



# EXPLORESCIENCE

*CSSP Discussion of HPD CubeSat Activities*

*November 13, 2023*

*Slides from:*

*Heliophysics Decadal Survey*

*Discussion led by :*

*Dan Moses, Program Scientist, Science Mission Directorate.*



National Aeronautics and  
Space Administration



# EXPLORESCIENCE

**Heliophysics Sounding Rockets, Balloons, CubeSats**

*Decadal Survey Supplemental Presentation*

*August 22, 2022*

**Dr. Nicola Fox**

Heliophysics Division Director  
Science Mission Directorate



# Research and Technology Flight Programs

- Research and Technology (R&T) Flight Program Objectives:
  1. Rapid scientific progress through short duration investigations
  2. Rapid development of new technology, observables and operational strategies
  3. Development of the cadre of future spaceflight experimentalists to conduct the next generation of spaceflight missions to fulfill NASA Science Goals
- Projects solicited and selected via open competitions
  - Heliophysics Low-Cost Access to Space (LCAS) [[ROSES-2022, B.9](#)]
    - Sounding Rockets
    - Scientific Balloons
    - Airborne
    - Commercial Suborbital [[STMD Flight Opportunities Program \(FOP\)](#)]
    - Small (<\$3M) ISS and CubeSat
  - Heliophysics Flight Opportunities for Research and Technology [[ROSES-2022, B.11](#)]
    - CubeSats/SmallSat
    - ISS payloads
    - Hosted payloads (e.g. DoD Space Test Program)
- All programs and competitions emphasize both scientific return and technology development
- Education and professional development is fundamental to R&T flight and is a selection consideration



# Explorers

## 2013 Decadal Recommendation:

*The survey committee recommends that NASA accelerate and expand the Heliophysics Explorer program. Augmenting the current program by \$70 million per year, in fiscal year 2012 dollars, will restore the option of Mid-size Explorer (MIDEX) missions and allow them to be offered alternately with Small Explorer (SMEX) missions every 2 to 3 years. As part of the augmented Explorer program, NASA should support regular selections of Missions of Opportunity.*

**NASA Implementation:** NASA accelerated the rate of solicitations and expanded the Explorers program to include contributions to international missions (EUVST) and to broaden the scope of heliophysics research (ESCAPADE). Further, NASA extended the Missions of Opportunity call to the Solar Terrestrial Probes program (GLIDE).

## Projects [LRD, **Agency Baseline Commitment**]

EZIE [Jun. 2024] \*\*

TRACERS [Nov. 2025]

HelioSwarm [Q4 2028] \*

EUVST [Dec. 2026]

SunRISE [Sept. 2025] \*\*

GLIDE (STP) [Dec. 2025] \*

MUSE [Q2 2027]

PUNCH [April 2025] \*

AWE [Dec. 2023]

ESCAPADE [Oct. 2024] \*

\*\*CubeSat

\* SmallSat (ESPA Class)

From Decadal  
"Program of Record"



# Research and Technology Flight Programs

- Management under [NPR 7120.8](#), supported through grants and cooperative agreements
  - PI-led investigations
  - Award funding defined at selection
  - Period of performance can be longer than typical research and technology awards
    - H-LCAS are typically 2-3 years, 4 years with justification
    - H-FORT are typically 3-4 years, 5 years with justification
- Schedule, performance, and cost in flight project management
  - Schedule and performance are adjusted to deal with unexpected developments
    - Science Traceability Matrix is used to evaluate impact of any performance changes on the ability of the investigation to achieve the proposed science objectives
  - Cost is fixed at selection; augmentations are subject to program budget constraints and granted in rare circumstances
    - Cost augmentations are most commonly granted when disruptions in NASA-provided services impose additional costs on investigation (e.g. reschedule of remote launch campaign)
    - Cost challenges in the project that cannot be overcome with acceptable modifications to schedule or performance require a NASA-conducted cost review. Augmentations require justifications based on unforeseeable new work necessary to achieve investigation success.
      - *Note:* Recent increased occurrence due to COVID-19 public health situation and supply chain challenges. These augmentations were needed at the time and will not be normal practice in the future.
  - When schedule, performance, and cost issues are not resolved through augmentation or adjustment, project continuation is considered through a competitive re-proposal



# CubeSats, Previous Decade

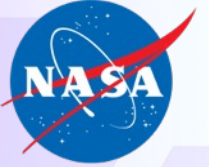
- CubeSats have advanced beyond a novel implementation
  - [CubeSat Design Specification \(Cal Poly\)](#) [2004]
  - [Achieving Science with CubeSats: Thinking Inside the Box](#) [2016]
- CubeSat mission expectations have evolved with technology and vendor maturation
  - Costs
    - Full development cost is significantly higher than originally projected
      - Actual cost is ~\$4-8M per project (Low Earth-orbiting)
    - Additional programmatic issues, cost drivers
      - Engineering, Mission Assurance
      - Launch services
      - Communications license process
      - International, National, and Agency requirements
        - Conjunction Avoidance (CARA)
        - De-orbit and residual debris requirements (ODAR)
        - Security (IT, communications)
  - Work effort
    - Work required for a successful CubeSat investigation significantly exceeds that for Sounding Rocket/Balloon payloads due to spacecraft system development; can be comparable to an AO-solicited Mission of Opportunity



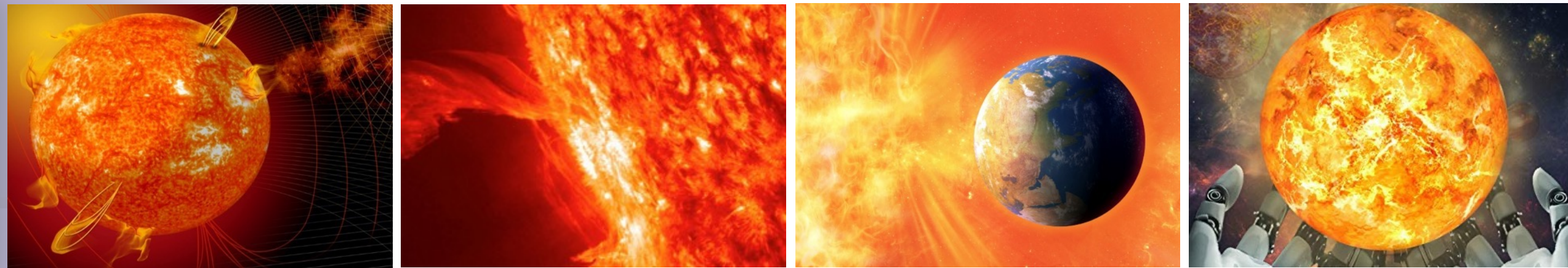
# CubeSats, Management

- SMD CubeSats initiative was started to speed growth, investment
  - Established management process following the SMD Suborbital program
    - NPR 7120.8
  - In 2014, CubeSat competitive selections had the dual emphasis of
    - 1) determining the utility of the platform, and
    - 2) achieving a meritorious science investigation
  - By 2018, CubeSats' useful capabilities were demonstrated,
    - CubeSat program management was turned over to individual divisions
    - CubeSat programs were incorporated into successful Explorers projects
- CubeSat development processes have evolved in a quickly changing landscape
  - Multiple suppliers and providers
  - Different capabilities, levels of reliability
  - Platform
- NASA management has increased over time in response to increasing programmatic overruns
  - Retained “light touch” management philosophy (PI has freedom on project work)
  - Increased NASA participation in lifecycle reviews
  - Required bi-monthly project status reviews
  - Instituted status monitoring by SmallSat Program Office (NASA Wallops Flight Facility)





# Heliophysics SmallSat Portfolio Mission Management



## Bi-monthly Status Review

Status as of September 30, 2023

Program Scientist:	Daniel J. Moses
Program Scientist:	Amy R. Winebarger
Program Executive:	David J. Cheney
Lead Portfolio Manager:	Thomas E. Johnson
Deputy Portfolio Manager:	Allison L. Evans
Grants Technical Officer:	Melissa A. Cold



# HPD Portfolio General Discussion

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## October 2023 Snapshot

### Missions in Development :15

**Mission On Orbit: 3 Functional** (LLITED, CIRBE, MinXSS 3)

**2 Not Functional** (CuPID, CuSP)

### Missions Completed: 7 Successful Investigations

(SPORT, DAILI, SORTIE, ELFIN, TBEX, MinXSS 1 & MinXSS 2)

### Upcoming Deliveries and Launches

REAL – Launch date slipped to NET March 2024

CURIE – Ariane 6 launch in April 2024

GTOSat – Removed from MMO Rideshare on June 30, 2022. No potential launch opportunity currently available

# HPD Portfolio Significant Highlights

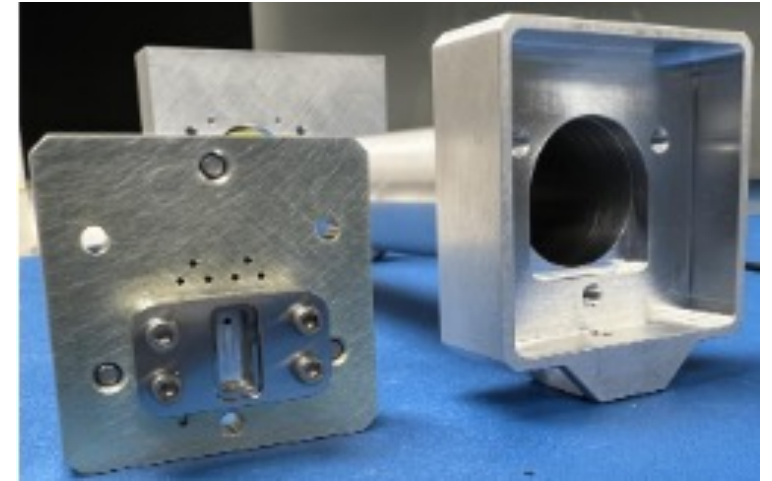
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AEPEX largely assembled



LARADO Laser Power Beam Testing Setup



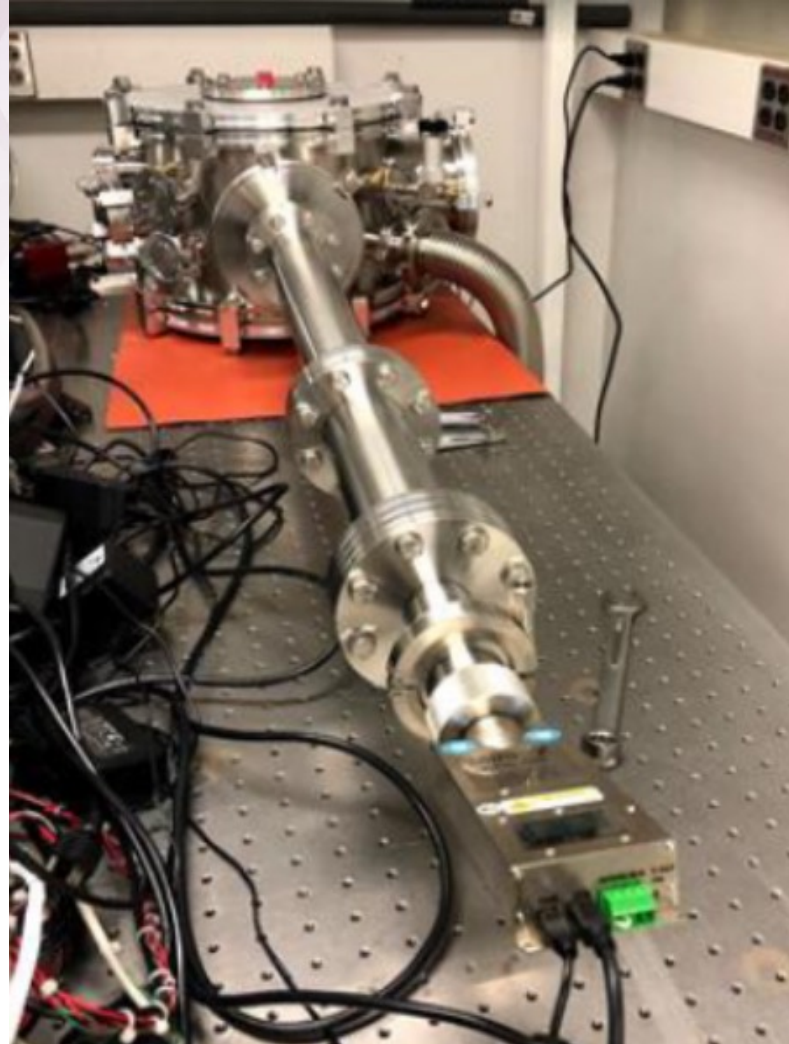
CUBIXSS – MOXSI instrument  
EM structure



# HPD Portfolio Significant Highlights - PADRE



S/C Simulator



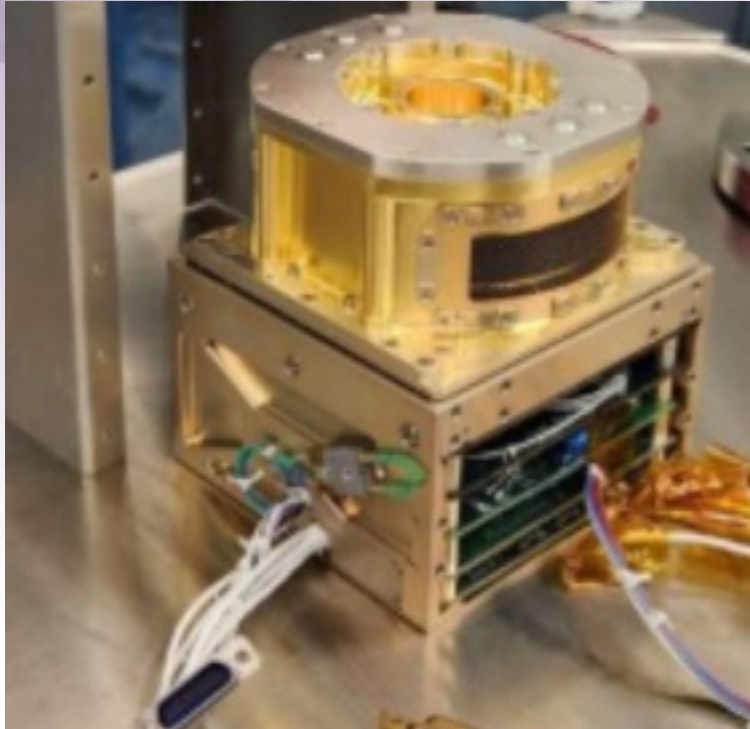
MeDDEA Test Set Up



SHARP Detector prototype

# HPD Portfolio Significant Highlights

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Dione – DESA Instrument



SunCET - EM Detector testing





# HPD Portfolio Mission Status: *In Development*



(1 of 5)

MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>AEPEX</b> PI: Robert Marshall University of Colorado, Boulder	To quantify the energy deposition from the radiation belts due to precipitation during both quiet and active conditions and provide spatial measurements of precipitation regions.	SRR – 4/24/20 PDR – 8/7/20 CDR – 3/25/21	<b>Achievements:</b> AXIS instrument cleaned of debris due to tin flaking during assembly. Running analysis and calibration test. AFIRE instrument X-ray source testing ongoing. Spacecraft structure completed. S-band, XACT, and Battery FSW integration ongoing.
			<b>Next Steps:</b> Final integration once AXIS instrument is complete. End to end testing and vibe test of the integrated spacecraft. FCC license being acquired, with help from Scott Palo.
<b>CODEX</b> PI: Jeffrey Newmark NASA GSFC (ISS Payload)	To understand the physical conditions in the solar wind acceleration region.	SRR – 3/26/20 Safety TIM0 – 5/21/20 PDR – 7/29/20 Safety TIM1 – 9/10/20 CDR – 10/28/21	<b>Achievements:</b> Camera issues have been resolved. GCE issue resolved. Installed the coronagraph into the pointing system, and started system level testing. Re-installing twist capsule. Yoke blanket installs 90% complete.
			<b>Next Steps:</b> System level "Day in the life" testing. Implement FSW Build 3 and perform ISSS C&DH interface verification. CG blanket installs in-work. System balance and vibration test at WFF in November.
<b>CubIXSS</b> PI: Amir Caspi Southwest Research Institute (SwRI)	To bridge a crucial, decades-long gap in ~0.25–3 keV soft X-ray (SXR) spectroscopic observations to measure many key low- and high-FIP ion species across the entire coronal temperature range from ~1 to >30 MK simultaneously.	SRR- 9/22/22	<b>Achievements:</b> MOXSI EM structure fabrication complete. EM SASS testing in progress. SPS long lead items ordered, some delivered. Sensor boards fabricated. IDPU EM delivered. Submitted CSLI proposal "just in case."
			<b>Next Steps:</b> Get MOXSI EM camera and filters in. Finish SASS aperture design. Complete SPS power board fabrication. Complete design revision of IDPU I/F board.

# HPD Portfolio Mission Status: *In Development*



(2 of 5)

MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>CURIE</b> PI: David Sundkvist University of California, Berkley	To use radio interferometry to study radio burst emissions from solar eruptive events such as flares and coronal mass ejections (CMEs) in the inner heliosphere	CDR – 10/2019 Inst. Del – 7/2020 PER – 9/2021 PSR#1 – 11/2021 LRR#1 – 11/2021	<b>Achievements:</b> Spacecraft now on shelf. FCC license extension granted.
			<b>Next Steps:</b> Continuing inconsequential flight software refinement. Awaiting Ariene 6 launch. ]
<b>Dione</b> PI: Eftyhia Zesta NASA GSFC	To quantify how the ionosphere and thermosphere respond to electromagnetic and kinetic energy inputs from the magnetosphere.	SRR – 11/21/19 iPDRG1 – 2/25/20 iPDRG2 – 5/6/20 mPDR – 6/16/20 iCDRG1 – 7/29/21 iCDRG2 – 8/3/21 mCDR – 10/27/21	<b>Achievements:</b> DESA/SPS completed Tvac and vibration testing. Completed NMS filament fix. Competed procurement of all magnetometer parts. Completed redesign of flex harness and star tracker baffle. Launch provided- Will go on Transporter 11.
			<b>Next Steps:</b> Awaiting NMS instrument delivery. Build of the magnetometers. Will most likely perform magnetometer testing in ambient field instead of relying on mag facility.
<b>DYNAGLO</b> PI: Aimee Merkel University of Colorado, Boulder	To contribute to the fundamental understanding of how vertical coupling by atmospheric waves contribute to the energy and momentum balance in the thermosphere.	SRR – 1/11/23	<b>Achievements:</b> HVPS trade completed and procurement in place. Momentum analysis for filter wheel mechanism is ongoing. 20 samples of the BaF2 filter are delivered. EM flatsat build finished. BCT XACT procured.
			<b>Next Steps:</b> Complete battery design trade. Procure solar cells from new vendor. Procure radio. Internal peer review of spacecraft design.



# HPD Portfolio Mission Status: *In Development*



(3 of 5)

MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>GTOSat</b> PI: Larry Kepko NASA GSFC	To advance our quantitative understanding of acceleration and loss of relativistic electrons in Earth's outer radiation belt from a Geosynchronous Transfer Orbit (GTO)	SRR – 10/31/18 FDR – 8/12/18 dFDR – 8/3/20 PER – 6/25/21 Bus Ready – 7/2/21 PSR – 4/25/22 LRR - 5/26/22	<b>Achievements:</b> N/A (On shelf for now)
			<b>Next Steps:</b> consider options to add propulsion to increase launch opportunities.
<b>ICOVEX</b> PI: Keiichi Ogasawara Southwest Research Institute (SwRI)	To decipher crucial ion dynamics to reveal how the magnetospheric drivers propagate to low altitude.	SRR – 2/16/23	<b>Achievements:</b> Preliminary 3DI anode and FEE layout completed. Sending LPSP magnet/optics design out for quote. Placed order for interface LPSP board.
			<b>Next Steps:</b> Continue ordering long lead items as soon as feasible. 3DI instrument design review 2/21/24, LPSP instrument design review 5/17/24.
<b>LARADO</b> PI: Andrew Nicholas Naval Research Laboratory (NRL)	To study orbital debris	Bus SRR – 12/16/21 LARADO/STPSat-7 PDR – 5/29/22 Instrument CDR – 1/18/23 Spacecraft CDR – Late Feb.	<b>Achievements:</b> Flight components are being delivered, with final components planned for delivery by beginning of November. Radiator thermal control hardware being installed. Clean room preparation complete. Laser power beam testing setup complete.
			<b>Next Steps:</b> Environmental testing, functional testing in November. Continuing detection algorithm work.

# HPD Portfolio Mission Status: In Development



(4 of 5)

MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>OWLS</b> PI: Ed Thiemann University of Colorado, Boulder	To address disparities in the current understanding of gravity wave (GW) effects on the Thermosphere.	CDR – 7/20/22	<b>Achievements:</b> IIST launch confirmed (contingent on CubeSpace ADCS passing OWLS verification). Received new CSOL spectrograph cover with correct coating application. Modified EUV-OP front aperture cover to conserve weight. Working on FSW minor improvements.
			<b>Next Steps:</b> Complete EUV-OP modifications. CSOL in-band/spectral test GSE coming in mid-October. Preparing for 1 yr storage of instrument at LASP to wait for 1/1/25 flight. I&T is planned at IIST.
			<b>Concerns/Issues:</b> Launch delayed 1 yr.
<b>PADRE</b> PI: Juan Carlos Martinez Oliveros University of California, Berkley	To observe the Sun in hard X-ray (HXR) from low earth orbit and investigate the accelerated electron angular distribution in solar flares.	SRR – 11/10/22 Delta-SRR – 4/5/23	<b>Achievements:</b> Engineering Peer Reviews (EPRs) held for both MeDDeA and SHARP and prototyping underway for both instruments. Completed spacecraft PDR and MOC training with Endurosat. First s/c simulator hardware delivered to SSL.
			<b>Next Steps:</b> Complete PDR in November. Continue prototype development for MeDDEA and SHARP. Set up testing station for s/c computer and begin interface development.
<b>REAL</b> PI: Robyn Millan Dartmouth College	To improve our understanding of physical mechanisms responsible for scattering radiation belt electrons into Earth's atmosphere.	SRR – 12/17/18 PDR – 5/17/19 CDR – 3/6/20 Inst. Del. – 4/1/22 MRR – 10/25/22	<b>Achievements:</b> Funding augmentation awarded. Completed system level noise characterization testing.
			<b>Next Steps:</b> Complete flight software. Perform TVAC testing. Deliver in January for a March launch.

# HPD Portfolio Mission Status: *In Development*



(5 of 5)

MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>STORIE</b> PI: Alex Glocer NASA GSFC	To understand the response of ring current composition to geomagnetic events.	SRR – 4/28/23	<b>Achievements:</b> Held kick-off meeting with STP and received draft ICD for H11. Continue to order long lead items. Began structural and thermal analysis. Making good progress on an engineering model.
			<b>Next Steps:</b> Complete the EM detector module. Complete or make design progress on numerous EM components. Select flight UV foils. Locate and secure shipping container.
<b>SunCET</b> PI: James Mason Johns Hopkins University Applied Physics Laboratory (APL)	To determine the dominant physical mechanism for Coronal Mass Ejection (CME) acceleration as a function of altitude and time.	SRR – 10/28/22 PDR – 5/18/23	<b>Achievements:</b> All long lead procurements made. Determined that telescope coatings will not degrade in air, so design and handling can be simplified.
			<b>Next Steps:</b> Perform acoustic testing on thin foil filters. Prepare for the DR, which will be held on January 25. Submit CSLI application. Receive mirrors.
<b>WindCube</b> PI: Scott Sewell University Corporation For Atmospheric Research (UCAR)	To understand the effects on ionosphere and thermosphere from above, meaning solar wind and magnetosphere, and from below, meaning lower atmosphere.	SRR – 9/21/22 Delta SRR – 3/23/223	<b>Achievements:</b> Camera engineering model is in fabrication.
			<b>Next Steps:</b> Hold S/C SRR with Space Inventor. Submit CSLI application. Release final ICD between payload and spacecraft. Complete acceptance testing of the etalon.



# HPD Portfolio Mission Status: On Orbit

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MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>CuPID</b> PI: Brian Walsh Boston University	To study the transfer of energy from the sun's solar wind to the Earth's space environment. will carry a wide field-of-view soft X-ray telescope	PDR – 10/2016 CDR – 8/2017 iDelivery – 9/2018 bDelivery – 12/2019 PER – 3/2021 IRR – 6/8/21 SC Del. – 7/23/21 Launch – 9/27/21 End of POP – 9/30/2023	<b>Achievements:</b> The POP ended on 9/30/2023 and the final report has been submitted (posted on BOX). The report identified the technologies developed by CuPID and being used on future flight missions. It also highlights the lessons learned and how they have been shared with the community
			<b>Next Steps:</b> Continue to monitor close approaches issued by the US 19 <sup>th</sup> SDS
<b>CuSP</b> PI: Mihir Desai Southwest Research Institute (SwRI)	To study the sources and acceleration mechanisms of solar energetic particles that are harmful to astronauts as well as Earth-based technologies.	SRR – 10/15/15 PDR – 9/13/17 CDR – 3/12/18 Inst. Del – 8/01/20 PER – 12/15/20 PSR – 4/14/21 SC Del – 7/13/21 Launch – 11/16/22	<b>Achievements:</b> Submitted a plan to contact CuSP, but it was not based on engineering analysis as requested.
			<b>Next Steps:</b> Issue closeout report. POP ends on 12/29/2023
<b>MinXSS-3</b> PI: Tom Woods University of Colorado, Boulder	To better understand the energy distribution of solar flare SXR (Soft X-ray) emissions and its impact on the Earth's Ionosphere, Thermosphere, and Mesosphere.	i-SC I&T – 6/2019 FRR – 4/23/21 Launch 2/14/22 Commissioning – 4/14/22	<b>Achievements:</b> Funding augmentation and mission extension awarded through 3/31/2024. Did not meet with mission this reporting period, but communicated by email.
			<b>Next Steps:</b> Continue the MinXSS-3 solar science campaign. Continue downlinking DAXSS data from InspireSat-1. MinXSS-3 graduate student (Anant Kumar) presenting solar flare results from the MinXSS-3 (DAXSS) observations at the upcoming August 2023 Solar Physics Division (SPD) meeting.

# HPD Portfolio Mission Status: On Orbit

National Aeronautics and  
Space Administration



MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>CIRBE</b> PI: Xinlin Li University of Colorado, Boulder	To provide some of the first advanced resolution of one of Earth's two Van Allen belts, a zone that traps energetic particles in the planet's magnetic field.	SRR – 6/10/19 PDR – 9/30/19 CDR – 8/12/20 Inst. Del. – 6/28/21 Bus Del. – 9/1/21 PER – 10/13/21 Launch – 4/15/23	<b>Achievements:</b> Addressed safe mode resets by increasing time out duration for the star tracker. Downloading limited data with the LASP ground station and WFF is coming on-line to support. Detected ground-based VLF waves from NWC transmitter in Australia. Conjunction with GOES shows that CIRBE has better energy resolution.
			<b>Next Steps:</b> Repair S-Band ground station. Download science data. Three presentations planned for AGU.
<b>LLITED</b> PI: Rebecca Bishop Aerospace Corporation	To provide first coincident measurements of Earth's dusk-side at lower altitudes, providing a detailed examination of equatorial temperature and wind anomaly.	ConOps – 1/16/18 SRR – 3/16/18 PIP Del – 5/13/19 bDR – 6/27/19 TRR – 9/28/21 PSR – 12/3/21 Launch – 4/15/23	<b>Achievements:</b> Spacecraft commissioning completed for both spacecraft. Collecting science data for both the PIP and MIGSI instruments. Co-observation of Annular Eclipse
			<b>Next Steps:</b> Coincide science observations with sounding rocket experiment from poker flats. Implement autonomous operations. Optimize payload operations to account for power, thermal, and other spacecraft factors.

# HPD Portfolio Mission Status: De-Orbit

National Aeronautics and  
Space Administration



MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>petitSat</b> PI: Jeff Klenzing NASA GSFC	To study density irregularities in the mid and low-latitude ionosphere, which occupies a tiny fraction of the atmosphere.	SRR – 4/27/18 PDR – 10/4/18 CDR – 9/11/19 GRIDS Del – 1/11/21 INMS Del – 9/28/21 PER – 11/30/21 PSR – 2/8/22 Delivered – 7/18/22 ORR – 11/4/22 Launch – 11/26/22 ISS Deployment – 12/29/22 De-Orbit – 4/9/23	<b>Achievements:</b> Final report from the FRB was released. Closeout report for petitSat was submitted.
			<b>Next Steps:</b> Update closeout report as required.
<b>SPORT</b> PI: Charles Swenson Utah State University	To address the compelling but difficult problem of understanding the preconditions leading to equatorial plasma bubbles.	SRR – 4/25/18 PDR – 8/1/18 CDR – 8/17/19 Inst. Del. – 5/26/21 PSR – 7/1/22 Delivered – 7/19/22 MRR – 10/25/22 Launch – 11/26/22 ISS Deployment – 12/29/23 Re-entry – 10/10/2023	<b>Achievements:</b> Collected and downloaded science data prior to the mission's re-entry
			<b>Next Steps:</b> Science data analysis. Write papers and make presentations.



# HPD Portfolio Mission Status: De-Orbit (Complete)



MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
<b>ELFIN</b> PI: Vassilis Angelopoulos UCLA	To measure how precipitated electrons vary across space and time.	Launch – 9/15/18 ELFIN A de-orbit – 9/17/22 ELFIN B de-orbit – 9/29/22	<b>Achievements:</b> Obtained funding from NSF for science data analysis. Papers submitted: 11 in press, 5 submitted, 5 in work; Data download backlog being reduced due to high power and support from WFF and Montana; 11 AGU abstracts submitted.8 (no changes)
			<b>Next Steps:</b> Congrats to the ELFIN team on a successful mission. This is our last bimonthly with ELFIN.
<b>SORTIE</b> PI: Geoff Crowley Astra Space	To study the complex challenges in discovering the wave-like plasma perturbations in the ionosphere.	SRR – 1/2015 PDR – 6/2015 CDR – 6/2016 iDel – 5/2019 PER – 7/2019 PSR – 7/2019 LRR – 8/2019 Launch – 12/2019 De-Orbit – 9/17/22	<b>Achievements:</b> Exceeded 2 years of operations since deployment from the ISS; Submitted NCE and it was approved. Extends mission to 2/28/23: 6 papers submitted and several more in process. (no changes)
			<b>Next Steps:</b> Re-entry on Sept 17 <sup>th</sup> , 2022. Science analysis is ongoing (requesting augmentation for analysis); This is our last bimonthly with SORTIE.
<b>DAILI</b> PI: James Hecht Aerospace Corporation	To improve the accuracy of operational models for both the neutral density and the ionosphere and will help further the study of wave propagation and transport processes in the lower thermosphere.	PIMR – 10/28/18 Reqs – 5/16/19 CDR – 5/20/20 TRR – 8/23/21 PSR – 9/16/21 Launch – 12/21/21 De-Orbit – 6/26/22	<b>Achievements:</b> Spacecraft re-entered on June 16. Determined that reaction wheels failed due to bearing failure. Bearings used non-vacuum rated lube and new wheels did not go through qualification testing. Asked for augmentation request for data processing (was denied).
			<b>Next Steps:</b> HFORT will not be providing additional funding for DAILI under this grant. They must re-propose to a different grant program if they want additional funding.
<b>MinXSS 1 and 2</b>	EUV Irradiance Variability	#1 ISS Release 5/16 #2 SSO A launch 12/18	
<b>TBEX</b>	Day-to-Day Variability of Equatorial Scintillations	Launch 6/19	

# HPD Portfolio Mission Status: Not Completed

HPD and  
Education



MISSION	OBJECTIVE	COMPLETED MILESTONES	STATUS
AERO / VISTA PI: Philip Erickson & Frank Lind MIT Haystack Observatory	To advance our knowledge by examining radio emissions from the auroral acceleration region in near-Earth space.	SRR – 3/15/19 Payload DR – 4/9/20 Payload ICD – 8/11/20 System DR – 8/20/20 DDR – 7/15/21 Delta-Delta DR- 10/5/22	Achievements: None during this reporting period. Still waiting for the s/c to be delivered.
			Next Steps: Will meet with mission when spacecraft are received.

# Upcoming Gate Reviews

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MISSION	REVIEW TYPE	TIMEFRAME	LOCATION
WindCube	Design Review	September 2024	Hybrid Format w/ In-Person at NCAR
SunCET	Design Review	January 15, 2024	Hybrid Format w/ In-Person at LASP
CubIXSS <sup>+</sup>	Design Review	February 16, 2024	Hybrid Format w/ In-Person at SwRI
STORIE	Design Review	May 2024	Hybrid Format w/ In-Person at GSFC
DYNAGLO	Design Review	February 14, 2024 (NET)	Hybrid Format w/ In-Person at LASP
PADRE	Design Review	March 2024 (NET)	Hybrid Format w/ In-Person at UCB/SSL



# Acronym Definitions



MISSION	TITLE
AEPEX	Atmosphere Effects of Precipitation through Energetic X-rays
AERO/VISTA	1. Auroral Emission Radio Observer 2. Vector Interferometry Space Technology using AERO
CIRBE	CubeSat: Inner Radiation Belt Experiment
CODEX	COronal Diagnostic EXperiment
CuIXSS	CubeSat Imaging X-ray Solar Spectrometer
CuPID	Cusp Plasma Imaging Detector
CURIE	CUbesat Radio Interferometry Experiment
CuSP	CubeSat Mission to Study Solar Particles
DAILI	Daily Atmospheric Ionospheric Limb Imager Mission
Dione	-
DYNAGLO	DYNAmics Atmosphere GLObal-Connection
ELFIN	Electron Losses and Fields Investigation
GTOSat	Geosynchronous Transfer Orbit Satellite
ICOVEX	Ionosphere Composition and Velocity EXperiment

MISSION	TITLE
LAICE	Lower Atmosphere/Ionosphere Coupling Experiment
Lightsheet	
LLITED	Low-Latitude Ionosphere/Thermosphere Enhancements in Density
MinXSS-3	Miniature X-ray Solar Spectrometer
OWLS	Occultation Wave Limb Sounder
PADRE	Solar PolAridization and Directivity X-Ray Experiment
petitSat	Plasma Enhancements in The Ionosphere-Thermosphere Satellite
REAL	Relative Electron Atmospheric Loss
SORTIE	Scintillation Observations and Response of the Ionosphere to Electrodynamics
SPORT	Scintillation Prediction Observations Research Task
STORIE	Storm Time O+ Ring current Imaging Evolution
SunCET	Sun Coronal Ejection Tracker
TBEx	Tandem Beacon Experiment
WindCube	-