



CEDAR 2023 NASA Agency Update

John McCormack

Program Scientist, Heliophysics Division, NASA

Congratulations to Dr. Nicola Fox on her appointment to Associate Administrator for the Science Mission Directorate!



Thank you for your service to the Heliophysics Community!
New HPD Director search open until June 30

NASA Heliophysics Division Leadership



Nicole (Nicki) Rayl, Associate Director for Flight



Peg Luce, Acting Division Director



Therese Moretto-Jorgensen
Acting Deputy Division Director

HPD STAFFING UPDATES

Welcome and Congratulations!



Gene Fisher



Kelly Korreck



Janet Kozyra



Reiner Friedel



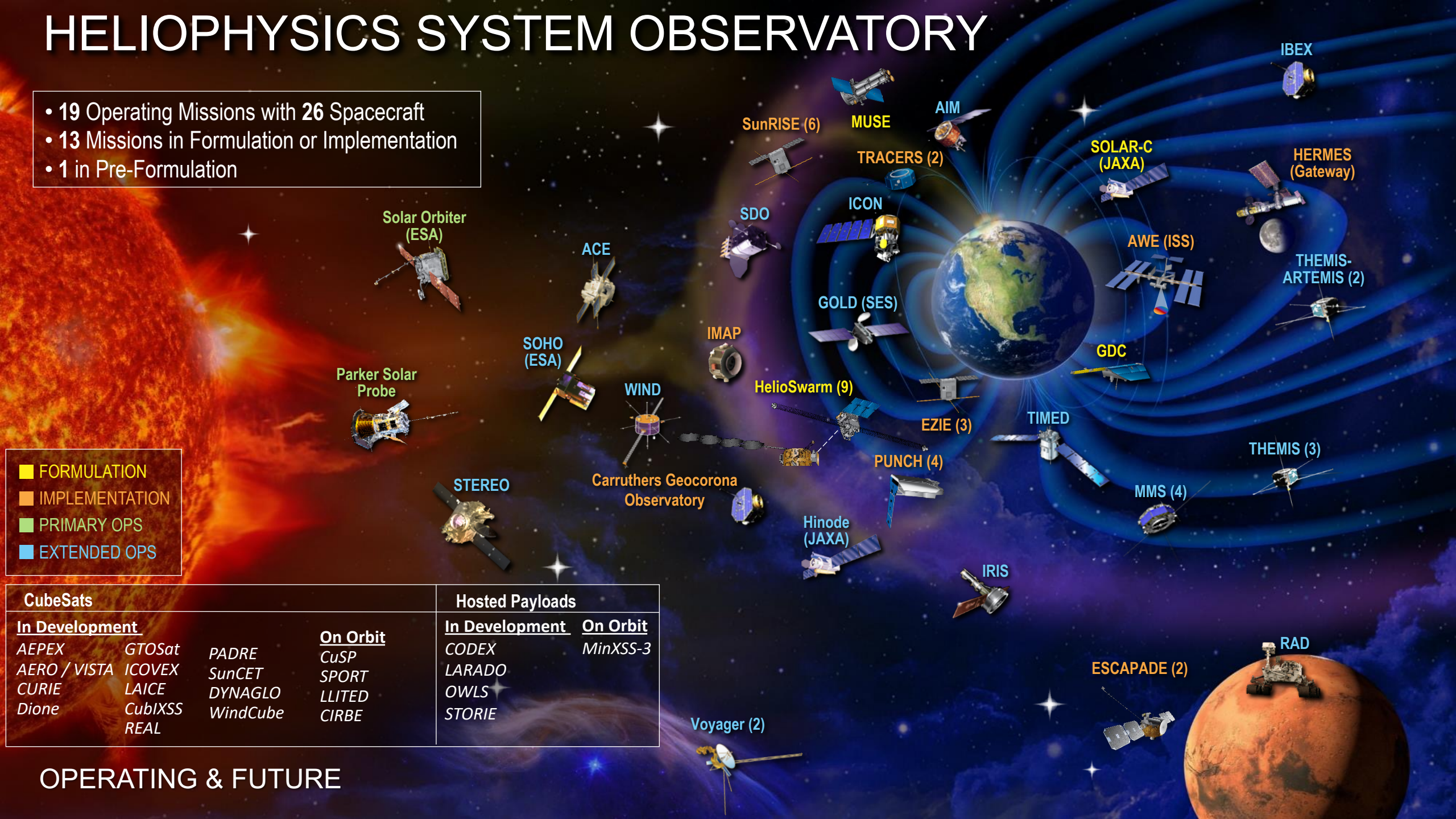
Elizabeth Esther

Hiring for new Program Scientists is underway!

HELIOPHYSICS
BIG YEAR

HELIOPHYSICS SYSTEM OBSERVATORY

- 19 Operating Missions with 26 Spacecraft
- 13 Missions in Formulation or Implementation
- 1 in Pre-Formulation



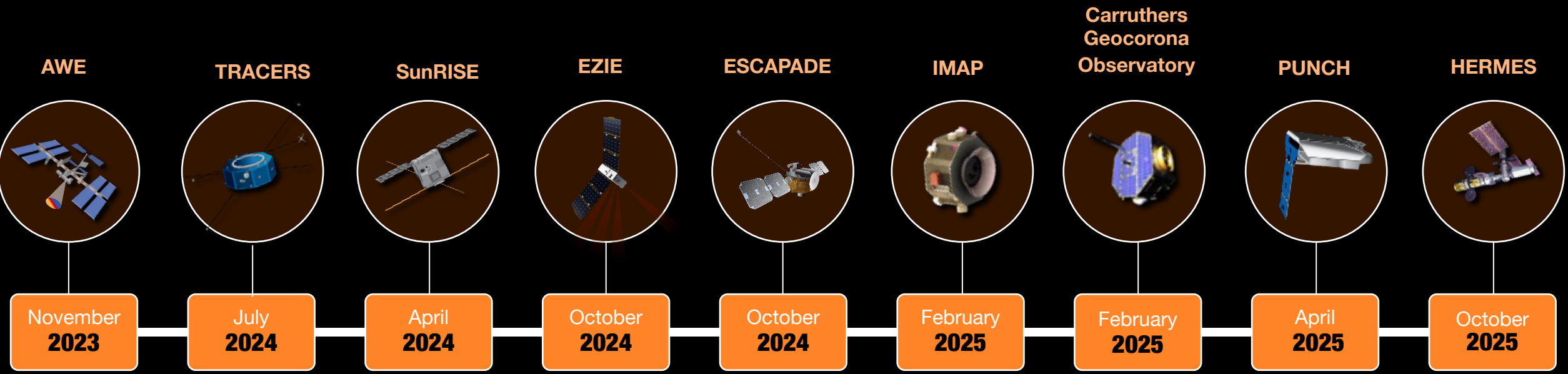
■ FORMULATION
■ IMPLEMENTATION
■ PRIMARY OPS
■ EXTENDED OPS

CubeSats			Hosted Payloads	
In Development			In Development	On Orbit
AEPEX	GTOSat	PADRE	CODEX	MinXSS-3
AERO / VISTA	ICOVEX	SunCET	LARADO	
CURIE	LAICE	DYNAGLO	OWLS	
Dione	CubIXSS	WindCube	STORIE	
	REAL			
On Orbit				
		CuSP		
		SPORT		
		LLITED		
		CIRBE		

OPERATING & FUTURE

HELIOPHYSICS
BIG YEAR

HELIO MISSION FLEET TIMELINE



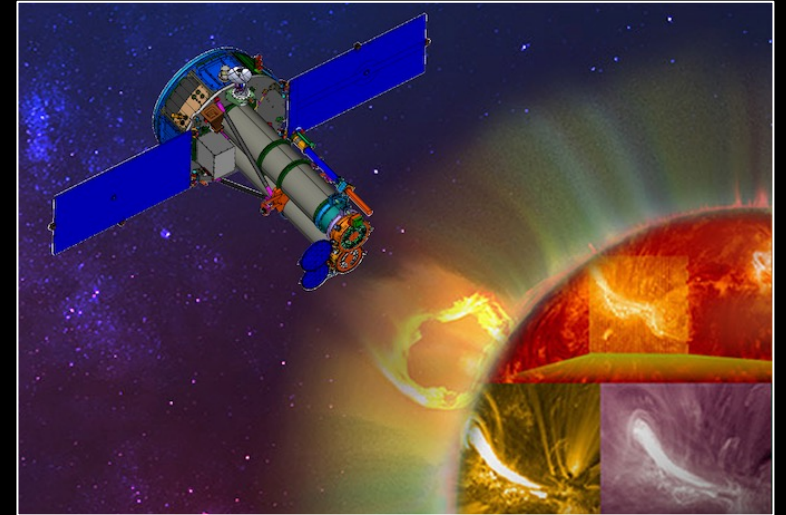
Division Updates

What's Changed

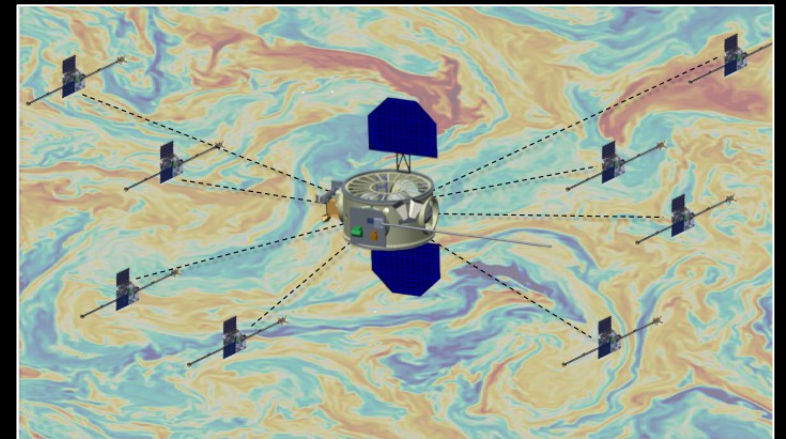
- New Explorers MIDEX selections MUSE and HelioSwarm in development
- Non-confirmation of Solar Cruiser due to schedule and budget concerns
- NASA AO released for instrument selection (EUV imager) to be hosted on ESA's Vigil mission to L5. Preproposal Conference on 13 July, Notice of Intent (mandatory) due by 9 August, and proposals due by 27 September
- The Heliophysics Strategic Technology Office (HESTO) first annual symposium is being held October 18-19
- GDC and DYNAMIC status
 - GDC pause proposed by FY24 President's Budget Request
 - DYNAMIC AO released May 19, proposals due August 22
- Senior Review conducted in April, report release this summer

What's the Same

- Explorers solicitations in 2022 (SMEX) and 2025 (MIDEX)
- Orbital Debris and Space Situational Awareness research to address gaps in orbital object detection and in our scientific understanding of their interactions with the environment
- Space Weather program includes HERMES instruments for Gateway, space weather research and applications and partnership on ESA Vigil mission
- Robust research program
- Continued support of 13 missions in development and 19 operating missions



The Multi-slit Solar Explorer (MUSE) mission science will reveal the physical processes of the solar corona and the eruptions at the foundation of space weather



HelioSwarm features a hub spacecraft and eight smaller ones that will work together to measure solar wind turbulence

ITM-Focused Missions

Recent Updates

- **TIMED (Thermosphere-Ionosphere-Mesosphere Energetics & Dynamics)**
 - Over two decades in orbit! Operations nominal.
- **GOLD (Global-scale Observations of the Limb and Disk)**
 - Extended prime mission, nominal observations Ch. A & B.
- **ICON (Ionospheric Connections Explorer)**
 - Loss of contact with spacecraft on 11/25/2023
 - Anomaly review board (ARB) in progress
- **AIM (Aeronomy of Ice in the Mesosphere)**
 - Loss of battery power on 3/10/2023, instruments are currently powered off, vehicle is in safhold mode

Together these missions enabled ground-breaking investigations of coupling between lower and upper atmosphere, most recently related to Hunga-Tonga eruption.

See Hunga-Tonga session (Pavel Inchin) TUES 1330



Article

Surface-to-space atmospheric waves from Hunga Tonga–Hunga Ha’apai eruption

<https://doi.org/10.1038/s41586-022-05012-5>
Received: 28 February 2022
Accepted: 22 June 2022

Corwin J. Wright¹, Neil P. Hindley¹, M. Joan Alexander², Mathew Barlow³, Lars Hoffmann⁴, Cathryn N. Mitchell¹, Fred Prata^{4,5}, Marie Bouillon¹, Justin Carstens⁶, Cathy Clerbaux⁷, Scott M. Osprey⁸, Nick Powell⁹, Cora E. Randall¹⁰ & Jia Yue¹¹

Significant Ionospheric Hole and Equatorial Plasma Bubbles After the 2022 Tonga Volcano Eruption

Ercha Aa¹, Shun-Rong Zhang¹, Philip J. Erickson¹, Juha Vierinen², Anthea J. Coster¹, Larisa P. Goncharenko¹, Andres Spicher², and William Rideout¹

¹Haystack Observatory, Massachusetts Institute of Technology, Westford, MA, USA, ²Department of Physics and Technology, The Arctic University of Norway, Tromsø, Norway

Tongan Volcanic Eruption Induced Global-Scale Thermospheric Changes Observed by the GOLD Mission

S. Aryal¹, Q. Gan¹, J. S. Evans², F. I. Laskar¹, D. K. Karan¹, X. Cai¹, K. R. Greer¹, W. Wang³, W. E. McClintock¹, and R. W. Eastes¹

¹Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA, ²Computational Physics, Inc., Springfield, VA, USA, ³High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO, USA

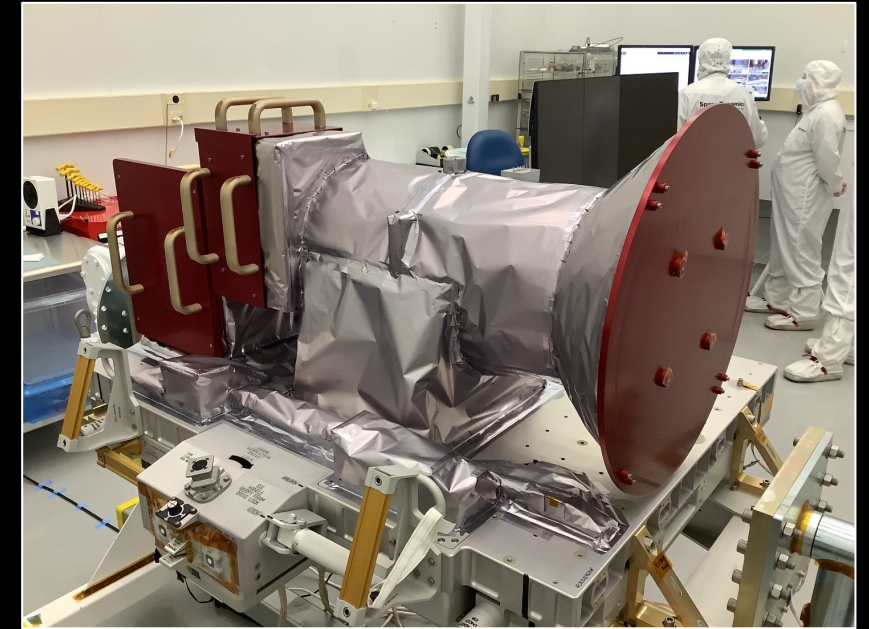
Atmospheric Waves Experiment (AWE)

- First dedicated NASA mission designed specifically to characterize the properties of global mesospheric gravity waves (GWs).
- Planned to launch in December 2023, will deploy nadir-viewing Advanced Mesospheric Temperature Mapper (AMTM) on International Space Station ELC1 in low Earth orbit.
- AWE will measure nighttime OH infrared emissions to quantify GW momentum flux transported into the upper atmosphere.

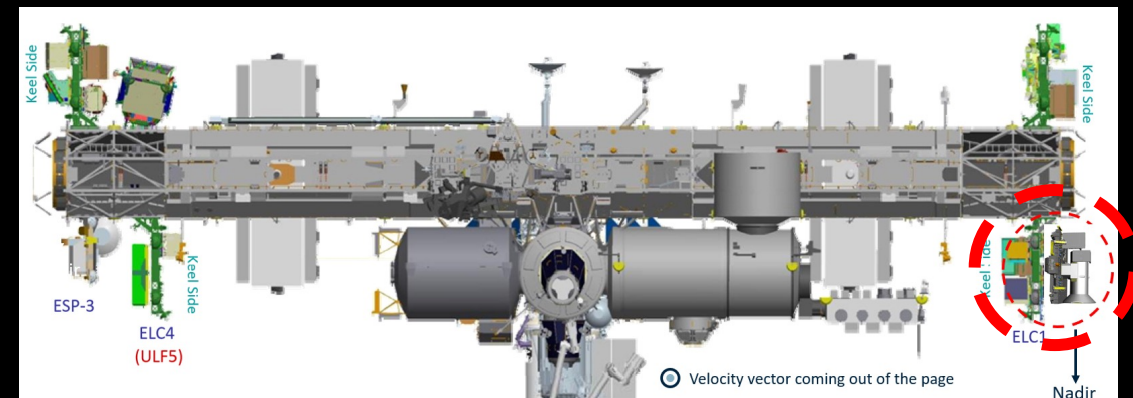
Recent Updates

- Successfully completed its critical space environment tests. AWE Launch to ISS in Dec. 2023.
 - <https://blogs.nasa.gov/awe/>
 - <https://science.nasa.gov/missions/awe>

AWE PI Mike Taylor's Distinguished Lecture THURS 8am



AWE AMTM instrument is built and ready for storage until delivery to KSC for launch. Credit: Utah State University and Space Dynamics Lab (SDL)



Credit: Utah State University and Space Dynamics Lab (SDL)

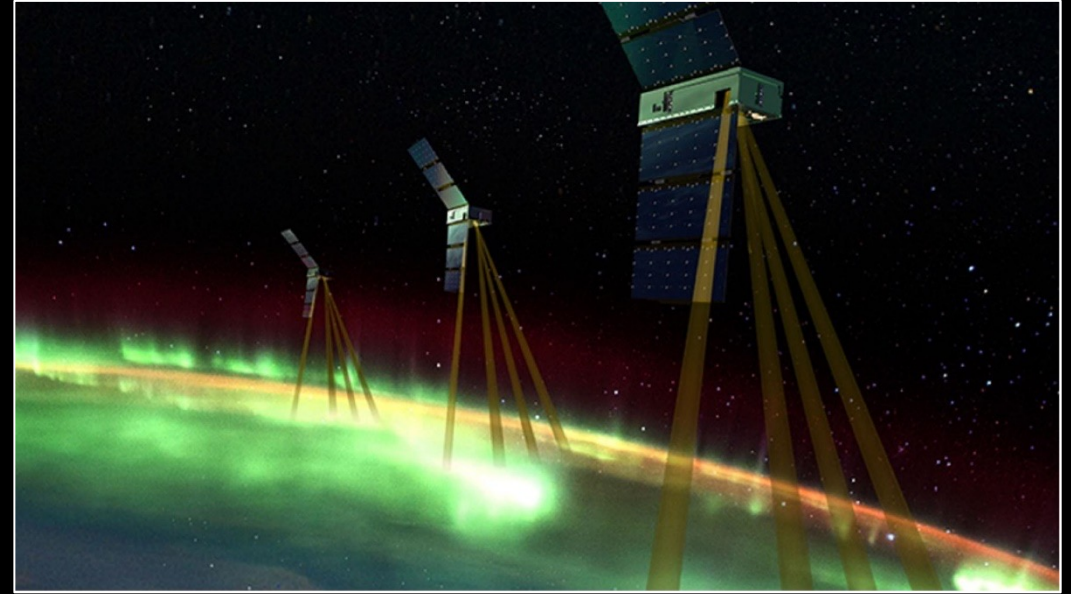
Electrojet Zeeman Imaging Explorer (EZIE)

- Three 6U CubeSats will study the auroral electrojets flowing at 100-130 km above the poles, linking Earth's magnetosphere and ionosphere to solar activity and space weather.
- EZIE will employ a Zeeman splitting of 118 GHz O₂ emissions to answer decades-long debate on how the auroral electrojet behaves during geomagnetic storms.
- Launch NET Q4 FY24.

Recent Updates

- EZIE recently completed its Critical Design Review.
- EZIE-Mag Education & Outreach Program is developing hands-on magnetometer kits for middle & high school students
- More EZIE info at <https://science.nasa.gov/missions/ezie>

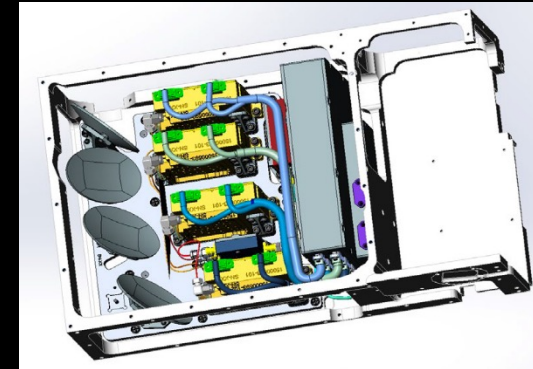
EZIE Plenary Session led by PI Sam Yee WED 0900



Credit: APL/NASA



Credit: Blue Canyon Technologies



Mockup of Microwave Electrojet Magnetogram Instrument (MEM)
Credit: Jet Propulsion Laboratory

Geospace Dynamics Constellation (GDC) and Dynamical Neutral Atmosphere-Ionosphere Coupling (DYNAMIC)

GDC and DYNAMIC provide a whole-system study of upper atmospheric dynamics by combining their scientific and technical capabilities

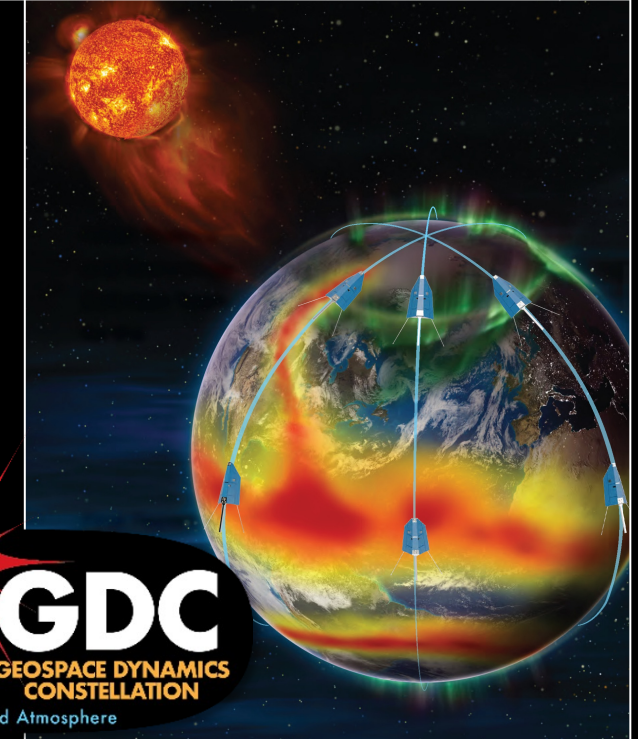
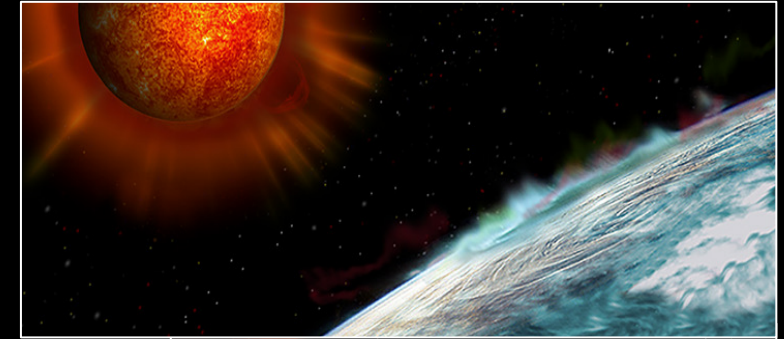
- In science...
 - GDC: Understand the upper atmosphere's internal processes and dynamics, and response to energy inputs from Earth's space environment (*energy from above*)
 - DYNAMIC: Understand the effect of lower atmosphere variability on the processes and dynamics of the upper atmosphere (*energy from below*)
- In architecture...
 - GDC: Provides in situ measurements above 300 km
 - DYNAMIC: Provides remote sensing of vertical profiles below 300 km altitude, leverages GDC measurements

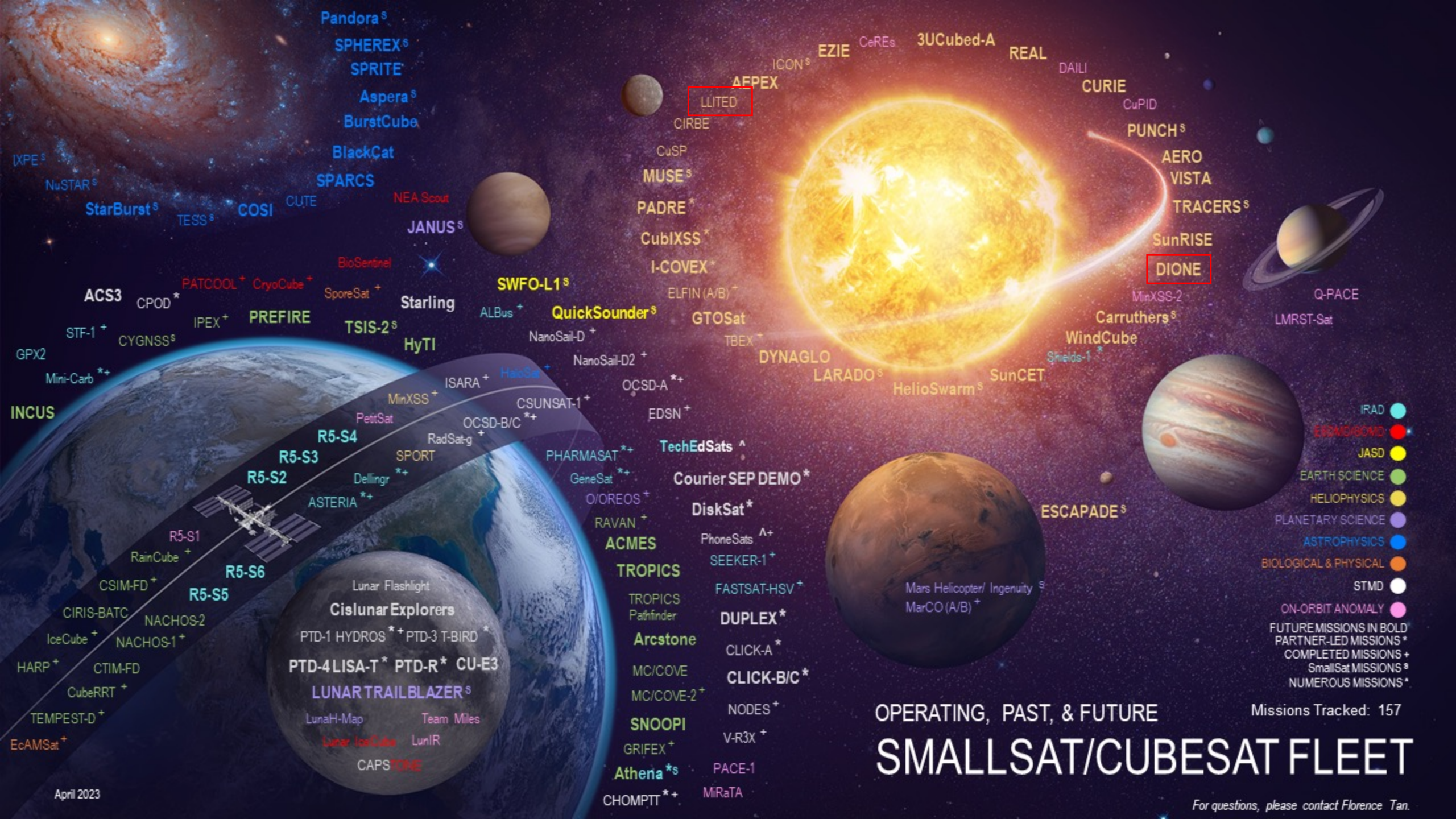
DYNAMIC AO

- AO released May 19
- Pre-proposal Conference was held June 6

GDC Instruments & Science (Katelyn Greer) TUES 1000

GDC & DYNAMIC Science (Doug Rowland) THURS 1600





LLITED

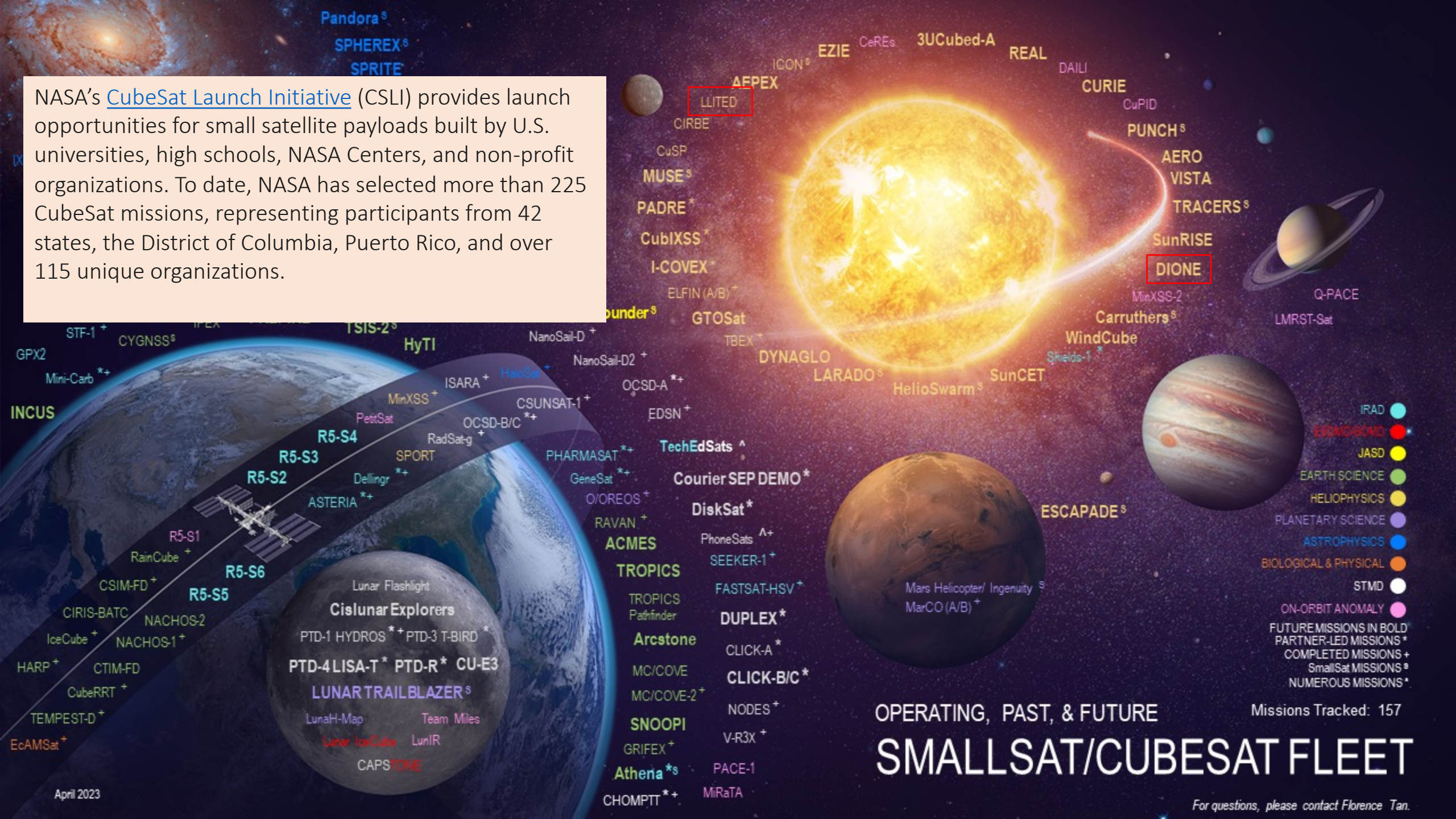
DIONE

- IRAD
- ESMO/ESMO2
- JASD
- EARTH SCIENCE
- HELIOPHYSICS
- PLANETARY SCIENCE
- ASTROPHYSICS
- BIOLOGICAL & PHYSICAL
- STMD
- ON-ORBIT ANOMALY
- FUTURE MISSIONS IN BOLD
- PARTNER-LED MISSIONS *
- COMPLETED MISSIONS +
- SmallSat MISSIONS §
- NUMEROUS MISSIONS *

OPERATING, PAST, & FUTURE
SMALLSAT/CUBESAT FLEET

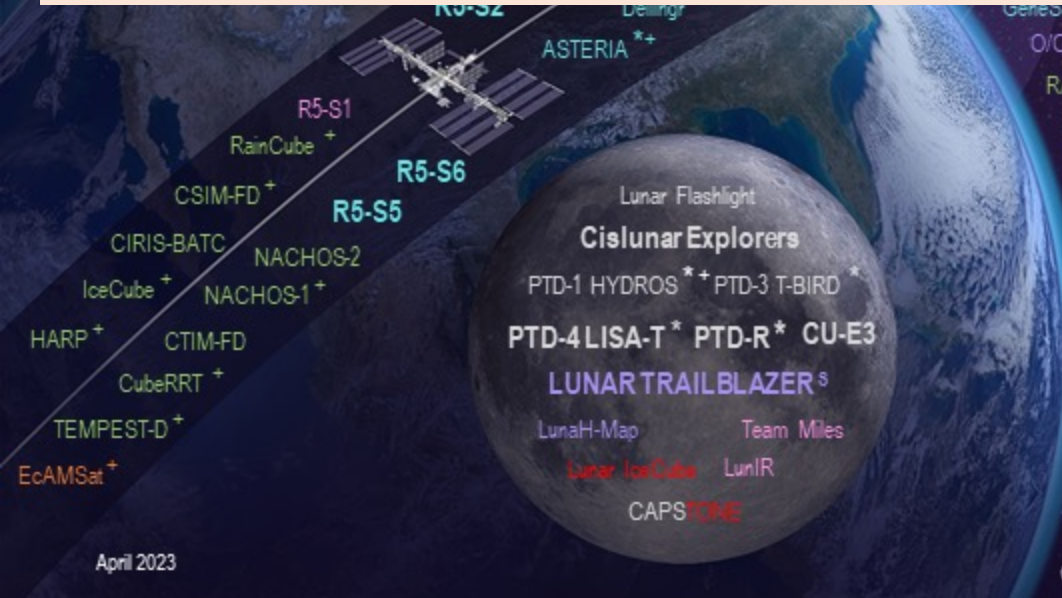
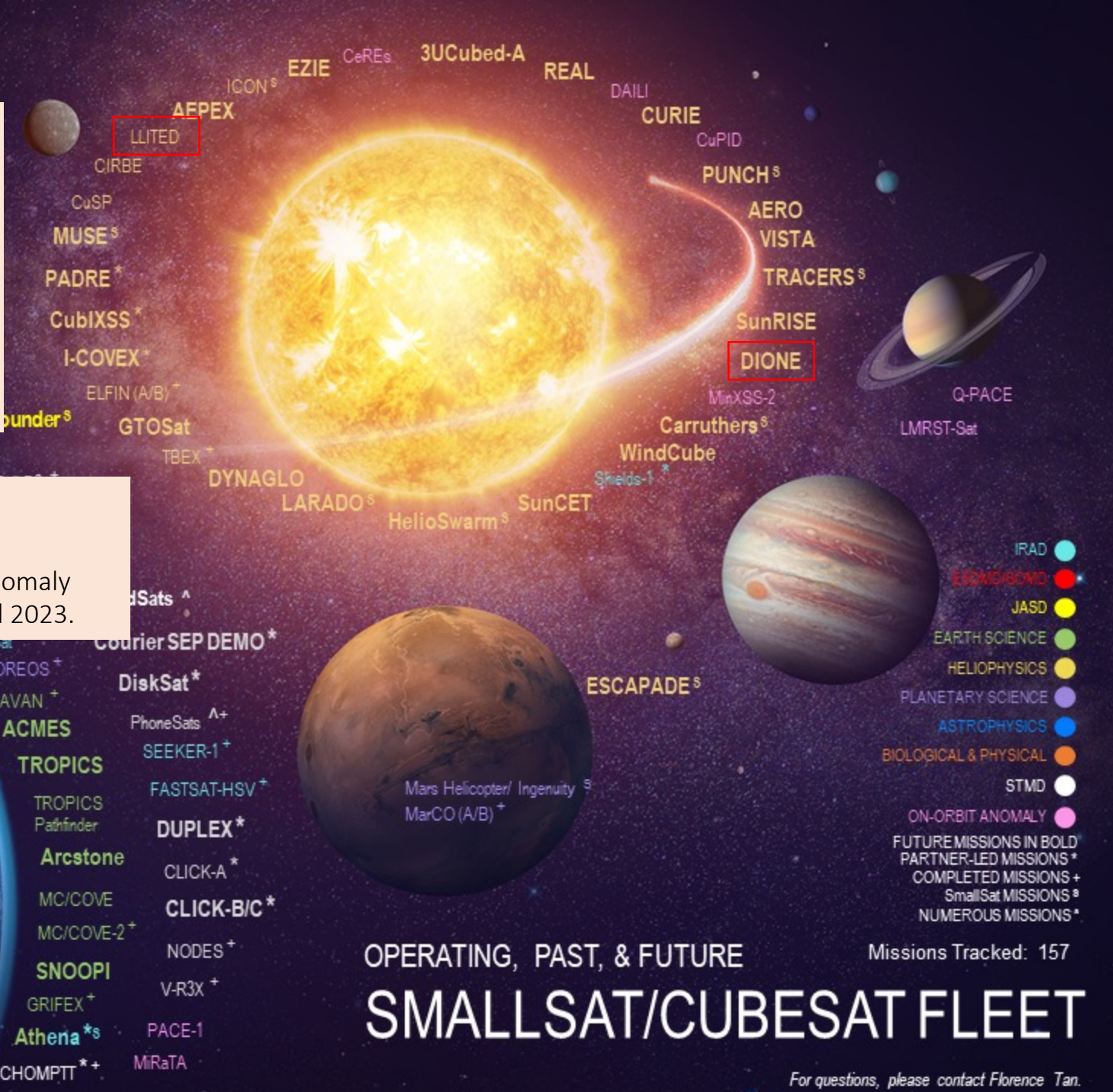
Missions Tracked: 157

NASA's [CubeSat Launch Initiative](#) (CSLI) provides launch opportunities for small satellite payloads built by U.S. universities, high schools, NASA Centers, and non-profit organizations. To date, NASA has selected more than 225 CubeSat missions, representing participants from 42 states, the District of Columbia, Puerto Rico, and over 115 unique organizations.



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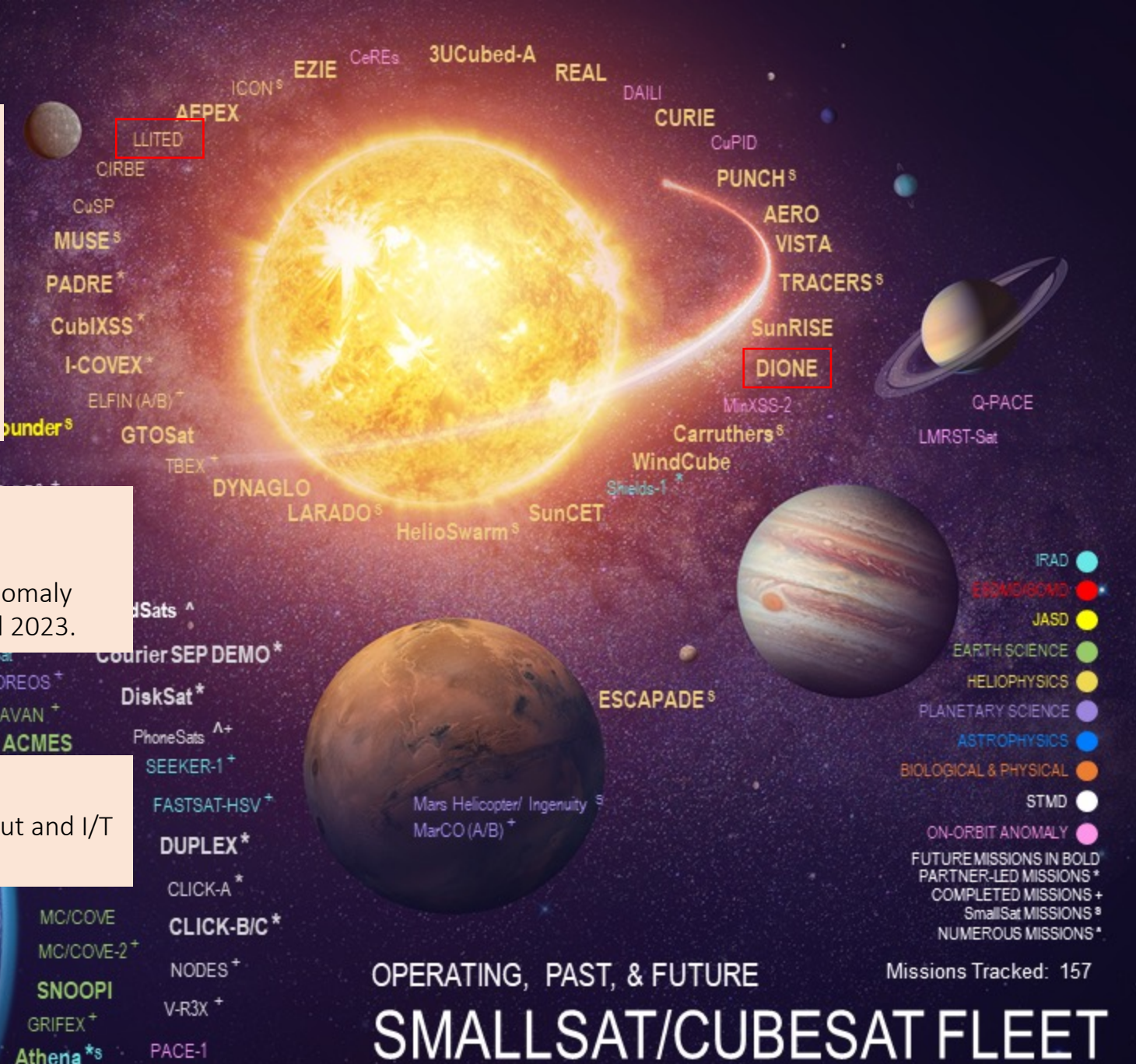
LLITED
 Low-Latitude Ionosphere/Thermosphere Enhancements in Density
 2 1.5U CubeSats will study the equatorial temperature and wind anomaly (ETWA) and the equatorial ionization anomaly (EIA). Launched April 2023.



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DIONE
 6U CubeSat will provide simultaneous measurements of energy input and I/T responses for the first time since the DE2 mission.



Space Weather Program

Space Weather Research to Operations / Operations to Research (R2O2R)

- ROSES-23 focused topics:
 - Data Assimilation for Neutral Density Forecasting
 - Open Call

Space Weather Grand Challenge

- Identify the next low-latency data stream to advance space weather forecasting

HERMES & Gateway

- HERMES: space weather instrument suite led by HPD will observe solar particles and the solar wind.
 - LRD for the first Gateway launch (incl. HERMES) is October 2025.
 - HPD working with the Gateway Program on future opportunities for competitive science payloads.

Space Weather Pipeline

- Constructing four instruments, SPAN-E, SST, ECP-Lite, Faraday Cup for future flight opportunities
- RFI for commercial platforms that can host instruments was released in April.

Vigil

- Vigil AO will be released soon with updates based on feedback from Draft AO



This photo was taken from the ISS on February 28th and shows the sweeping scale of the aurora during a geomagnetic storm **Credits: NASA/Josh Cassada**

Strong and Growing Inter-Agency Partnerships

- *NOAA, NASA and NSF work jointly to observe and understand space weather and how it impacts the solar system, Earth, and humanity.*
- **Collaborative Efforts**
 - Annual coordination on the ROSES Space Weather solicitations
 - The ROSES solicitation topics are decided by NASA with input from NOAA and NSF.
 - Space Weather with Quantified Uncertainties: NSF runs solicitations for which NASA provides input and funding, including currently funding two proposals as well as co-funding one other.
 - Quick Wins Efforts with NOAA:
 - GONG Magnetic Flux Maps: Applying the image analysis from the Solar Dynamics Observatory (SDO) to the Global Oscillation Network Group (GONG) solar observing network to enable far-side imaging of solar magnetic flux
 - WSA Model Improvements: Upgrade the WSA-Optimized model with new solar wind plasma data
 - NASA is a voting member in the interagency Space Weather Operations, Research, Mitigation (SWORM)–Working Group established under the National Science and Technology Council.
 - Collaboration with NOAA, NSF & DAF via the Space Weather Framework and under the soon-to-be-signed Quad Agency MOA
 - The Quad MOA is intended to provide a structure through which NASA, NSF, NOAA, and DAF can coordinate R2O2R activities.
 - Space Weather Tabletop Exercise: inter-agency exercise to ensure the nation's resilience to an extreme space weather storm by walking through the day-in-the-life of a space weather event



Research and Analysis (R&A) Update

- Heliophysics R&A Programs have grown significantly since DRIVE Initiative was recommended by 2013 Decadal Survey
 - ROSES-2022 selection rates are healthy (avg 30% across all programs)
 - Space Weather Centers of Excellence selections are imminent
 - Eclipse 2024 element in ROSES 2022: **5 interdisciplinary projects selected**
 - Three DRIVE Science Centers selected in 2022 have kicked off Phase 2 activities
 - ROSES-2023 solicitation provides the greatest scope ever offered for NASA Heliophysics
 - New Technology Program and Space Weather Program
 - Growing number of Cross-Divisional programs
 - New opportunities with AI/ML aspects (MDRAIT and H-ARD)
- *Living With A Star Program Analysis Group is seeking input for Focused Science Topics (presentation by McCoy & Verkhoglyadova later this session)*

2023 R&A Program Elements

- HSR: Supporting Research (Dual Anonymous Format)
- HGIO: Guest Investigator (Dual Anonymous Format)
- Living With a Star (LWS) Science
- Space Weather R2O2R (+Transition)
- HTIDS: Technology and Instrument Development for Science
- HLCAS: Low Cost Access to Space
- HFOS: Flight Opportunity Studies
- HFORT: Flight Opportunities for Research and Technology
- HITS: Heliophysics Innovation in Technology and Science
- H-ARD: Heliophysics AI/ML-Ready Data
- H-TM: Heliophysics Tools and Methods
- H-CSI: Heliophysics Citizen Science
- SOGI: Solar Orbiter Guest Investigator
- Multi-Disciplinary:
 - Habitable Worlds
 - FINESST
 - MDRAIT: Multidomain Reusable Artificial Intelligence Tools
 - XRP: Exoplanets

Please help by serving as review panelist!

<https://science.nasa.gov/researchers/solicitations/robes-2023/research-opportunities-space-and-earth-science-robes-2023-released>

SMD: Transform to Open Science (TOPS)

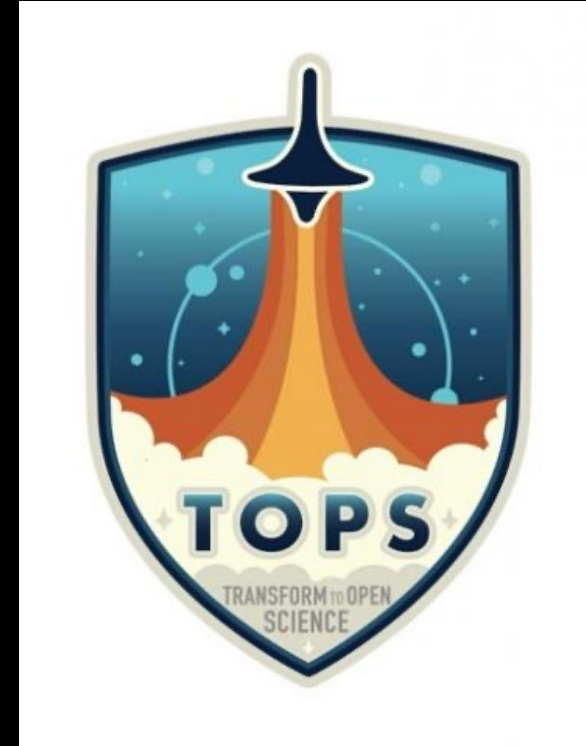
From 2022 to 2027, TOPS will accelerate the engagement of the scientific community in open science practices through events and activities aimed at:

- Lowering barriers to entry for historically excluded communities
- Better understanding how people use NASA data and code to take advantage of our big data collections
- Increasing opportunities for collaboration while promoting scientific innovation, transparency, and reproducibility

NASA is designating 2023 as the Year of Open Science, a global community initiative to spark change and inspire open science engagement through events and activities that will shift the current paradigm.

- TOPS has three overarching goals:
 - Increase understanding and adoption of open science principles and techniques in our Mission and Research Communities
 - Accelerate major scientific discoveries through supporting the adoption of open science
 - Broaden participation by historically excluded communities

Join the TOPS email list: <https://science.nasa.gov/open-science/transform-to-open-science>



Looking for ways to engage with public? hq-heliobigyear@mail.nasa.gov



Two solar eclipses

Annular on Oct. 14, 2023,
and total on April 8, 2024,
across North America

Parker Solar Probe

Parker will make its
closest approach to the
Sun in Dec. 2024

HELIOPHYSICS BIG YEAR

Solar Cycle 25

Solar maximum will present more opportunities to experience space weather

For additional information, please visit

[Eclipses Home](#) | [Eclipses – NASA Solar System Exploration](#)



The 2023 & 2024 Solar Eclipses through the eyes of NASA

Lunar topography data from NASA's Lunar Reconnaissance Orbiter and the Japan Aerospace Exploration Agency's SELENE lunar orbiter were used to precisely calculate the location of the Moon's shadow for the 2023 and 2024 solar eclipses. The planetary positions are from NASA's Jet Propulsion Laboratory Development Ephemeris 421. Earth imagery from NASA's Blue Marble: Next Generation series were used to create the terrain and Earth at night imagery from NASA's Black Marble were used under the eclipse paths.

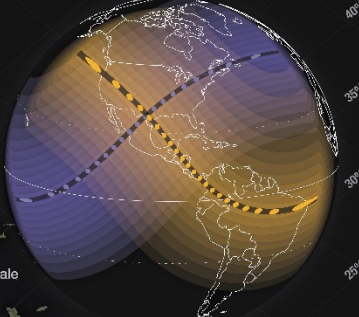
2023 Annular Solar Eclipse Saturday October 14, 2023
2024 Total Solar Eclipse Monday April 8, 2024

Credit: Michala Garrison and the Scientific Visualization Studio (SVS), in collaboration with the NASA Heliophysics Activation Team (NASA HEAT), part of NASA's Science Activation portfolio
 Eclipse calculations by Ernie Wright, NASA Goddard Space Flight Center

2023 Path of Annularity Sat. October 14, 2023
 Along a path about 125 miles wide, the Sun will appear as a "ring of fire" in the sky. Annularity lasts up to 5 minutes depending on the viewer's location within this path.

2024 Path of Totality Mon. April 8, 2024
 Along a path about 115 miles wide, the Moon will completely block the Sun in the sky. Totality lasts up to about 4 minutes and 20 seconds depending on the viewer's location within this path.

Outside of these paths, viewers within the 48 contiguous U.S. states and many other areas will see a partial solar eclipse (in the shaded areas below).



Find More: <http://solarsystem.nasa.gov/eclipses>

NP-2022-11-909-GSFC

Get Involved and Stay Informed!

Stay in touch and help us find new ways to highlight your work and keep you in the loop!

Sign up for the NASA Eclipse Newsletter to receive updates on eclipse activities!

- <https://tinyurl.com/ym9epkfy>

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

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

Let us know what you've been working on:

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

Learn more about the next solar eclipse:

- <https://solarsystem.nasa.gov/eclipses/home/>

Join us for our next Community Town Hall *10 JULY 10am EDT* :

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



NASA.gov/sunearth



blogs.nasa.gov/sunspot



@NASASun



facebook.com/NASASunScience

IT'S A GREAT TIME TO BE A HELIOPHYSICIST



Geospace Dynamics Constellation (GDC)

- GDC will provide key advances in our understanding of Earth's ionosphere-thermosphere system, including providing the scientific foundation for our ability to quantify and forecast space weather effects both on Earth and in space.
- NASA is happy to announce the start of the GDC mission science team!
 - Project Scientist – Dr. Doug Rowland
 - Deputy Project Scientists – Dr. Larry Kepko & Dr. Katherine Garcia-Sage
 - 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
 - Modular Spectrometer for Atmosphere and Ionosphere Characterization (MoSAIC): Dr. Mehdi Benna, UMBC
 - The Comprehensive Auroral Precipitation Experiment (CAPE): Dr. Daniel Gershman, NASA GSFC
 - Atmospheric Electrodynamics probe for THERmal plasma (AETHER): Dr. Laila Andersson, CU Boulder
 - Thermal Plasma Sensor (TPS): Dr. Phillip Anderson, University of Texas, Dallas
 - Near Earth Magnetometer Instrument in a Small Integrated System (NEMISIS): Dr. Mark Moldwin, University of Michigan
- Spacecraft procurement via GSFC-managed RFP, proposals received Feb. 10, 2023