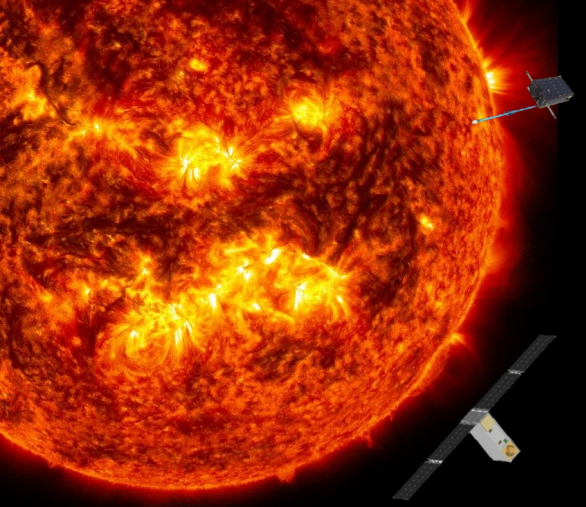
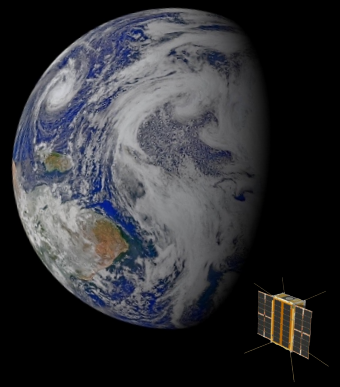

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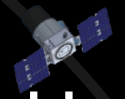
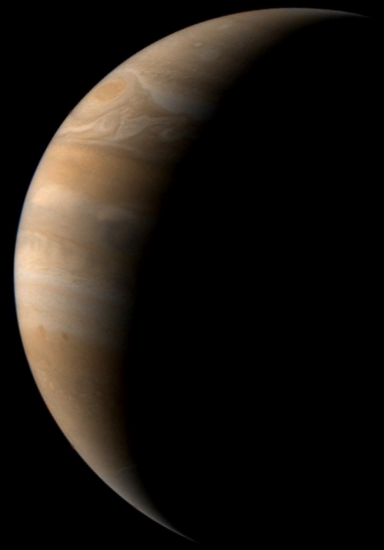
SmallSats @ GSFC: Learning and Leaning Forward



John Hudeck

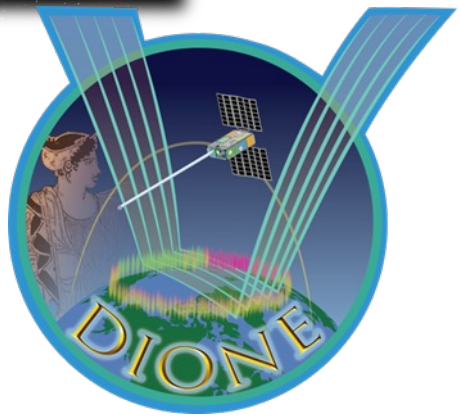
Deputy Chief, Small Satellite and Special Projects Office,

Wallops Flight Facility

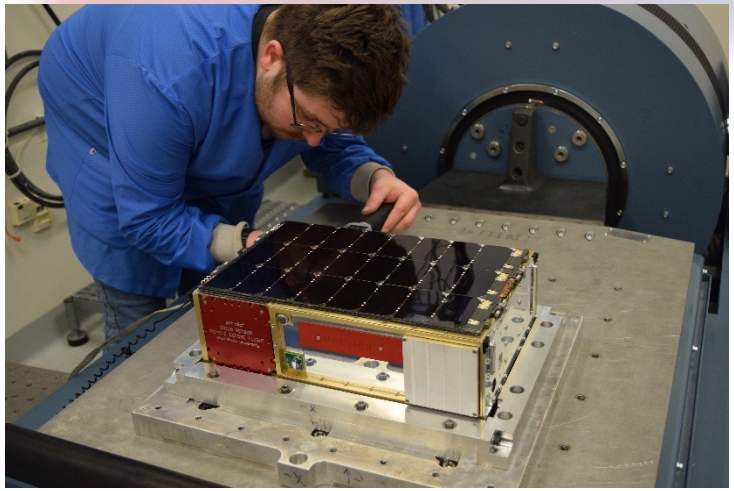


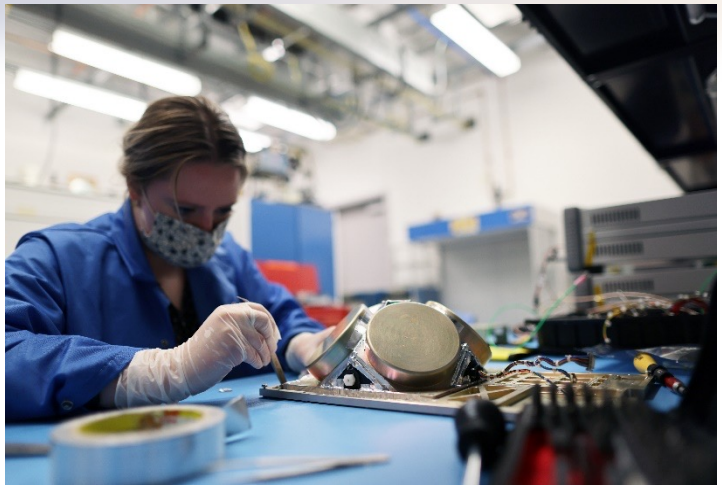
NASA GODDARD SPACE FLIGHT CENTER | www.smallsat.wff.nasa.gov/

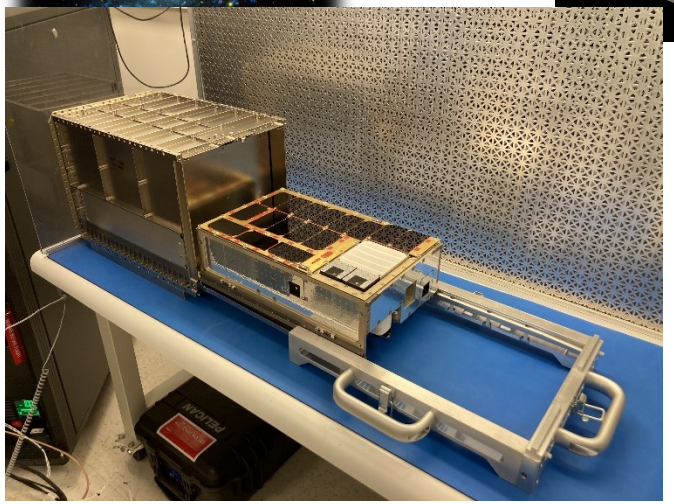
SmallSats @ GSFC

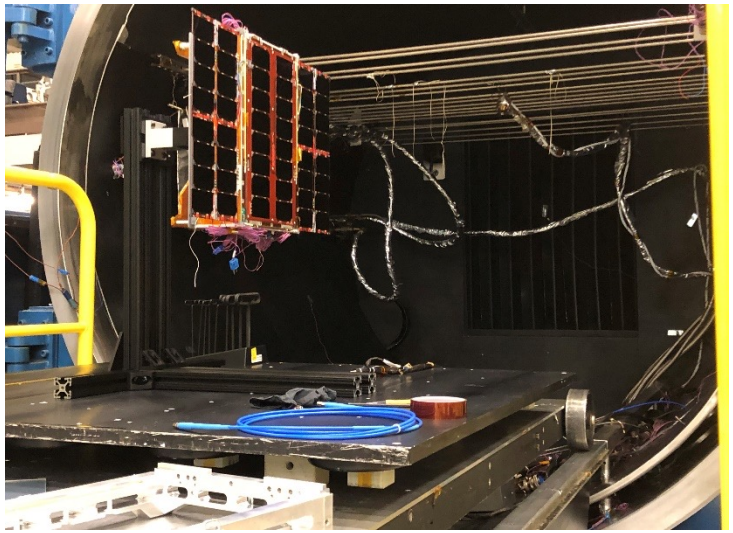


We've Been Busy









Learning – GTOSat (6U - Heliophysics)

Science Objective: To advance our quantitative understanding of accelerations and loss of relativistic electrons in Earth's outer radiation belt

Technology: Relativistic Electron Magnetics Spectrometer (REMS), Fluxgate Magnetometer, Z-shielding Panels, Higher Radiation Tolerance COTS

Launch: TBD, Earliest 2025, Geo-Transfer

Status: In Storage

What Happened?

- The perfect launch opportunity was delayed
- GTO is very sensitive to launch parameters and the mission was no longer able to meet the LEO 25 year de-orbit requirement with the new launch date
- Satellite was de-manifested and placed in storage

➢ Recommend anyone planning a mission to GTO include propulsion in their concept

Learning – petitSat (6U - Heliophysics)

Science Objective: To study the interaction between the ionosphere and thermosphere which creates a variety of plasma structures within the ionosphere

Technology: Gridded Retarding Ion Drift Sensor (GRIDS), Ion Neutral Mass Spectrometer (INMS), and Ion Thruster Control System (Tech Demo)

Launch: December 15, 2022, LEO ISS

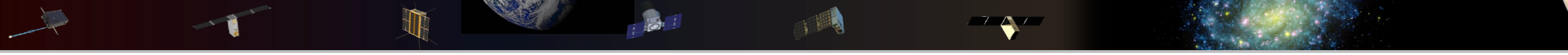
Status: De-Orbited w/o Comms

What Happened?

Failure Review Board (FRB) investigation determined a proximate cause:

- Insufficient charge in the battery at launch from the International Space Station
  - Battery capacity was significantly degraded (loss of >50%) early in spacecraft I&T
- The spacecraft design precluded the autonomous acquisition of the sun after depletion of the battery
  - Attitude Control System (ACS) disabled at low battery voltage (undervoltage protection)
  - ACS only re-enabled by ground command
  - The spacecraft likely ran through multiple on-off cycles where the system went below survival temperature, further degrading the battery

Leaning Forward – Active Missions



SNOOPI (6U - Earth Science)

Science Objective: To demonstrate an innovative instrument that shows promise for measuring vegetative root-zone soil moisture (RZSM) and snow water equivalent (SWE) from space.

Status: De-manifested due to petitSat bus concerns, acquiring a new EPS and re-evaluating early mission operations strategy

Launch: TBD, Readiness: November 2023, LEO ISS

Dione (6U - Heliophysics)

Science Objective: To simultaneously measure both energy inputs from the magnetosphere and the responses from the ionosphere-thermosphere system so that orbital drag can be specified

Status: Early stages of spacecraft I&T, FlatSat testing of flight components

Launch: TBD, Readiness: March 2024, LEO Sun Synchronous

BurstCube (6U - Astrophysics)

Science Objective: To detect and characterize short gamma-ray bursts that are counterparts of gravitational wave sources.

Status: Slipped a launch opportunity to repair instrument and respond to FRB findings. Currently in spacecraft I&T and preparing for TVAC.

Launch: TBD, Readiness: November 2023, LEO ISS

Pandora (ESPA - Astrophysics)

Science Objective: To conduct a long baseline survey of transitioning exoplanets orbiting nearby stars with simultaneous photometric and spectroscopic observations in order to quantify and correct for stellar contamination in transmission spectra and subsequently identify exoplanets with hydrogen or water dominated atmosphere

Status: Qualified the telescope design and working towards CDR

Launch: TBD, Readiness: February 2025, LEO Polar

Leaning Forward – Welcome PolSIR!

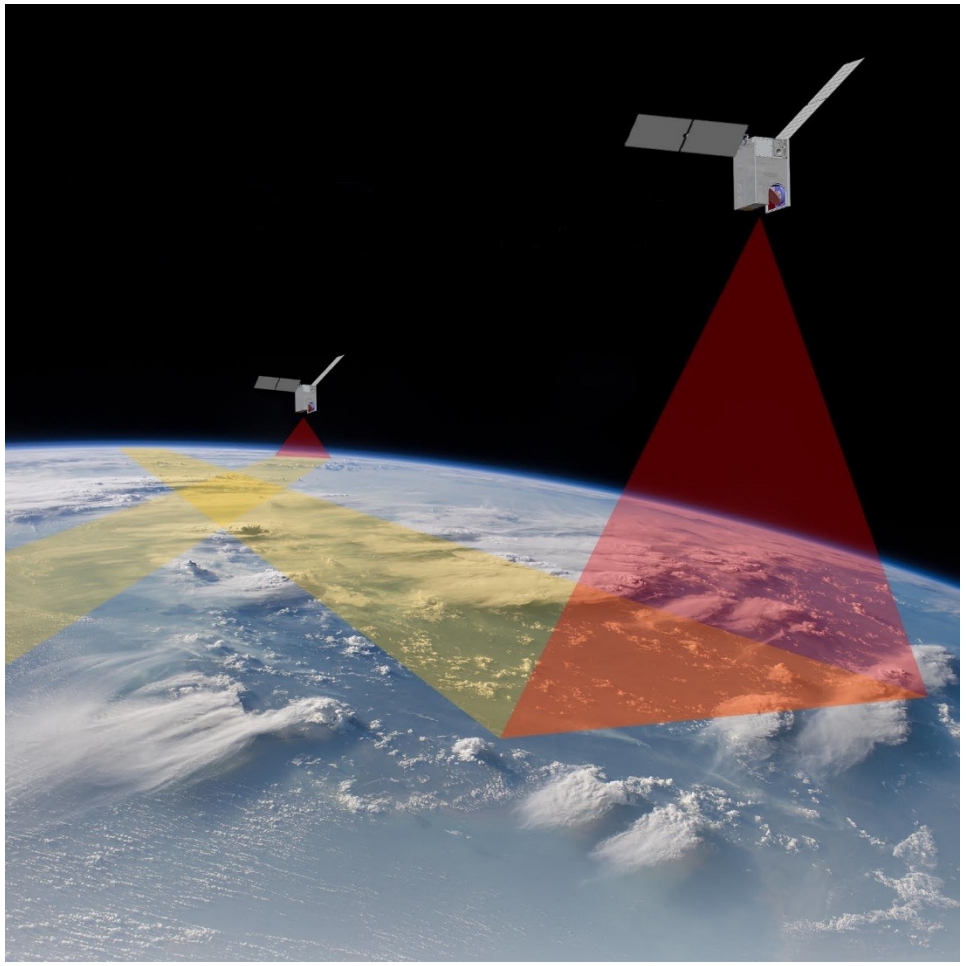
PolSIR (2x12U – Earth Science)

Science Objective: To better characterize and understand the diurnal variability of tropical and subtropical ice clouds

Technology: 325 and 680 GHz polarimetric radiometer, scanning mirror, intermediate frequency assembly, 12U buses provided by BCT

Launch: TBD, Readiness: November 2026, LEO 51.2°

Status: Formulation Phase



Leaning Forward - Distributed Systems Missions (DSM) Architecture

Move missions towards a network-centric approach to transform science impact

Combine components, systems, instruments, data, models, and even other missions into a unified whole—and enable timely actions from fusion of the resultant knowledge

Vision: Mission objectives are routinely achieved by cooperative dynamically-networked ”anywhere-based” sensors, systems, models, …

Collaboration. Cooperation. Communication. Agility. Resilience …
Migrating effective human behaviors to space.

Signature Response
Determine Environment From Sensor or Model

Communicate
Across Fleet

Collaborate Autonomously
Manage Node, Cognizant of Fleet Status

Autonomously Navigate, Guide, Control

Process Data

Implement Mission Resilience

Prioritize Data
for downlink

DSM Enabling Capabilities

Cross-Goddard team is advancing, integrating and fielding critical intelligent constellation–enabling capabilities

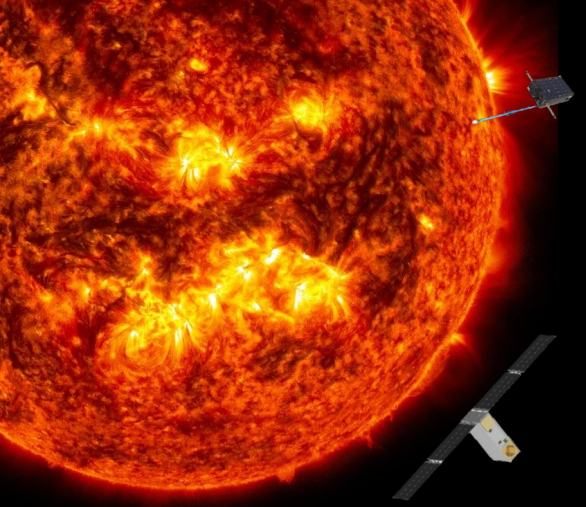
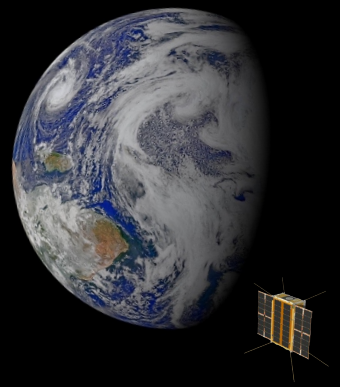
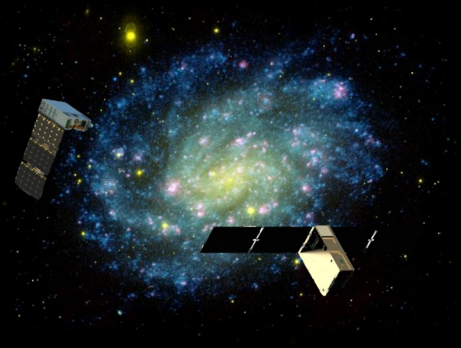
Whole System/ Emulation Environment

Systems Engineering

Combine components, systems, instruments, data, models, and even other missions into a unified whole

NASA Goddard is eager to explore potential DSM-enabling partnerships with private industry, academia, and other government agencies

Contact: Michael.A.Johnson@nasa.gov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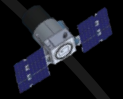
Come See Us at Booth 76



Thank You