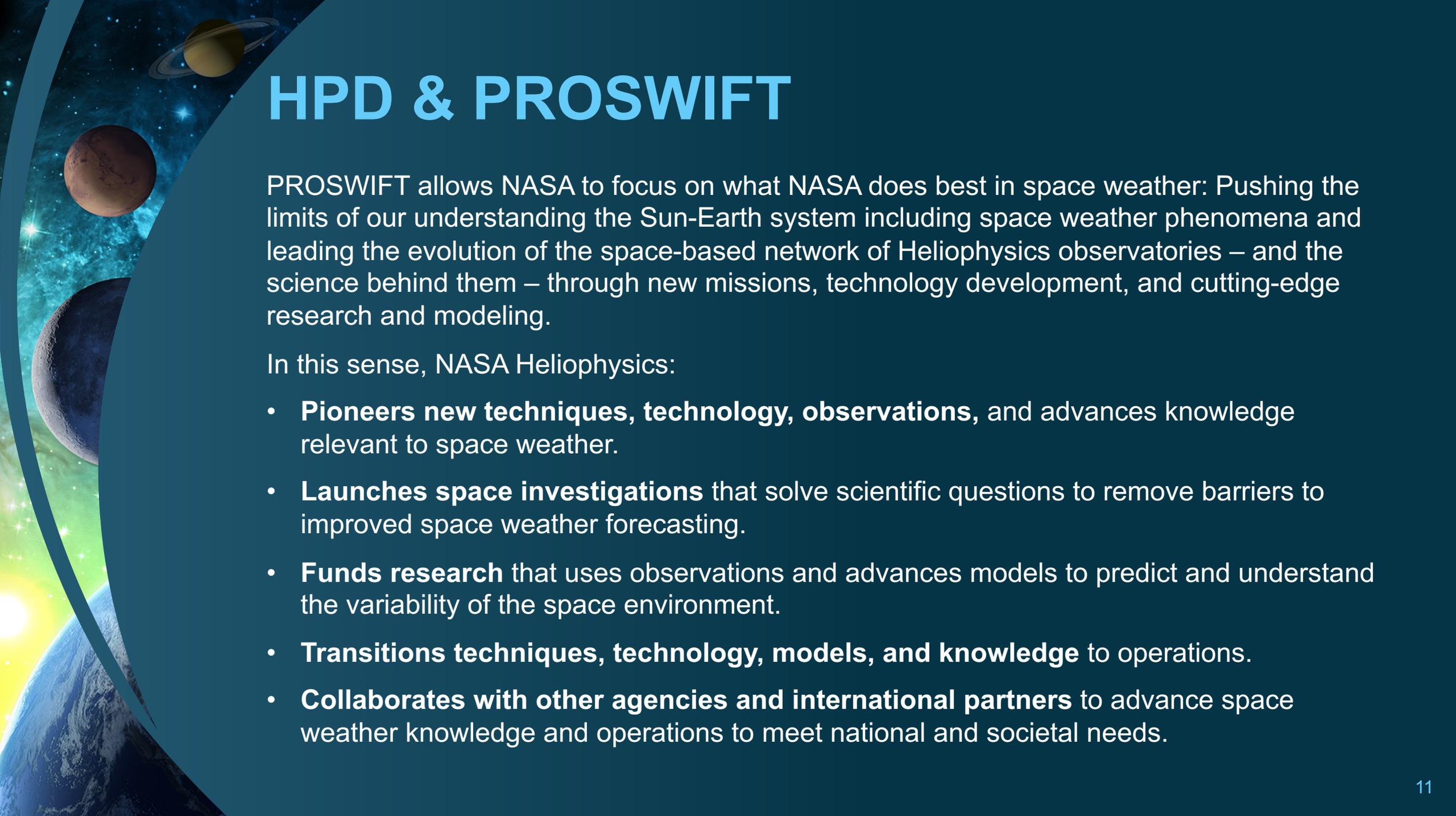


- New Space Weather Program
 - Goals: Advance the science of space weather to empower a technological society safely thriving on Earth and expanding into space.
- Established Space Weather Council; first meeting held March 2022
- HERMES passed KDP C in early 2022 and interdisciplinary scientists selected
- Developed a NOAA and DoD Framework to transition NASA research, techniques and technology relevant to space weather operations
- Supported the Research to Operations to Research (R2O2R) grant solicitation via Transition-Step for efforts that show promise to use in an operational space weather environment at NOAA or DoD
 - Made selections for ROSES-21 (6 selections)
- Space Weather Centers of Excellence solicitation (ROSES-22)
- Four Space Weather CubeSats selected: CubIXXS/SwRI; DYNAGLO/UCBoulder; WindCube/UCAR; SunCET/APL



Looking Ahead

- PROSWIFT: continue with actions already underway to support interagency efforts, space weather observations, research, modeling, operational forecasting, and applications (SOHO, SWFO-L1, R2O2R)
- Develop space weather instrument pipeline for future opportunities
- Engage international partners on future collaborations: Vigil, ENLoTIS (ESA), AOM (CSA), SNIPE (KASI)

The background of the slide is a vibrant space scene. It features a bright yellow sun in the lower-left corner, partially obscured by the blue and white horizon of Earth. Above the Earth, the dark grey, cratered surface of the Moon is visible. Further out, the reddish-brown planet Mars is shown, followed by the yellow planet Saturn with its prominent rings. The background is filled with a field of blue and white stars, creating a sense of depth and cosmic scale.

HPD & PROSWIFT

PROSWIFT allows NASA to focus on what NASA does best in space weather: Pushing the limits of our understanding the Sun-Earth system including space weather phenomena and leading the evolution of the space-based network of Heliophysics observatories – and the science behind them – through new missions, technology development, and cutting-edge research and modeling.

In this sense, NASA Heliophysics:

- **Pioneers new techniques, technology, observations,** and advances knowledge relevant to space weather.
- **Launches space investigations** that solve scientific questions to remove barriers to improved space weather forecasting.
- **Funds research** that uses observations and advances models to predict and understand the variability of the space environment.
- **Transitions techniques, technology, models, and knowledge** to operations.
- **Collaborates with other agencies and international partners** to advance space weather knowledge and operations to meet national and societal needs.

Research and Analysis Update

Overall

- Maintaining healthy R&A Program
- Maintaining DRIVE initiative – Phase 2 selections made March 2022
- Establishing ECIP cadence every 2 years
- Engaging in efforts to increase diversity in research
 - Dual anonymous
- Cross-Divisional programs:
 - E.3 Exoplanets (2 selections in 2021)

Citizen Science

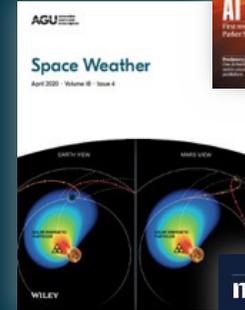
- **Mission:** Build a robust, dynamic, and engaging Heliophysics citizen science portfolio that fuses natural phenomena, mission opportunities, and the power of people's diverse viewpoints to fuel collective innovation
- 4 selections in 2021 from Citizen Science Seed Funding Program, 1 selection in SWO2R
- **Heliophysics “Big Year”**

ROSES-2020

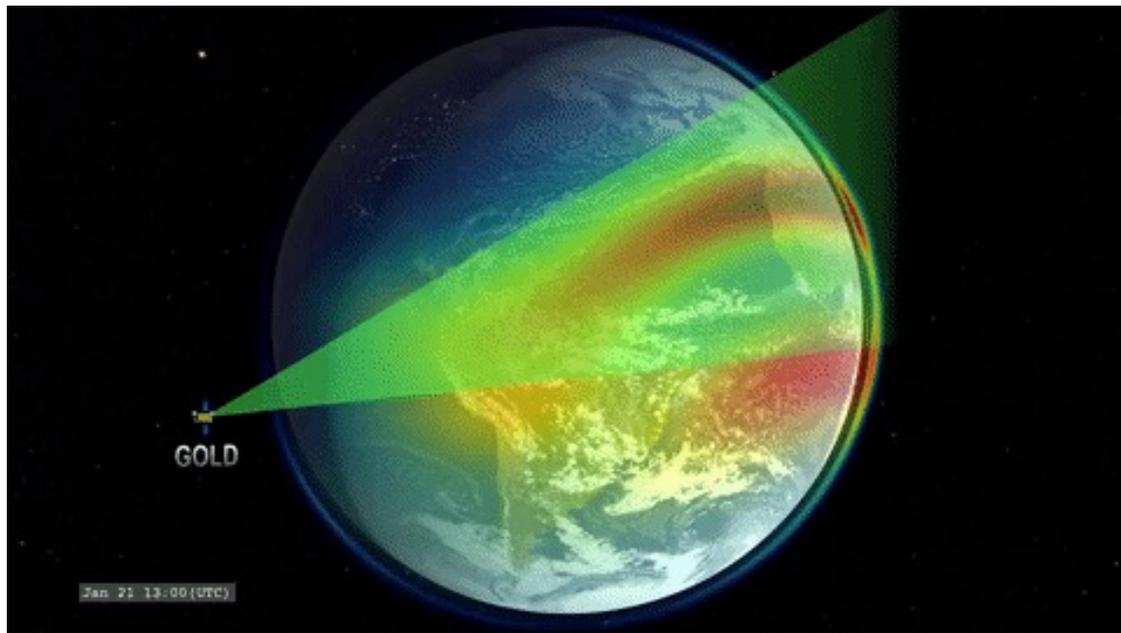
- Received 565 proposals and funded 186 **for a success rate of 33%**
- This is up from 30% in ROSES 2019
- We also had 104 new PIs in the 2020 programs
- ROSES-21 selections ongoing

ROSES-22

- AI/ML – strong emphasis in H-TMS
- New ROSES elements responding to Open Data and Open Source Science initiatives
- Eclipse 2024 element
- Space Weather Centers of Excellence (IDEA emphasis included)

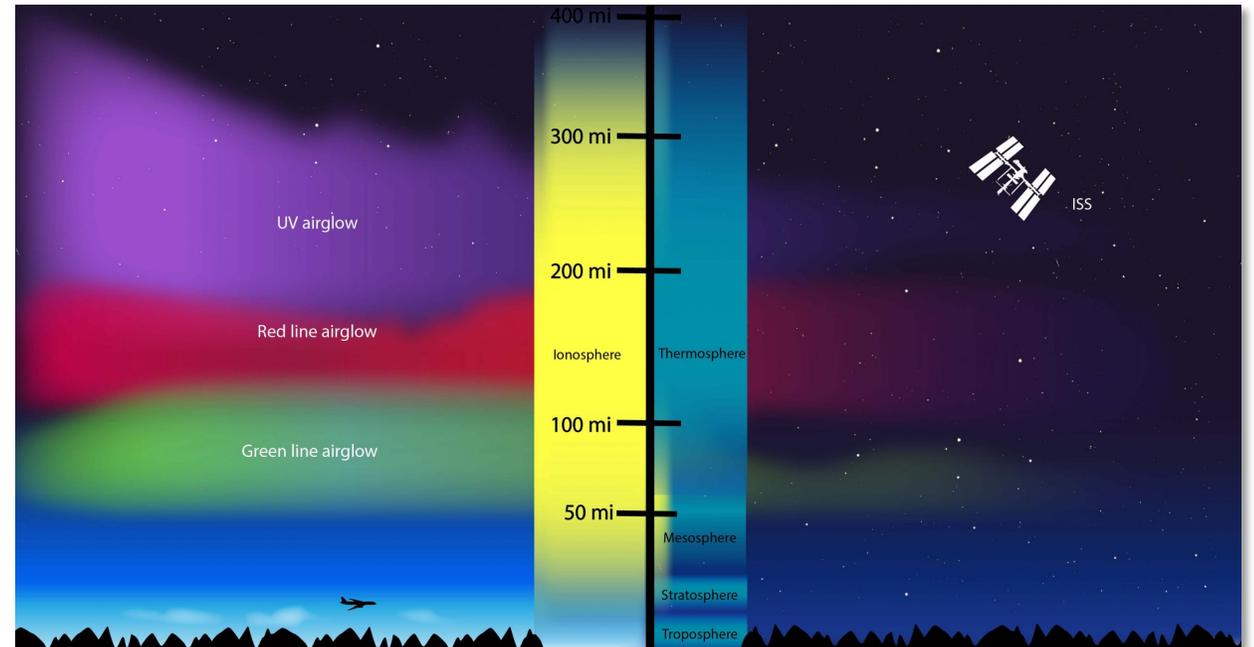


GOLD finds that Space Weather Can Heat Up Earth's Hottest and Highest Atmospheric Layer



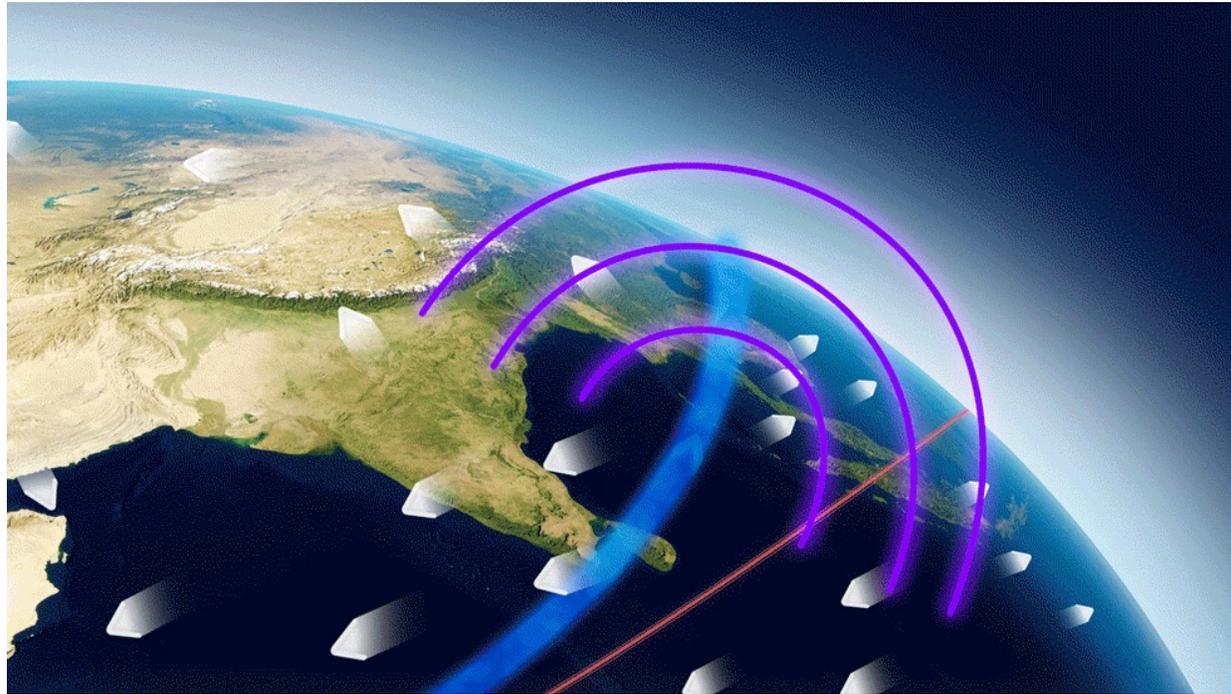
Above: GOLD scans the thermosphere from a position in geostationary orbit, which stays over one particular spot on Earth as it orbits and the planet rotates.

Credit: NASA's Goddard Space Flight Center/Tom Bridgman

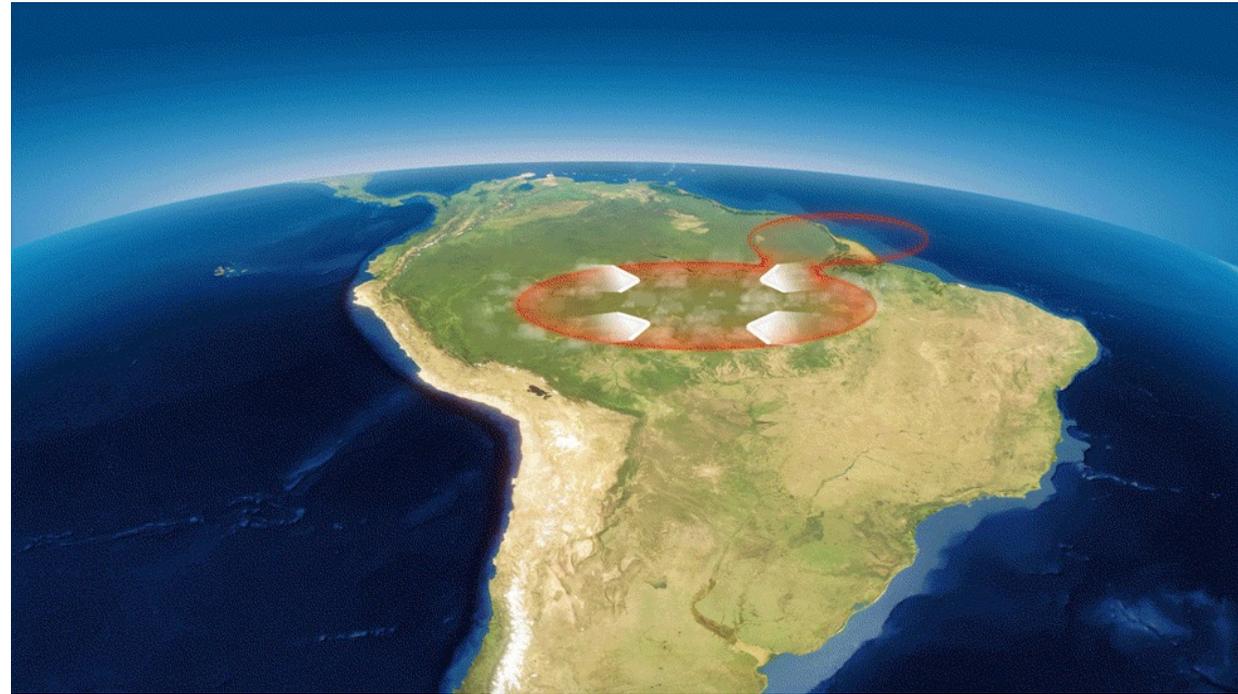


Above: The thermosphere is the highest and hottest atmospheric layer, where the ISS flies and the aurora and airglow can be observed. **Credits:** NASA's Goddard Space Flight Center/Genna Duberstein

ICON Finds Strong Winds Power Electric Fields in the Upper Atmosphere



Above: At 60-95 miles above the ground, winds associated with atmospheric tides (white arrows) move ions and separate them from electrons, forming an electric field (blue line) in the dynamo region. The electric field permeates through the upper atmosphere and pushes plasma (pink) upwards and downwards like a fountain. **Credits:** NASA's Conceptual Animation Lab



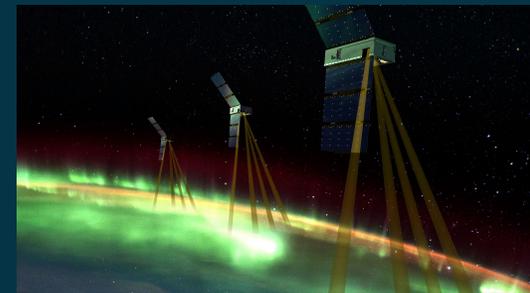
Above: Daily cycles of cloud formation put energy into the atmosphere that, in turn, create a daily cycle of heating and cooling. The heating and cooling pushes wind patterns out and towards regions where clouds are forming. These winds eventually form an atmospheric tide that propagates up through the atmosphere. **Credits:** NASA's Conceptual Animation Lab

Inclusion, Diversity, Equity, and Accessibility (IDEA) in Heliophysics

IDEA initiatives in Helio recognized as a long-term effort, but immediate and mid-term action and problem solving will advance initiatives in parallel with systemic, enduring activity.

Funded Ongoing and Exploratory Efforts

- Selected HPD IDEA Working Group Co-chairs: Kelly Korreck and Denise Hill
- Incentivized newly selected mission teams to expand traditional communications plans to include outreach targeting minority groups to inspire and increase diversity of future Heliophysicists
 - PUNCH and IMAP student collaborations
 - EZIE is planning an extended outreach program that includes middle and high school students with an IDEA emphasis
 - Projects target nontraditional audiences as well as rural & underserved populations with hands-on hardware experiences for a variety of age groups
- Implemented new grant programs to energize the community & enhance diversity and inclusion
 - Heliophysics Innovations for Technology & Science (HITS) program which solicits proposals for innovative & novel ideas to advance Heliophysics research which currently fall outside the traditional grant solicitations
 - Inclusion of language that broaden and incentivize diverse participation on investigation teams and improve accessibility to mission science
- Exploring options for current in-development missions including broadening the impact of Participating Scientists and Interdisciplinary Scientists solicitations
- Early career individuals expressed during roundtables a strong desire that IDEA training should be a critical part of being a PI, student training, and more broadly, for those in positions of power. HPD is exploring this recommendation
- Coordinating with SciAct and OSTEM to expand engagement opportunities
- **DRIVE Science Centers** are currently engaged in initiatives to increase diversity and inclusion all of which will help to develop the future STEM workforce, in addition to impacts in breakthrough science



Heliophysics Big Year



What is the Heliophysics Big Year?

Ties together three major Heliophysics events in 2023-2025 (2 solar eclipses, solar maximum) to maximize participation in a coordinated incentivized citizen science campaign.

- NASA is developing a program to use these remarkable events to highlight and motivate solar system science
 - Two Solar Eclipses cross N. America (14 Oct 2023 and 8 April 2024)
 - The rising phase of the Solar Cycle 25 with Solar Maximum predicted to occur in 2025

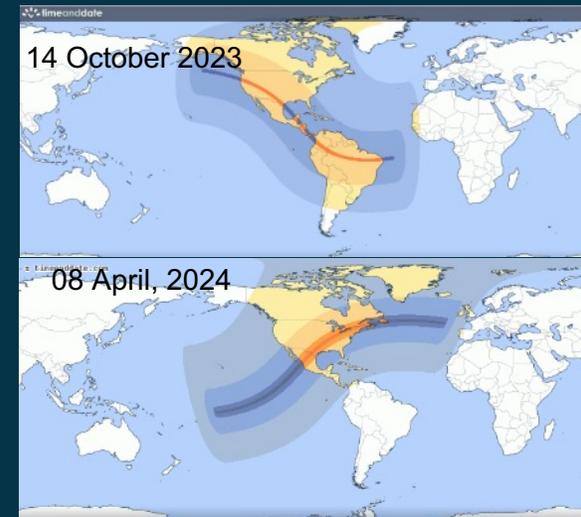
- Look out for opportunities to be part of our Big Year

<https://science.nasa.gov/heliophysics/programs/citizen-science>

Helios Big Year is an opportunity to reach a **generation** for Heliophysics.

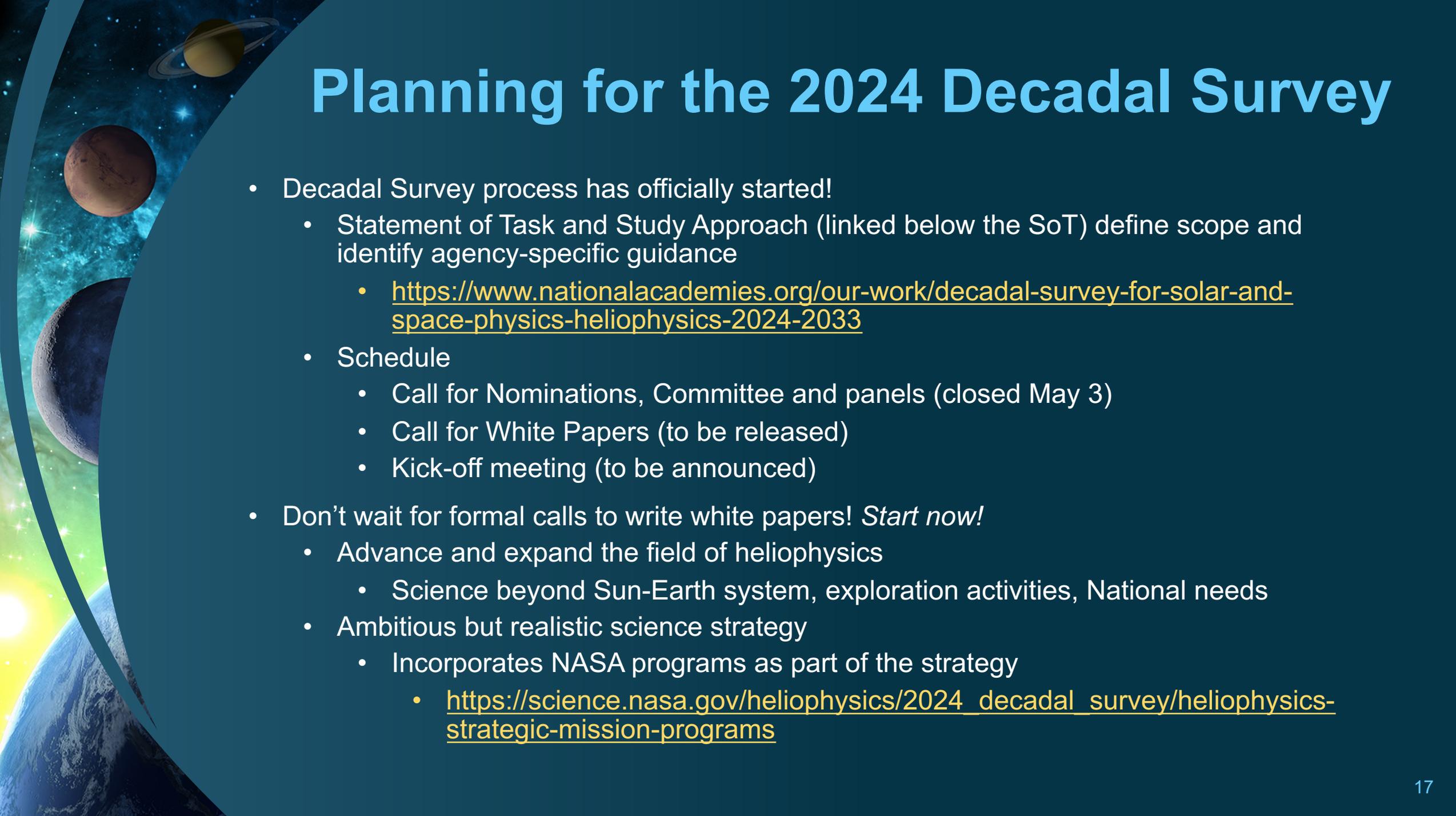


Totality during the solar eclipse in Australia's Tropical North Queensland on November 14, 2012. Getty Images.



The paths of totality for total solar eclipses during the HBLY.

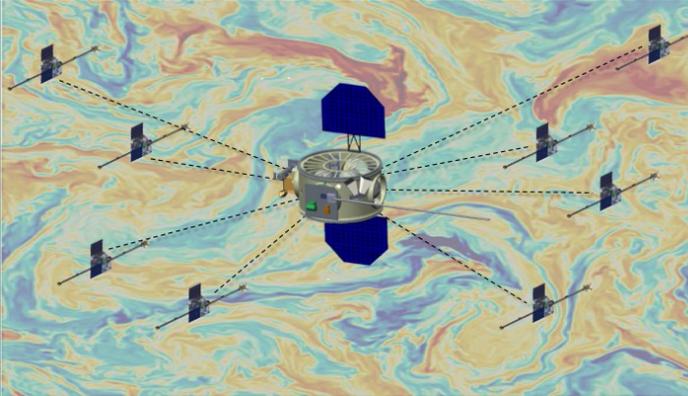
What is a “Big Year”? A big year is a birding term for maximizing a birder’s number of species.



Planning for the 2024 Decadal Survey

- Decadal Survey process has officially started!
 - Statement of Task and Study Approach (linked below the SoT) define scope and identify agency-specific guidance
 - <https://www.nationalacademies.org/our-work/decadal-survey-for-solar-and-space-physics-heliophysics-2024-2033>
 - Schedule
 - Call for Nominations, Committee and panels (closed May 3)
 - Call for White Papers (to be released)
 - Kick-off meeting (to be announced)
- Don't wait for formal calls to write white papers! *Start now!*
 - Advance and expand the field of heliophysics
 - Science beyond Sun-Earth system, exploration activities, National needs
 - Ambitious but realistic science strategy
 - Incorporates NASA programs as part of the strategy
 - https://science.nasa.gov/heliophysics/2024_decadal_survey/heliophysics-strategic-mission-programs

FY23 President's Budget Features



What's Changed

- MIDEX-19 selections in early 2022: MUSE and HelioSwarm
- Creation of new Space Weather Program; includes contribution to HERMES
- Investments in Orbital Debris detection technology
- Support for additional selection of DRIVE Science Center (3 total)
- Adjusted profiles for successfully confirmed missions: IMAP, PUNCH, GLIDE, SunRISE, and HERMES
- Confirmation of ESCAPADE
- Out year reductions potentially delay implementation of Geospace Dynamics Constellation (GDC)
- In order to support higher priority projects within the Heliophysics portfolio, the budget does not include funding for a future DYNAMIC mission or FY23 contributions to the ESA L-5 mission

What's the Same

- Support for 20 operating science missions
- Support for EUVST, EZIE, TRACERS, Solar Cruiser (Phase B) and AWE (Phase C)
- Robust research program, including the DRIVE initiative
- Investments in data facilities and archives, including mission operations services

HPD Staffing Updates

WELCOME!



Bradley Williams
Program Executive



Eric Linderman
Program Executive



Matt McClure
Program Scientist



Ha-Hoa Hamano
Presidential Innovation Fellow

Congratulations to our Staff Award Winners and Honorees!

2021 Agency Honor Award Recipients

- **Willis Jenkins:** Exceptional Service Medal
- **Dan Moses:** Exceptional Service Medal
- **Darcia Brown:** Exceptional Administrative Achievement Medal
- **Jackie Mackall:** Exceptional Administrative Achievement Medal
- **Aly Mendoza-Hill:** Exceptional Achievement Medal
- **Alan Zide:** Exceptional Achievement Medal
- **Heather Futrell:** Early Career Achievement Medal

2021 Headquarters Honor Award Recipients

- **Jamie Favors:** Excellence in Achievement Award
- **Jared Leisner:** Excellence in Achievement Award

2021 American Geophysical Union Ambassador Award

- **Madhulika Guhathakurta**

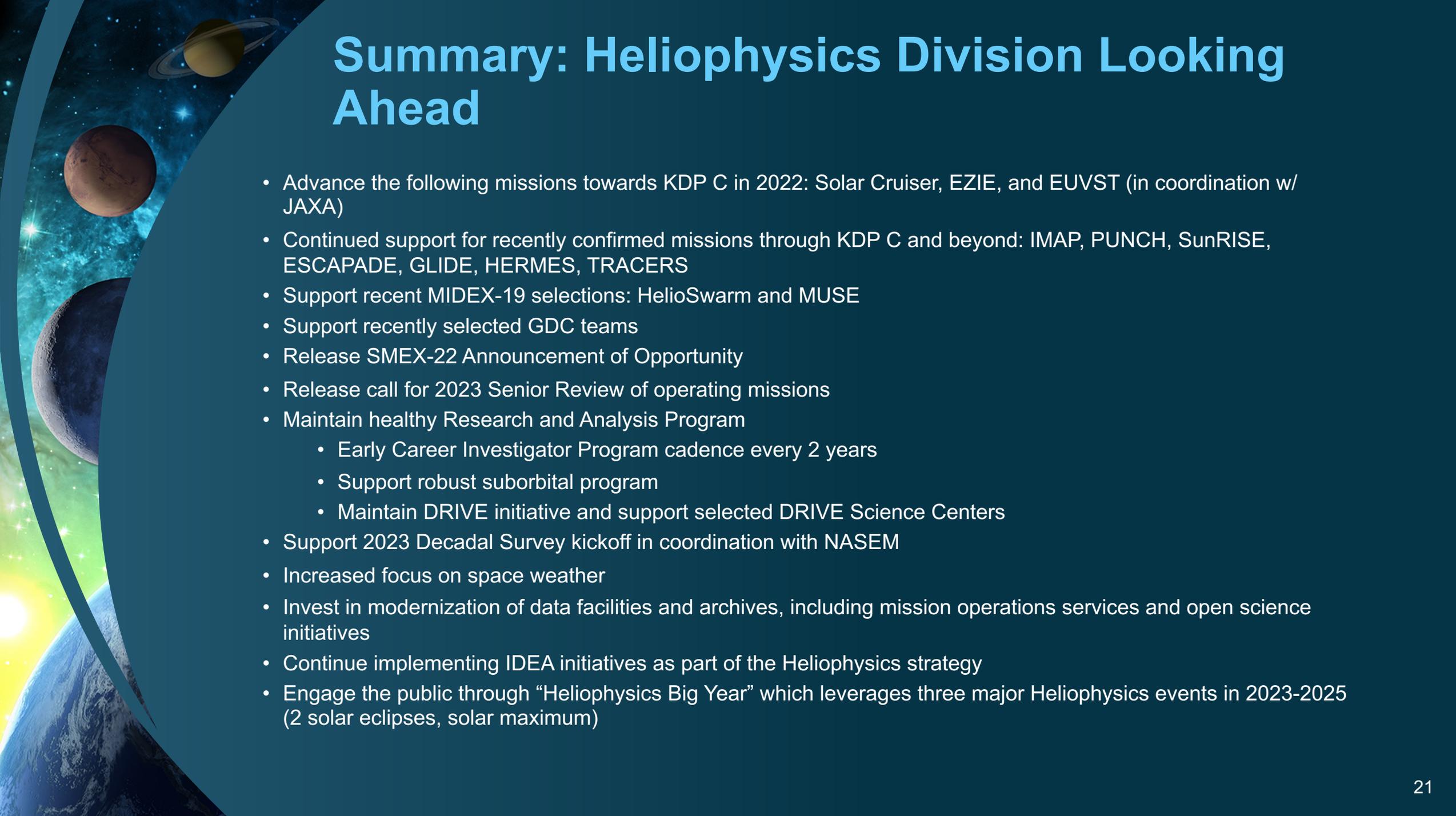
2021 American Geophysical Union Honoree

- **Elizabeth (Liz) MacDonald**

2021 Carl Sagan Memorial Award (Planetary Society)

- **Nicky Fox**



A vibrant space-themed background featuring a curved blue arc on the left side. The background is filled with a starry field, a bright yellow sun in the bottom left, and several celestial bodies: Saturn with its rings at the top, Mars in the middle, and the Earth's horizon at the bottom. The title 'Summary: Heliophysics Division Looking Ahead' is written in a large, bold, light blue font at the top center.

Summary: Heliophysics Division Looking Ahead

- Advance the following missions towards KDP C in 2022: Solar Cruiser, EZIE, and EUVST (in coordination w/ JAXA)
- Continued support for recently confirmed missions through KDP C and beyond: IMAP, PUNCH, SunRISE, ESCAPEDE, GLIDE, HERMES, TRACERS
- Support recent MIDEX-19 selections: HelioSwarm and MUSE
- Support recently selected GDC teams
- Release SMEX-22 Announcement of Opportunity
- Release call for 2023 Senior Review of operating missions
- Maintain healthy Research and Analysis Program
 - Early Career Investigator Program cadence every 2 years
 - Support robust suborbital program
 - Maintain DRIVE initiative and support selected DRIVE Science Centers
- Support 2023 Decadal Survey kickoff in coordination with NASEM
- Increased focus on space weather
- Invest in modernization of data facilities and archives, including mission operations services and open science initiatives
- Continue implementing IDEA initiatives as part of the Heliophysics strategy
- Engage the public through “Heliophysics Big Year” which leverages three major Heliophysics events in 2023-2025 (2 solar eclipses, solar maximum)

Get Involved and Stay Informed!

We are continuing to work hard to grow the Heliophysics community, especially at a time where we find ourselves so separated. Stay in touch and help us find new ways to highlight your work and keep you in the loop!

Check out our “Nicky Notes” email!

- Sign up for it at <https://bit.ly/2R1w8HT>

Stay up to date with what’s happening at Headquarters:

- <https://science.nasa.gov/researchers/virtual-townhall-2020>

Let us know what you’ve been working on:

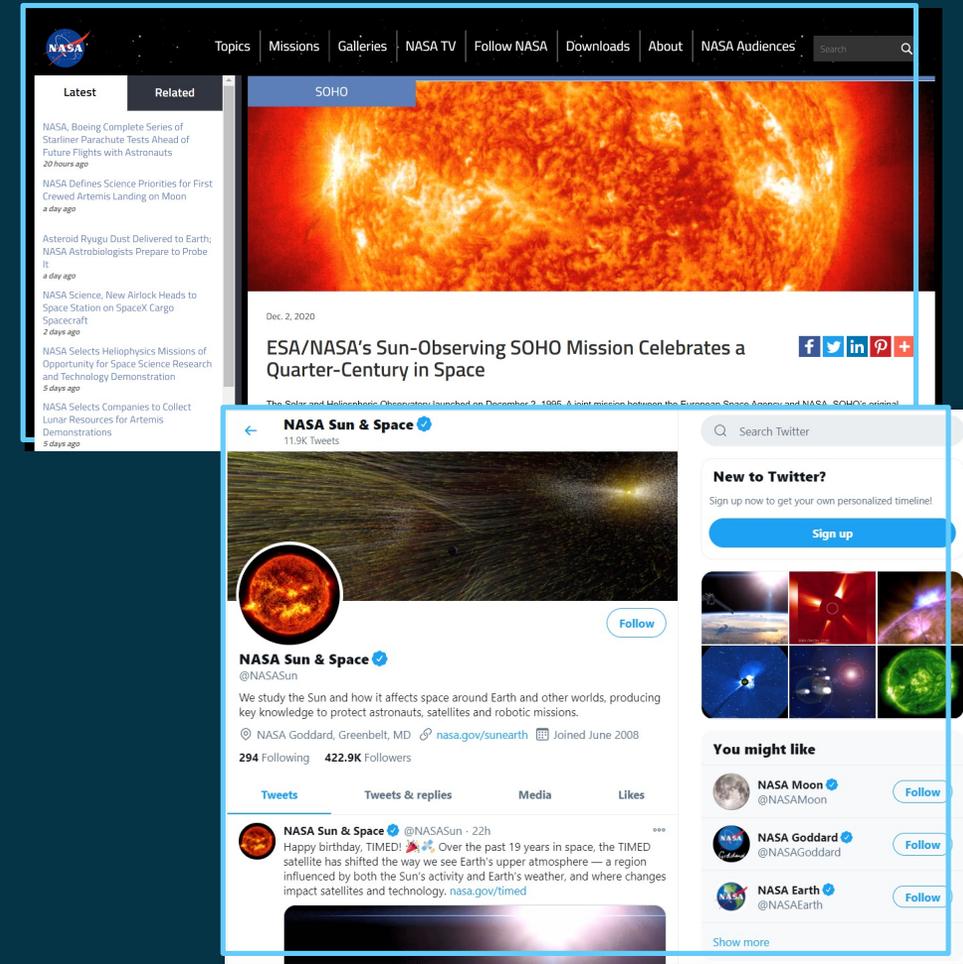
- <https://bit.ly/SubmitHelioScience>

Web and social media:

- NASA.gov/sunearth
- blogs.nasa.gov/sunspot
- [@NASASun](https://twitter.com/NASASun)
- facebook.com/NASASunScience

Volunteer for a panel:

- <https://science.nasa.gov/researchers/volunteer-review-panels>







#HelioRocks!