National Aeronautics and Space Administration

2023 NASA SCIENCE

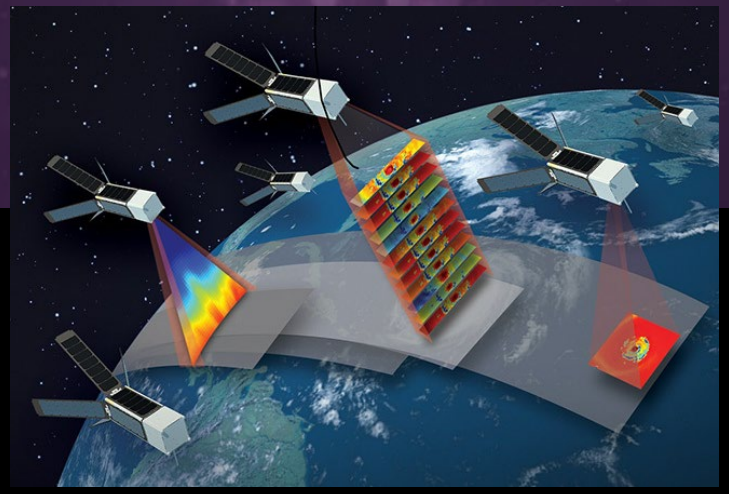
All about SmallSats, Challenges, Lessons Learned

Florence Tan
Chair, Small Spacecraft Coordination Group
NASA Headquarters

PI Launchpad 2023

July 25, 2023

SCIENCE MISSION DIRECTORATE (SMD) & CUBESAT/SMALLSAT OVERVIEW

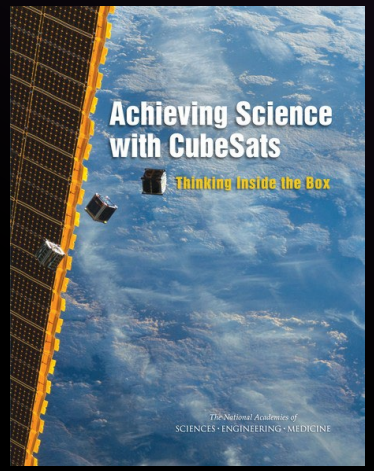


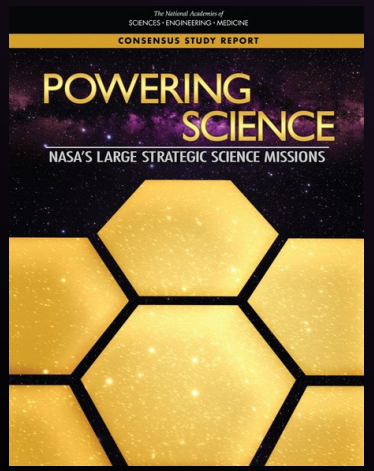
CUBESAT/SMALLSAT PROGRAM REVIEWS & HIGHLIGHTS

MISSION STRATEGY & OPPORTUNITES

Establishing the Vision for Small Mission Science

Small satellite community can contribute to the scientific and technical rationale for a sustainable, productive, and relevant role within a balanced portfolio of strategic science missions



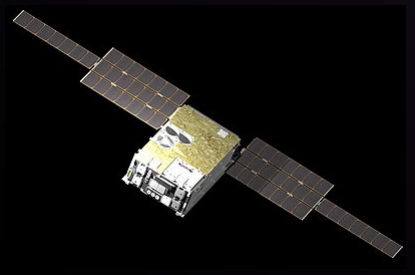


National Academies and NASA Reports Impact SmallSat/CubeSat Strategy

- NASA formed and chartered a Cross-Agency Coordination Group that Advises AAs on Strategy, Guidance, and Policy For Innovative Small Spacecraft Science and Technology Missions
- SMD, STMD, and SOMD's small spacecraft missions are actively pursuing science, space technology, and strategic knowledge gaps

Science
Hurricane observations via TROPICS constellation

New Observation Methods



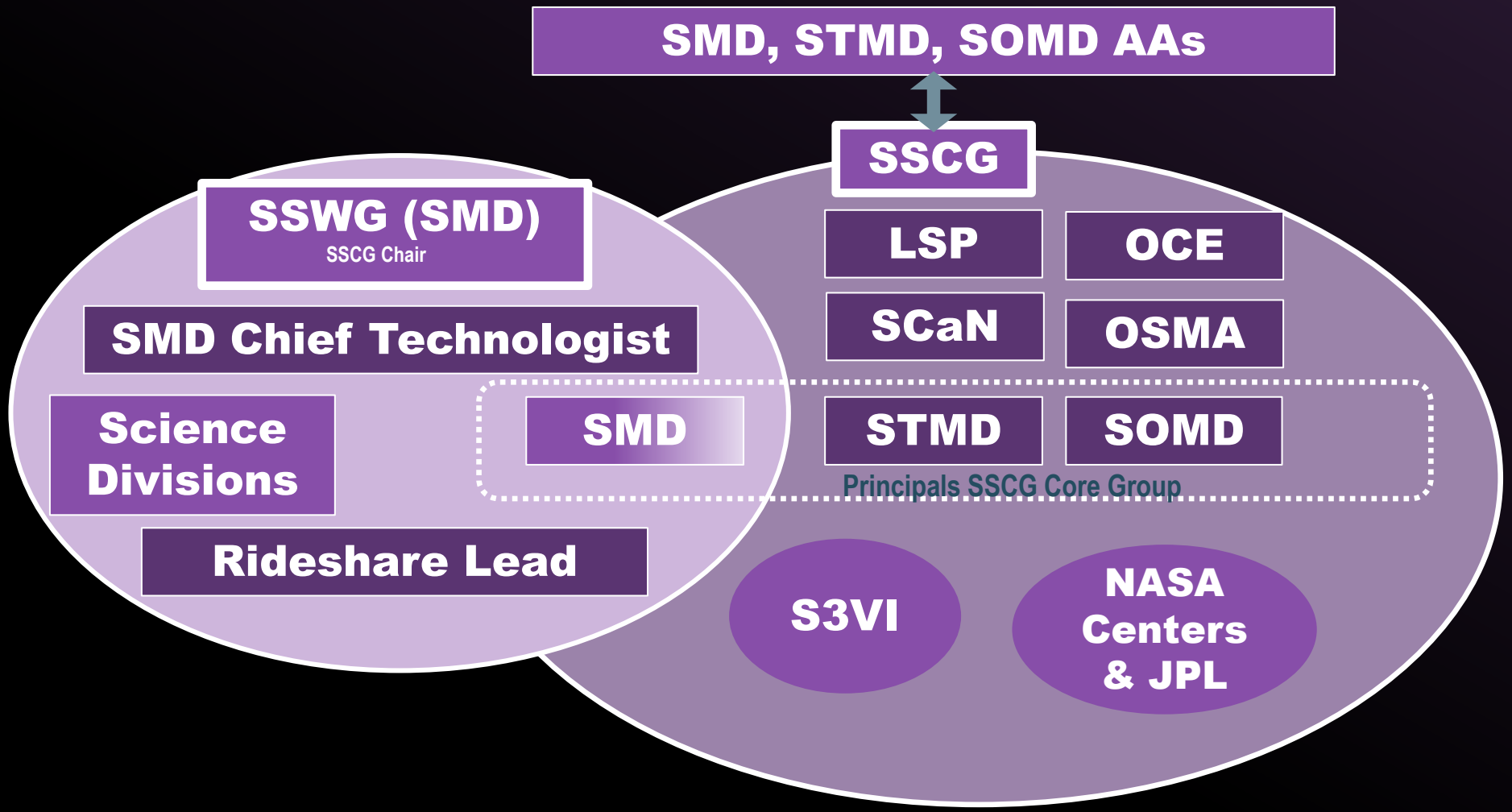
Exploration
Lunar imaging via Equuleus mission

Strategic Knowledge Gaps

Technology maturation via CAPSTONE mission

Spacecraft Subsystems

Structure of NASA Small Spacecraft Coordination Group

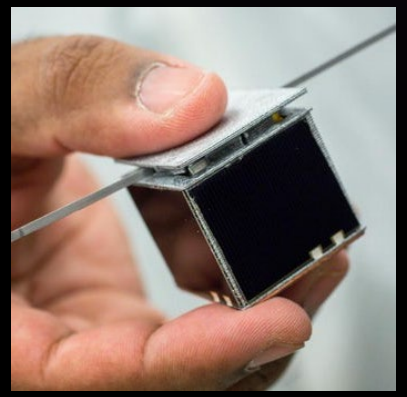


Organizational Alignment and Coordination to Support Small Mission Science and Technology Community

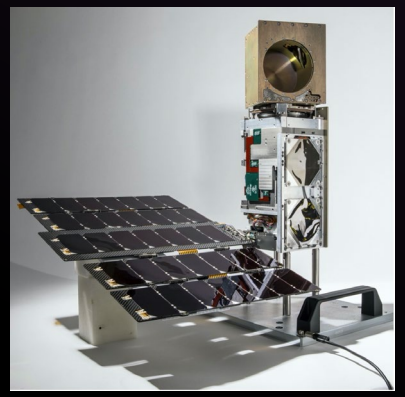
Small Spacecraft Coordination Group (SSCG) advises AAs on strategy to guide cross-agency initiatives and relevant policies, programmatic scope and priorities

Small Spacecraft Working Group (SSWG) advises the SSCG and assists SMD in development of innovative science investigations

Fundamentals of Small Spacecraft
Spectrum of Satellite Development

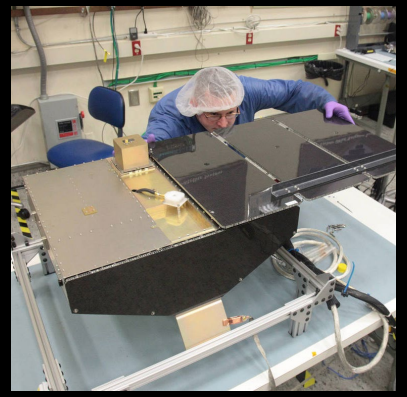


Picosatellite
PocketSat (0.1 – 1 kg)



CubeSat/Nanosatellite
TROPICS 3U/6U (1 – 10 kg)

SPA-Ring
Payload Port Limit (450 kg)



Microsatellite
CYGNSS (10 – 100 kg)

Small Satellite
ESCAPADE (100 – 500 kg)

SmallSat Definition

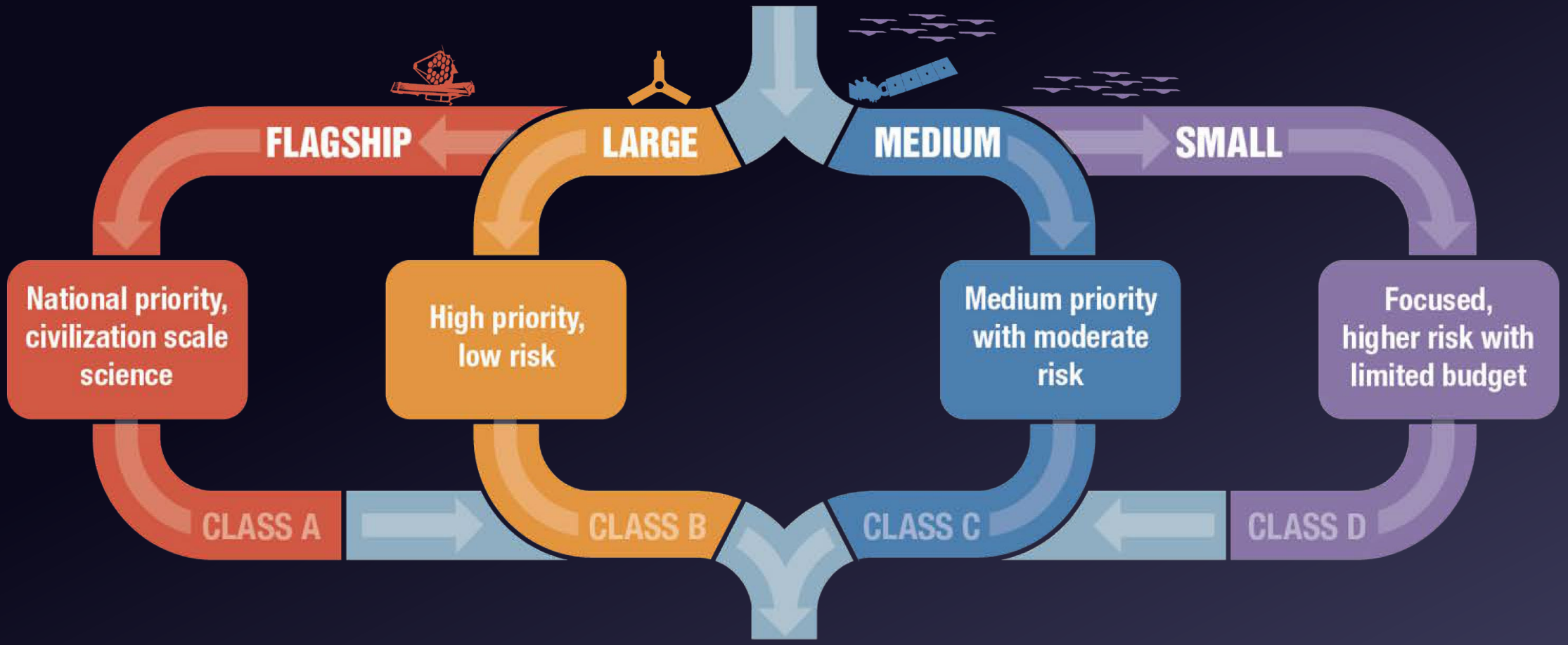
A spacecraft that is interface compatible with a SPA Ring, a dedicated small or medium-lift launch vehicle, or a containerized dispenser, and with an upper mass limit of approximately 500 kg

ISS

Rideshare

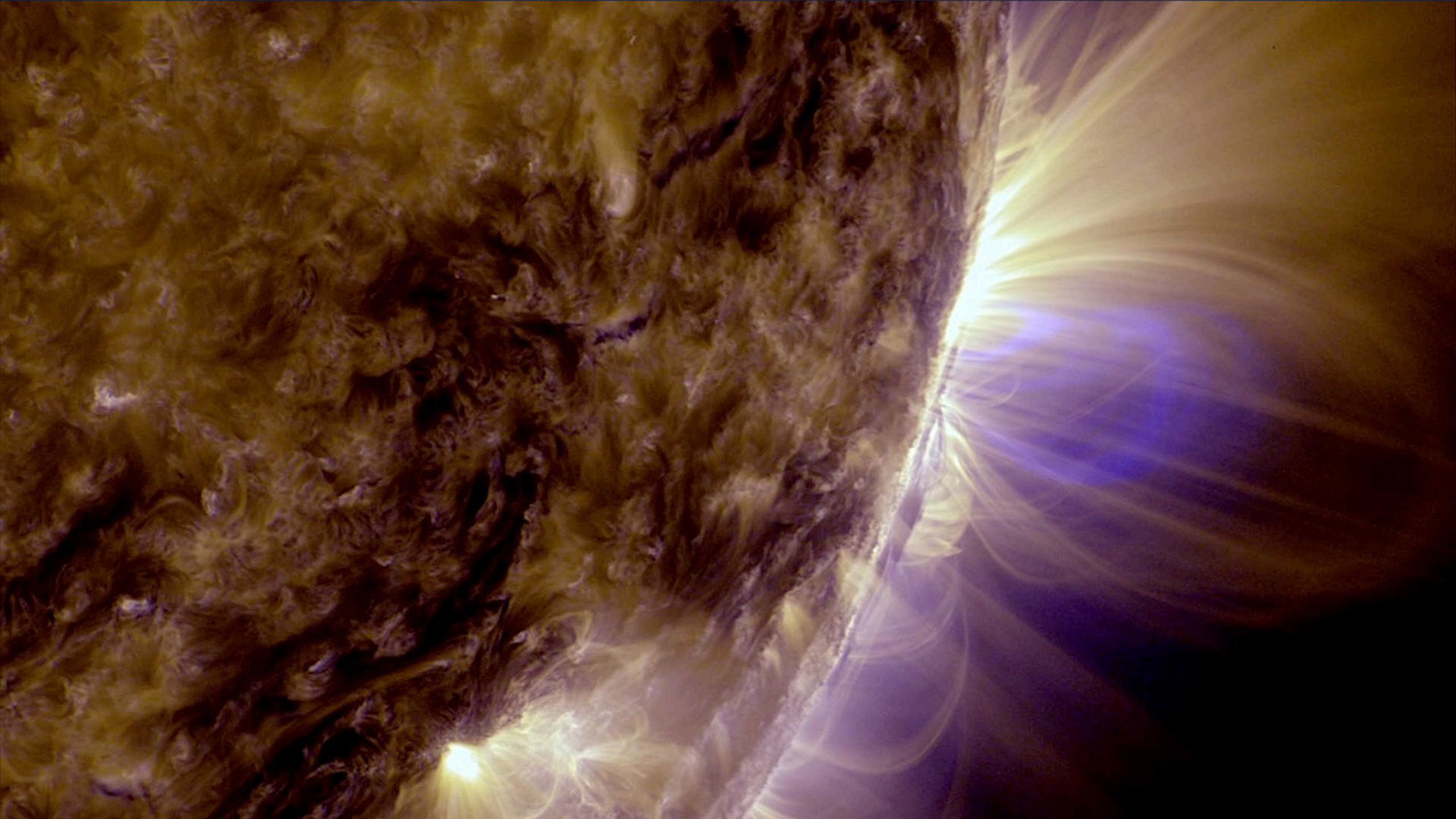
Dedicated

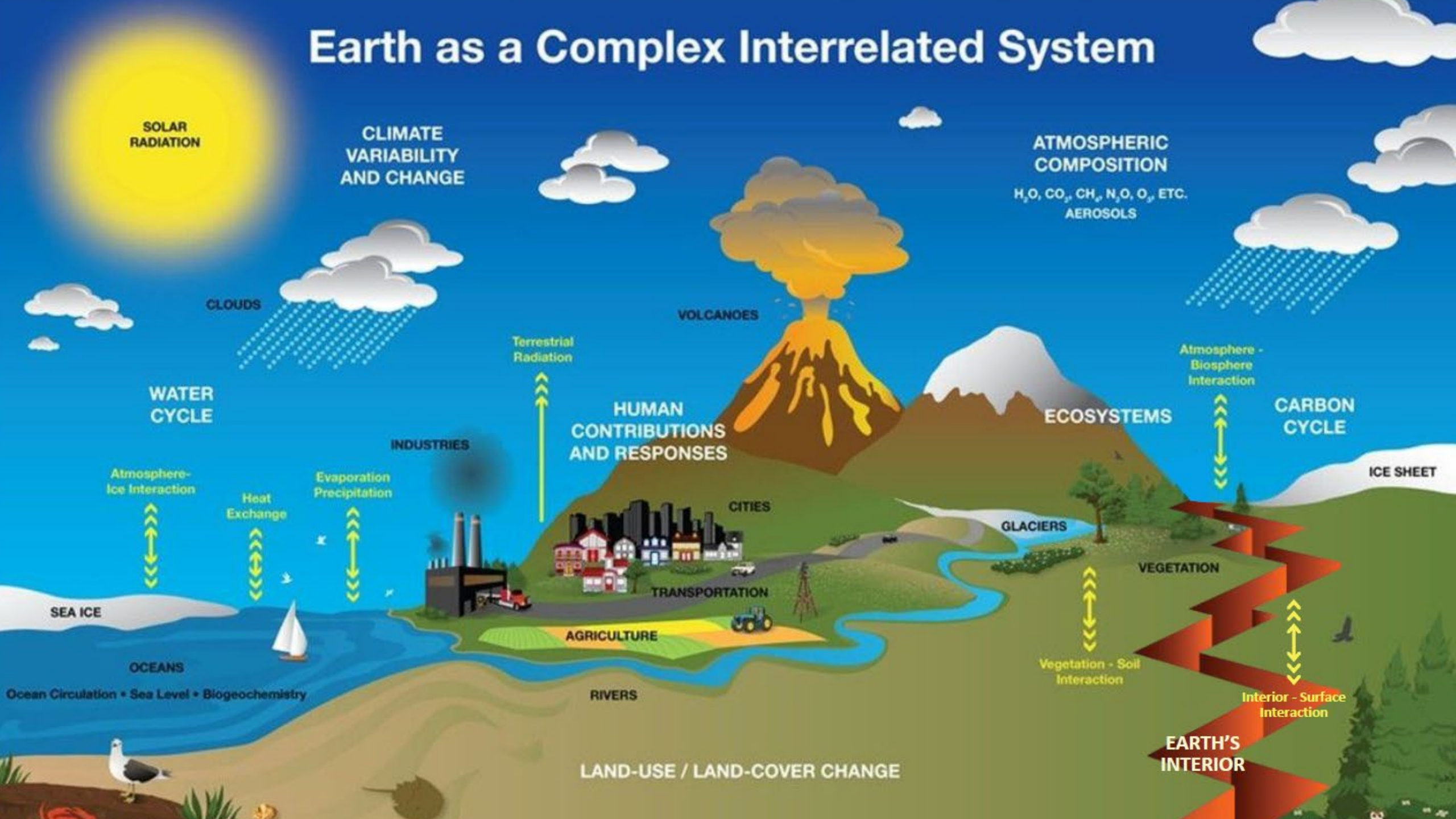
BALANCED MISSION PORTFOLIO

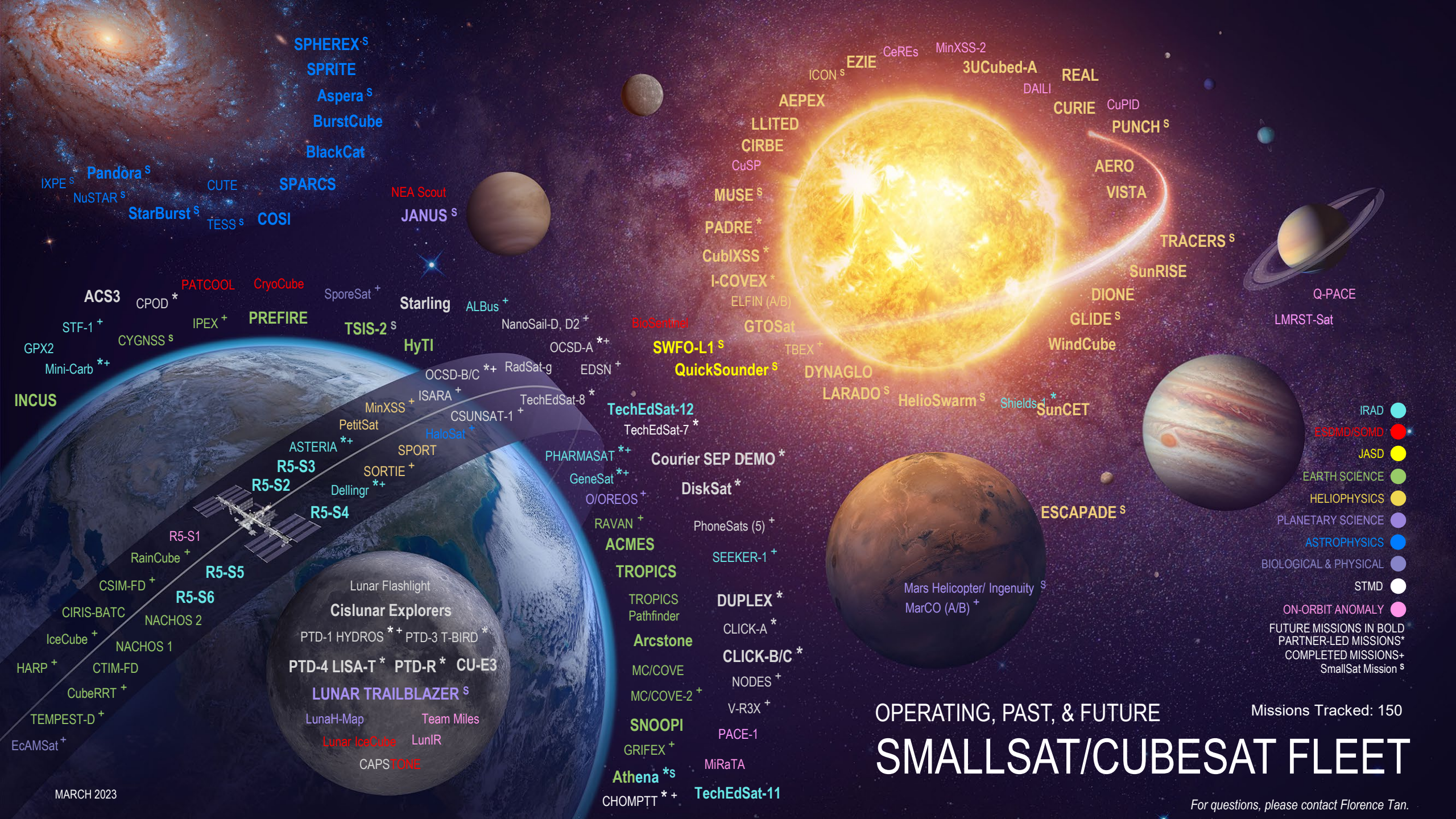


GREAT SCIENCE

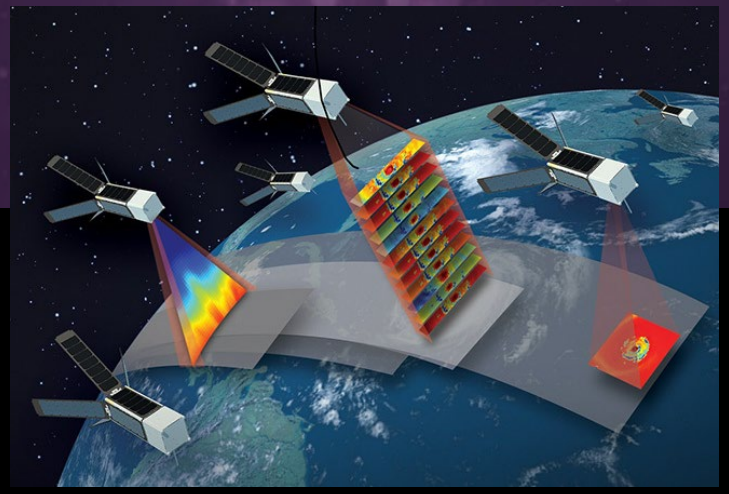

SPACE WEATHER
Researching Causes
Studying Impacts
Improving Predictions
EXOSPHERE
IONOSPHERE
STRATOSPHERE




Earth as a Complex Interrelated System
SOLAR RADIATION
CLIMATE VARIABILITY AND CHANGE
ATMOSPHERIC COMPOSITION
H_2O, CO_2, CH_4, N_2O, O_3, ETC.
AEROSOLS
CLOUDS
VOLCANOES
Terrestrial Radiation
WATER CYCLE
HUMAN CONTRIBUTIONS AND RESPONSES
ECOSYSTEMS
Atmosphere - Biosphere Interaction
CARBON CYCLE
INDUSTRIES
ICE SHEET
Atmosphere-Ice Interaction
Heat Exchange
Evaporation Precipitation
CITIES
GLACIERS
VEGETATION
TRANSPORTATION
SEA ICE
AGRICULTURE
OCEANS
Ocean Circulation • Sea Level • Biogeochemistry
Vegetation - Soil Interaction
Interior - Surface Interaction
RIVERS
EARTH'S INTERIOR
LAND-USE / LAND-COVER CHANGE


SPHEREX S
SPRITE
Aspera S
BurstCube
BlackCat
Pandora S
IXPE S
NuSTAR S
CUTE
SPARCS
StarBurst S
TESS S
COSI
NEA Scout
JANUS S
ACS3
CPOD *
PATCOOL
CryoCube
SporeSat +
Starling
ALBus +
STF-1 +
IPEX +
PREFIRE
TSIS-2 S
CYGNSS S
GPX2
Mini-Carb *+
HyTI
NanoSail-D, D2 +
OCSD-A *+
OCSD-B/C *+
RadSat-g
EDSN +
INCUS
ISARA +
MinXSS +
TechEdSat-8 *
CSUNSAT-1 +
PetitSat
HaloSat +
ASTERIA *+
SPORT
R5-S3
R5-S2
SORTIE +
Dellingr *+
R5-S4
R5-S1
RainCube +
R5-S5
CSIM-FD +
R5-S6
CIRIS-BATC
NACHOS 2
IceCube +
NACHOS 1
HARP +
CTIM-FD
CubeRRT +
TEMPEST-D +
EcAMSat +
Lunar Flashlight
Cislunar Explorers
PTD-1 HYDROS *+
PTD-3 T-BIRD *
PTD-4 LISA-T *
PTD-R *
CU-E3
LUNAR TRAILBLAZER S
LunaH-Map
Team Miles
Lunar IceCube
LunIR
CAPSTONE
MARCH 2023
ICON S
EZIE
CeREs
MinXSS-2
3UCubed-A
REAL
DAILI
AEPEX
CURIE
CuPID
LLITED
PUNCH S
CIRBE
CuSP
AERO
MUSE S
VISTA
PADRE *
TRACERS S
CubIXSS *
SunRISE
I-COVEX *
DIONE
Q-PACE
ELFIN (A/B)
GLIDE S
LMRST-Sat
GTOSat
BioSentinel
SWFO-L1 S
TBEX +
WindCube
QuickSounder S
DYNAGLO
LARADO S
HelioSwarm S
Shields-1 *
SunCET
TechEdSat-12
TechEdSat-7 *
PHARMASAT *+
Courier SEP DEMO *
GeneSat *+
DiskSat *
O/OREOS +
RAVAN +
PhoneSats (5) +
ACMES
SEEKER-1 +
TROPICS
TROPICS Pathfinder
DUPLEX *
CLICK-A *
Arcstone
CLICK-B/C *
MC/COVE
NODES +
MC/COVE-2 +
V-R3X +
SNOOPI
PACE-1
GRIFEX +
MiRaTA
Athena *S
CHOMPTT *+
TechEdSat-11
ESCAPADE S
Mars Helicopter/ Ingenuity S
MarCO (A/B) +
IRAD
ESDMD/SOMD
JASD
EARTH SCIENCE
HELIOPHYSICS
PLANETARY SCIENCE
ASTROPHYSICS
BIOLOGICAL & PHYSICAL
STMD
ON-ORBIT ANOMALY
FUTURE MISSIONS IN BOLD
PARTNER-LED MISSIONS*
COMPLETED MISSIONS+
SmallSat Mission S
OPERATING, PAST, & FUTURE
Missions Tracked: 150
SMALLSAT/CUBESAT FLEET
For questions, please contact Florence Tan.

SCIENCE MISSION DIRECTORATE (SMD) & CUBESAT/SMALLSAT OVERVIEW



CUBESAT/SMALLSAT PROGRAM REVIEWS & HIGHLIGHTS

MISSION STRATEGY & OPPORTUNITES

SMD SmallSats/CubeSats Mission Overview

Data from Jan 2003 - May 2023 *Data excludes studies unless specified*

90 MISSIONS
132 SPACECRAFT

46 *HELIOPHYSICS: 8 Studies, 38 Missions, 42% funding*
33 *ASTROPHYSICS: 20 Studies, 13 Missions, 30% funding*
28 *EARTH SCIENCE: 28 Missions, 22% funding*
25 *PLANETARY SCIENCE: 18 Studies, 7 Missions, 7% funding*
2 *BIOLOGICAL & PHYSICAL SCIENCE: 2 Missions*
2 *JOINT AGENCY SATELLITE: 2 Missions*

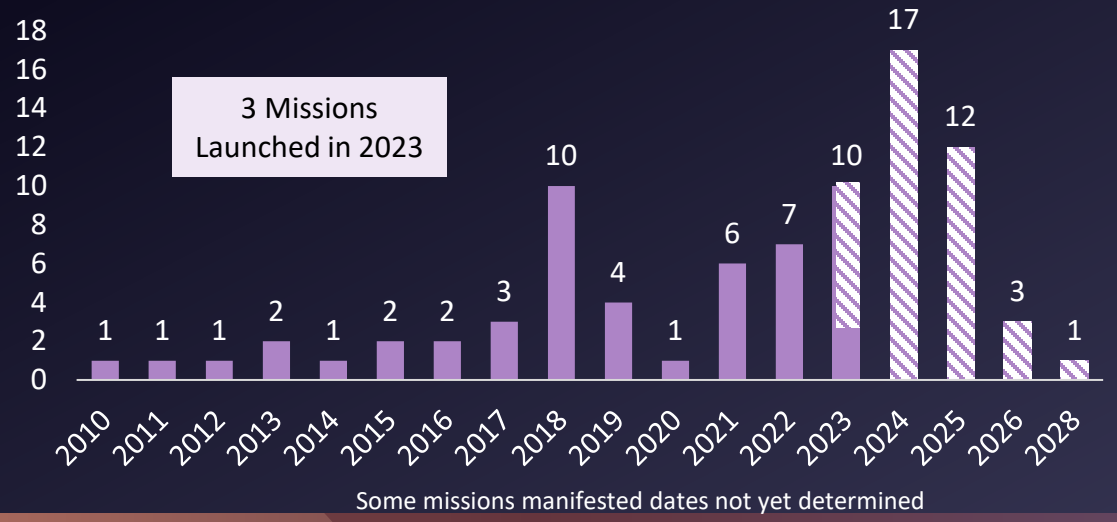
90 *MISSIONS*
46 *STUDIES*

60 Spacecraft, 44 Launches since 2010

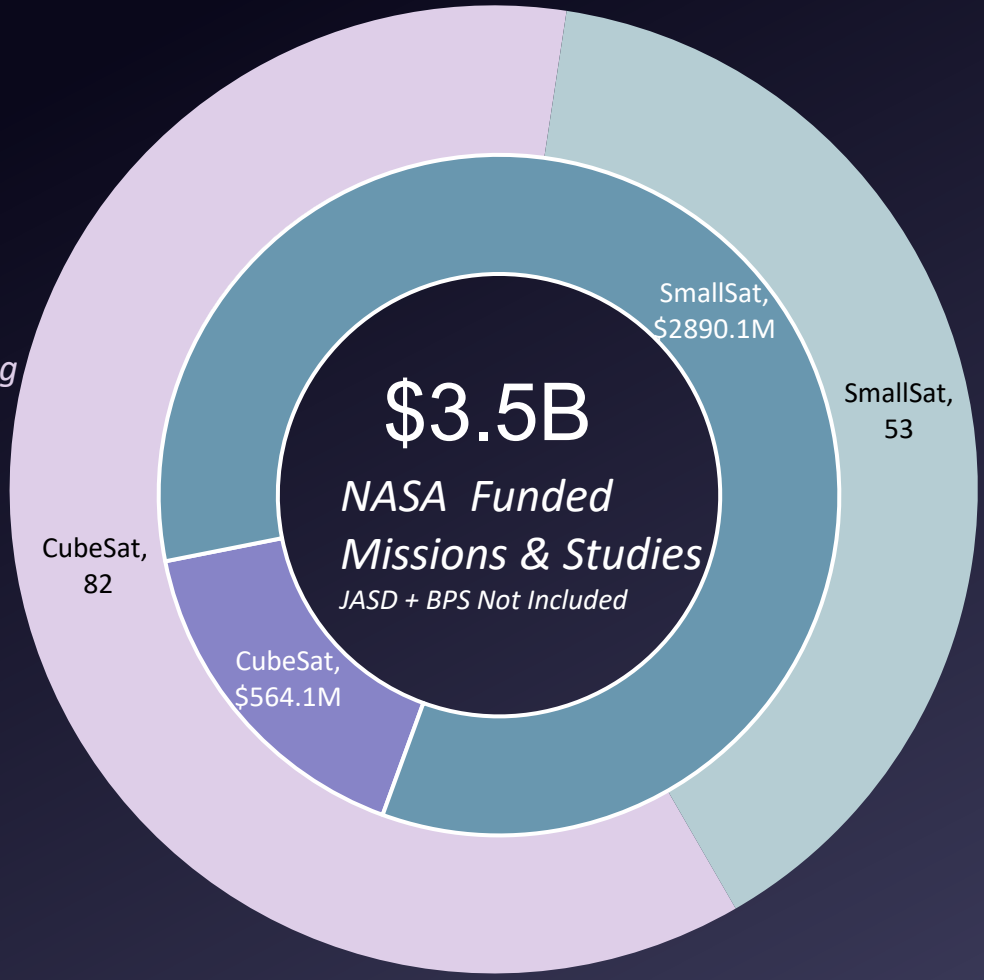
HPD has the highest amounts of total funding and highest number of awarded missions

ESD (19) have the highest number launched missions

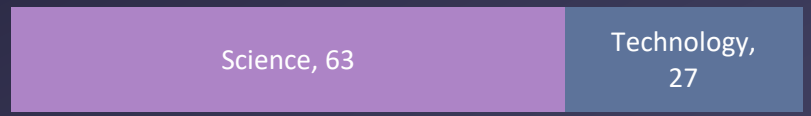
Launch Timeline



Some missions manifested dates not yet determined



Mission Themes

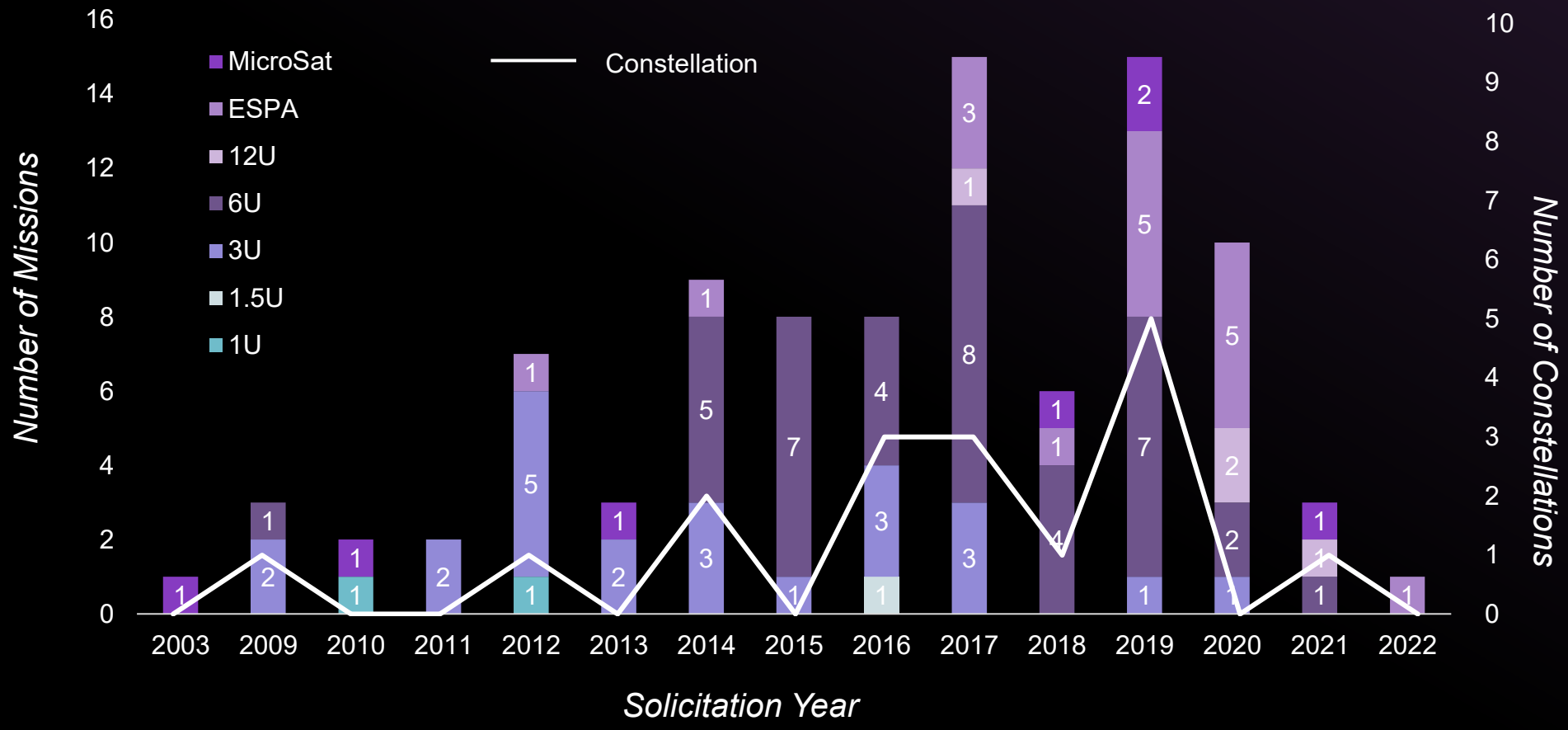


NASA SMD SmallSat Mission Trends

Excluding Studies

Data as of Jan 2023

Mission Size & Constellation Trends

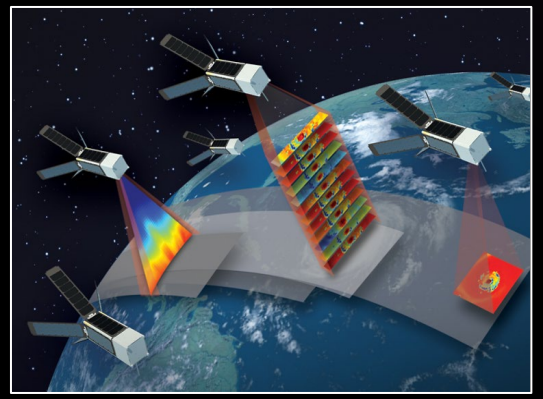


Missions Trends

- Progressively growing larger
- Trending towards constellations
- Continuing to produce more results in science collection and technology development

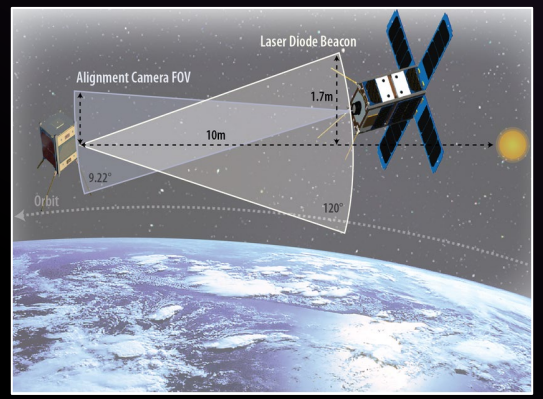
SmallSat Program Opportunities

Investing in Earth Science Constellations



Earth Venture Missions (EVM/EVI) and In-Space Validation of Earth Science Technologies (InVEST)

Major Investment in Astro SmallSat Missions



Astrophysics APRA CubeSat and PIONEERS program, Small Explorer (SMEX) Astrophysics Science SmallSat Studies

Investing in SmallSat Constellations and ESPA Class Missions

Heliophysics Technology and Science Mission of Opportunity (MoO), Small Explorer (SMEX), Medium Explorer (MIDEX), Flight Research and Technology (H-FORT) programs

Investing in Deep Space SmallSat Missions

Small Innovative Missions for Planetary Exploration (SIMPLEx)

SmallSat/CubeSat commercial engagement opportunities are essential to NASA Science's balanced portfolio, achieving distinct science objectives

SMD SmallSat and CubeSat Programs

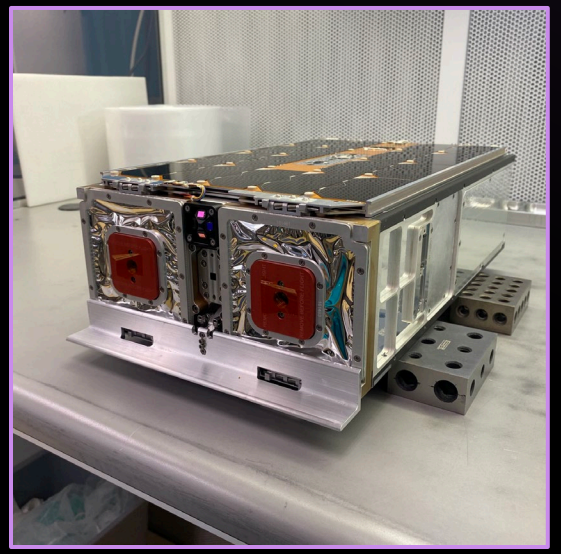
SMD Directorate	Funding Program: CubeSats	Example Missions: CubeSat	Funding Program: SmallSats	Example Missions: SmallSats
Astrophysics	APRA	SPRITE, BLACKCAT, CUTE, BURSTCUBE	PIONEERS	Starburst, Aspera, PANDORA
Astrophysics			Explorer Small Explorer (SMEX) Program	IXPE
Astrophysics			Explorer Medium Explorer (MIDEX) Program	SPHEREx
Earth Science	INVEST	ACMES, SNOOPI, HyTI, CTIM-FD, NACHOS, RainCube	Earth Venture / SMEX	CYGNSS, TROPICS, PREFIRE, INCUS, TEMPEST-D
Heliophysics	H-FORT	GTOSAT, AERO / VISTA, CURIE, REAL, CUSP	SIMPLEX-2 / SMEX / MIDEX	ESCAPADE
Heliophysics	Explorer Mission of Opportunity	SunRise, EZIE	SMEX	TRACERS, PUNCH
Heliophysics	MIDEX		STP Explorer Mission of Opportunity	GLIDE
Heliophysics			STP Explorer Mission of Opportunity	Solar Cruiser
Heliophysics			MIDEX	Helioswarm
Planetary Science	SIMPLEX-1	Q-PACE, LunaH-Map	SIMPLEX-2	JANUS
Exploration Science Strategy & Integration Office			SIMPLEX-2	Lunar Trailblazer

https://science.nasa.gov/technology/smd-technology-programs

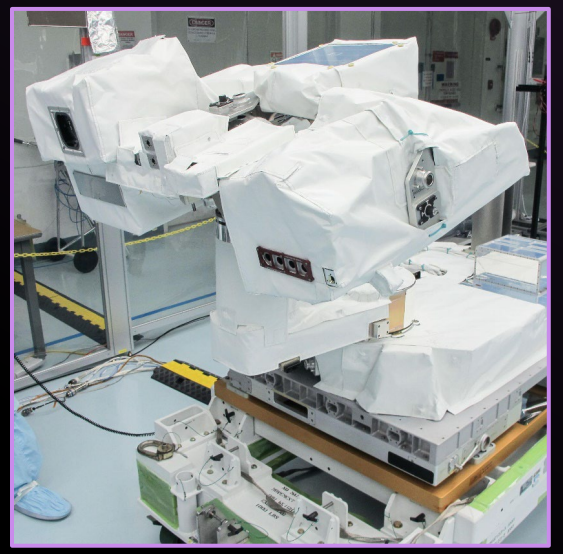
Compact Solar Irradiance Monitor-Flight Demo (CSIM-FD) / Compact Total Irradiance Monitor-Flight Demo (CTIM-FD)

Measures solar spectral irradiance (SSI), and monitoring Total Solar Irradiance (TSI) to explore how solar variability impacts the Earth's climate, contributing to long-term continuity measurements from TSIS SIM/TIM and SOURCE SIM/TIM

CSIM: 11kg CubeSat
- Built by LASP



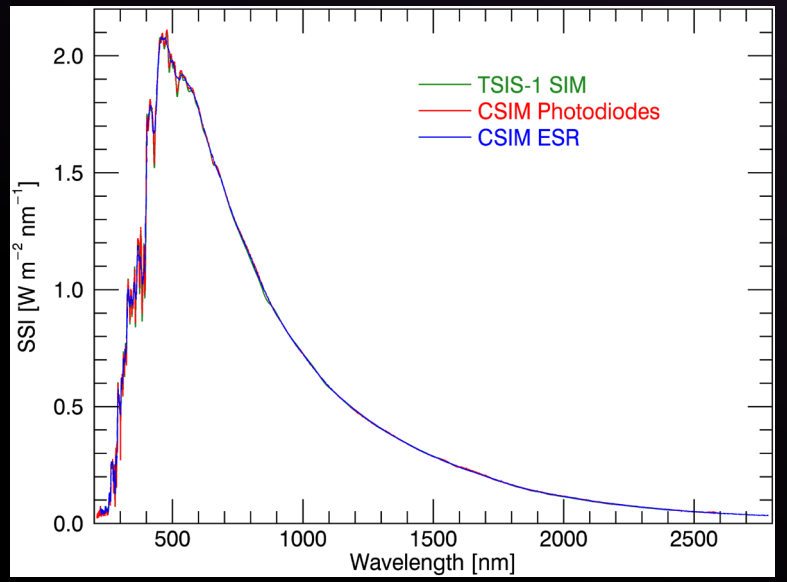
CTIM: 11kg CubeSat
- Built by LASP

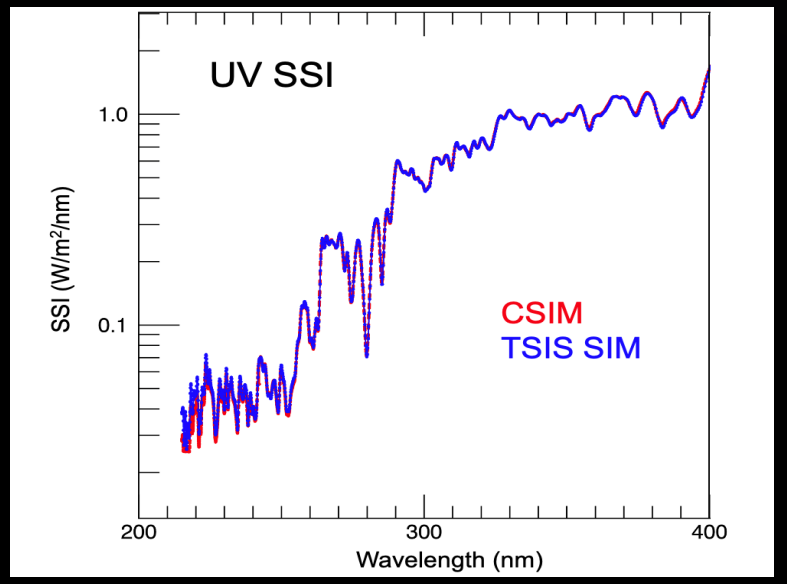


TSIS-1: 363kg
- Built by LASP
- Mounted to the ISS

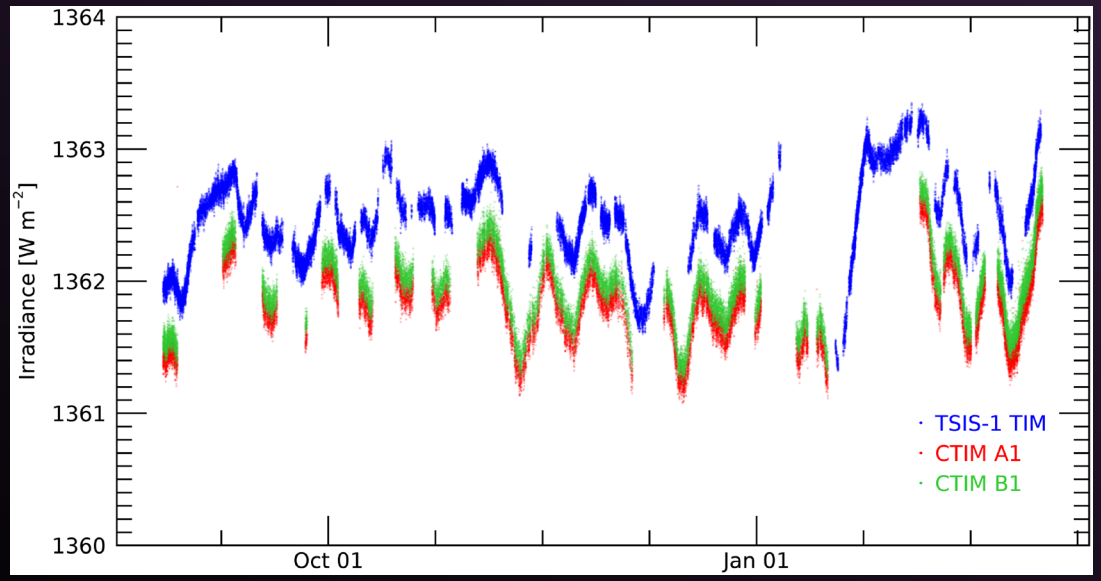
SORCE: 290kg
- On an Orbital LEOStar-2 bus

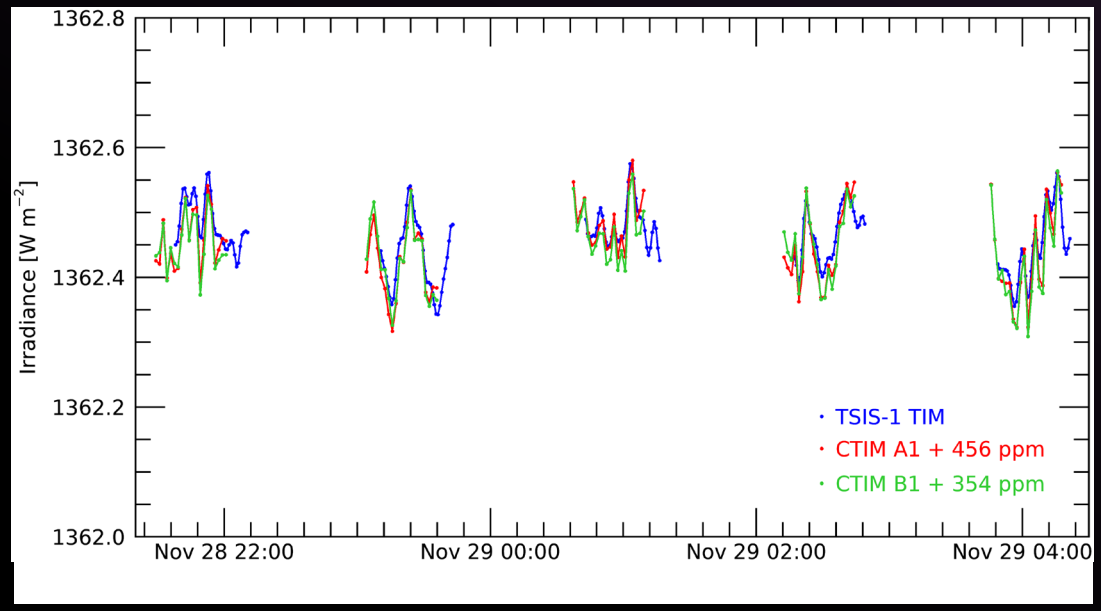
CSIM spectrum compared to TSIS spectrum





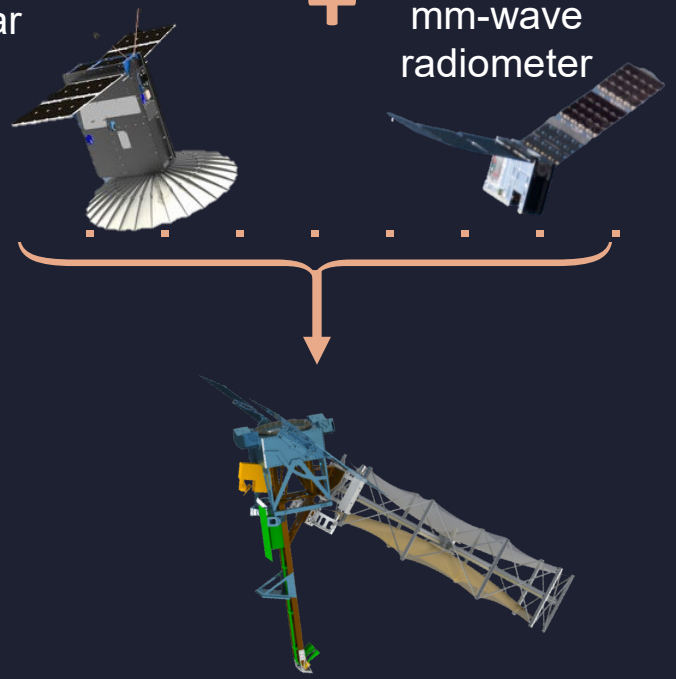
CTIM TSI measurements compared to TSIS TIM





INCUS

RainCube Ka-band radar + TEMPEST-D mm-wave radiometer

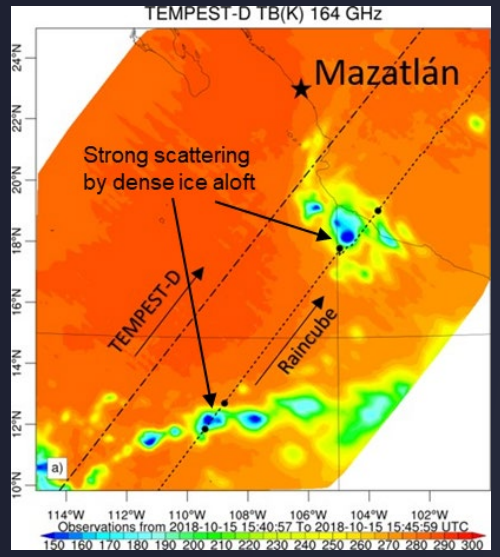


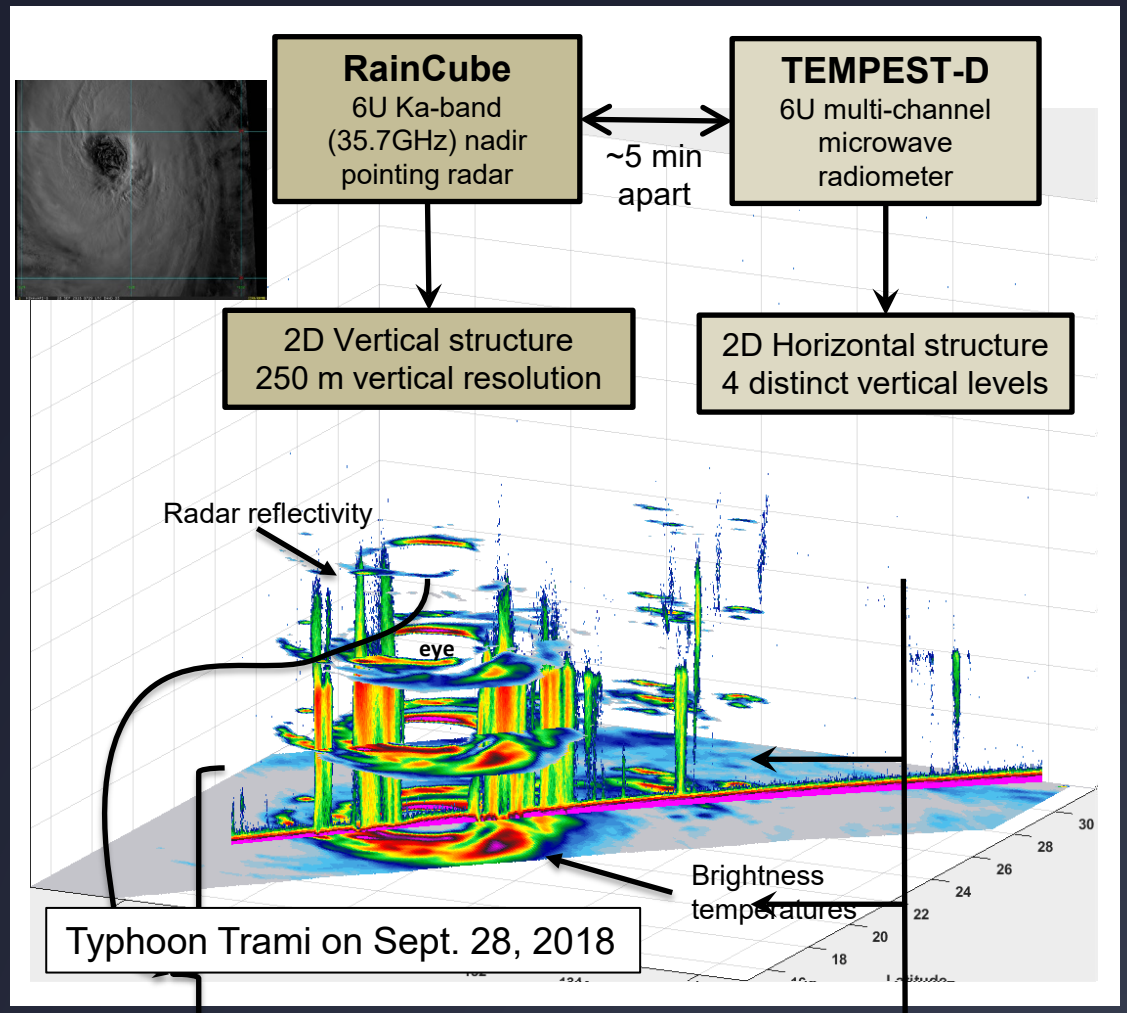
INCUS draws on the strengths of BOTH RainCube and TEMPEST-D to provide unprecedented vertical and horizontal views of storm structure and processes.

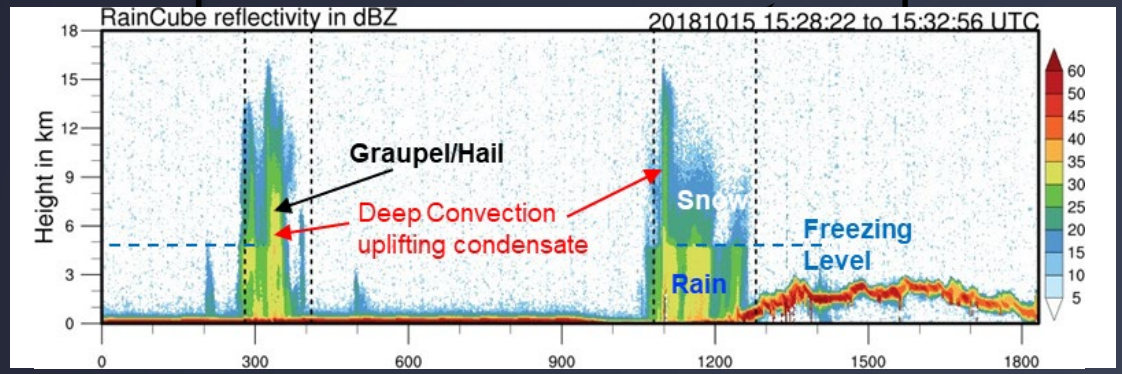
Figures and animations by Simone Tanelli, Shannon Brown and Steve Reising

(Right) On September 28, 2018, TEMPEST-D and RainCube overflew Typhoon Trami < 5 minutes apart

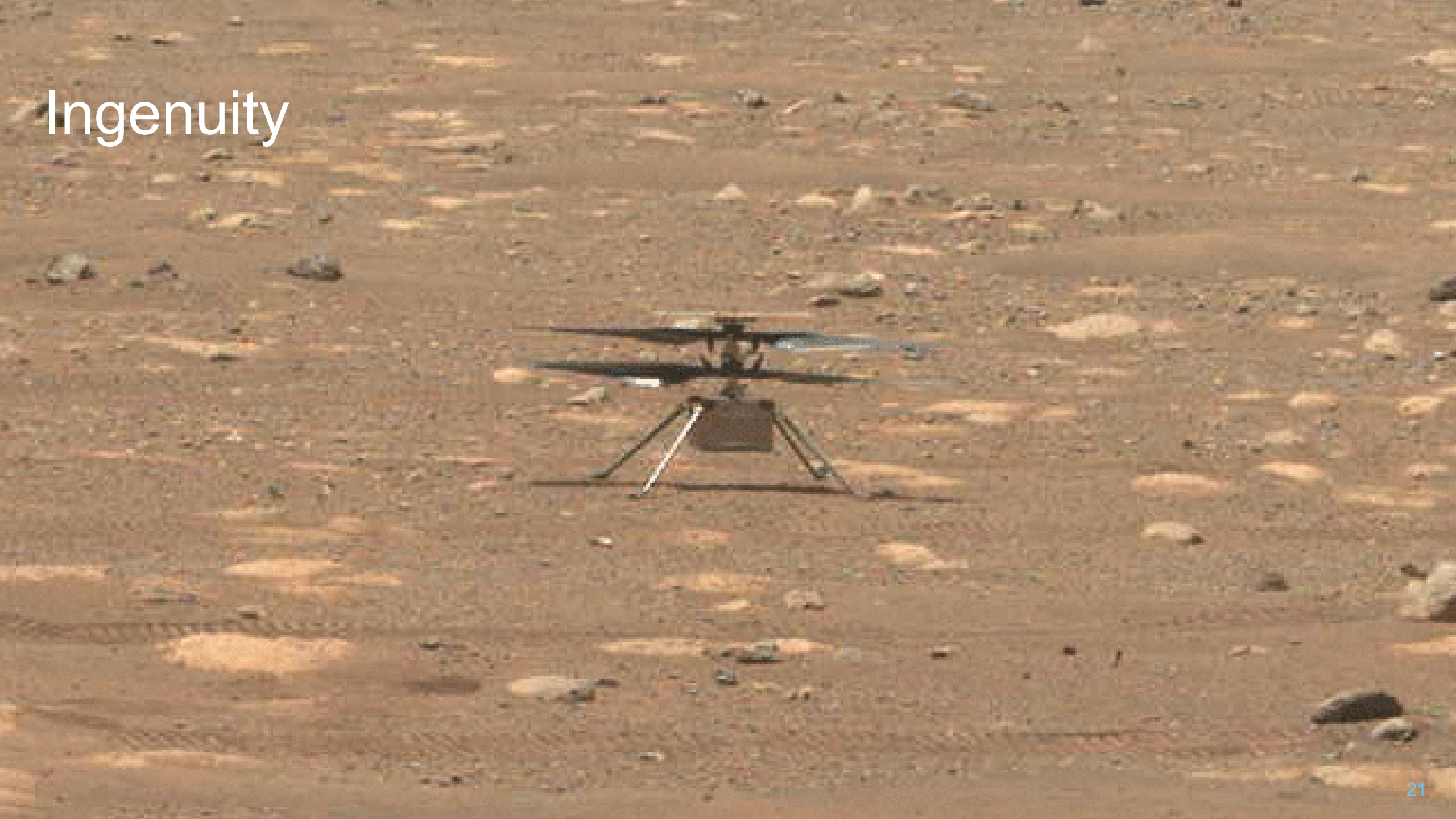
(Bottom) Correlated storm measurements from RainCube radar and TEMPEST-D radiometer over Texas, Mexico and Pacific Ocean



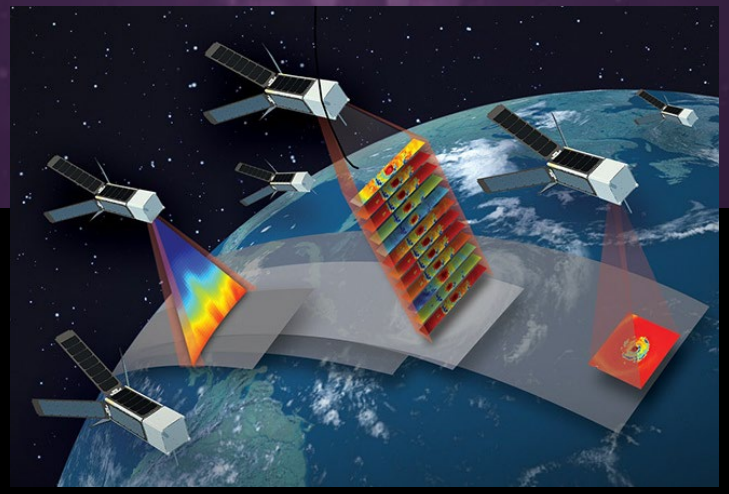




Ingenuity



SCIENCE MISSION DIRECTORATE (SMD) & CUBESAT/SMALLSAT OVERVIEW



CUBESAT/SMALLSAT PROGRAM REVIEWS & HIGHLIGHTS

MISSION STRATEGY & OPPORTUNITES

Small Spacecraft Focus Areas of Strategic Emphasis

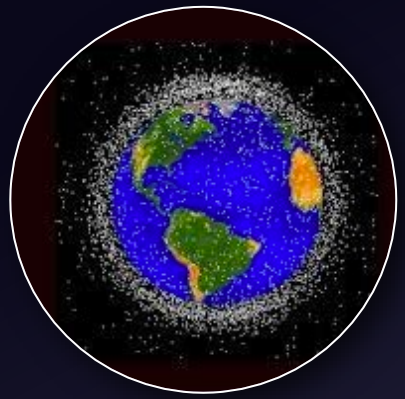
Fundamental to Enabling NASA's Overall Vision for Small Mission Activities

1 - Strategy and Implementation

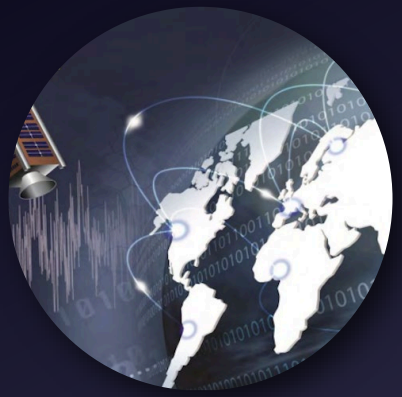
2 - S&MA, Reliability, and Technical Excellence

3 - Launch Accommodation and Rideshare

4 - Services and Infrastructure



5 – Conjunction Assessment and Mitigation

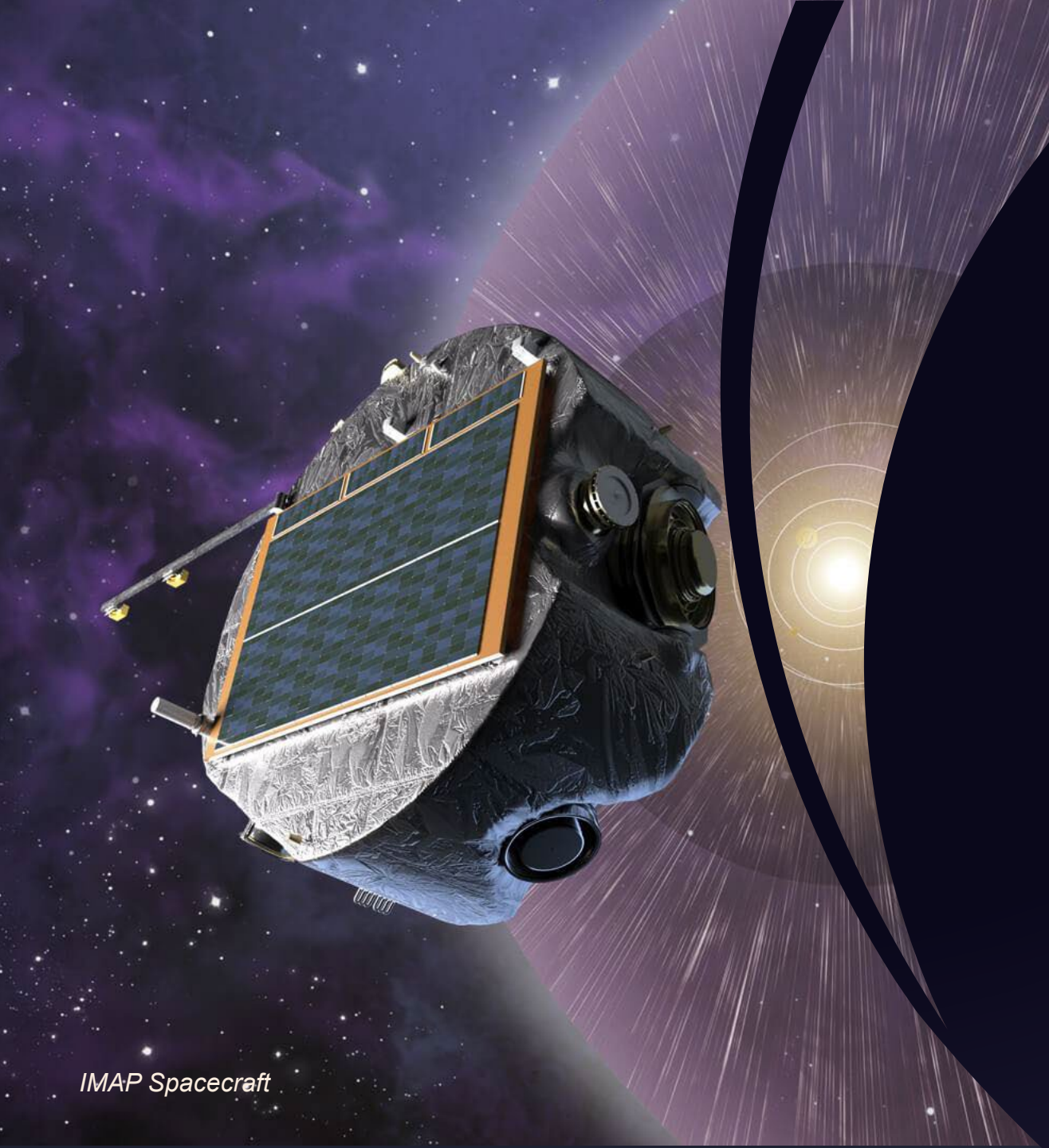


6 - Cybersecurity and Enterprise Protection

7 - Commercial Partnerships and New Space

8 - International Relationships and Outreach

Focus areas guided by National Academies' recommendations



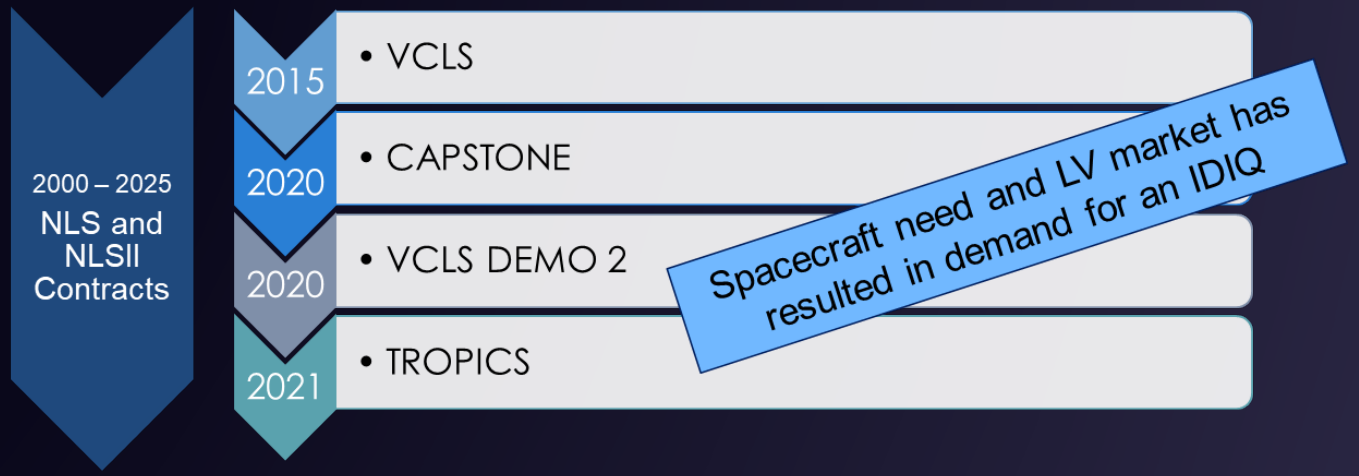
IMAP Spacecraft

SMD Rideshare Strategy

Access to Space For SmallSats on ESPA-Rings

- **SPD-32 Policy Impacts**
- NASA's Science Mission Directorate (SMD) Rideshare Policy SPD-32 provides ESPA-rings for SmallSats to utilize excess lift capacity on SMD-procured launch vehicles
- The SMD Rideshare Office manages SPD-32 implementation
- The Carruthers selection was assigned to the IMAP mission launch vehicle under the SPD-32 policy
- SMD's rideshare strategy has accelerated the frequency and diversity of science returned while maximizing launch vehicle performance

Venture-Class Acquisition of Dedicated and Rideshare (VADR) Overview



VADR IDIQ:

- FAA licensed commercial launch services
- Class D or more risk tolerant payloads; Very limited LSP mission assurance (NPD 8610.23 modified technical oversight approach)
- Multiple providers/launch vehicles
- Mission specific requirements
- Dedicated (allow option for provider to sell excess capacity) and rideshare
- Capability for CubeSats due to risk posture (e.g., UCLASS, TROPICS Pathfinder, Non-ISS)
- On-ramp capability
- The loss of these payloads will not be considered a NASA “Mishap” under NPR 8621.1. Launch vehicle mishap investigations will not be conducted as part of the VADR contract

SMD Rideshare Lead: Aly Mendoza-Hill

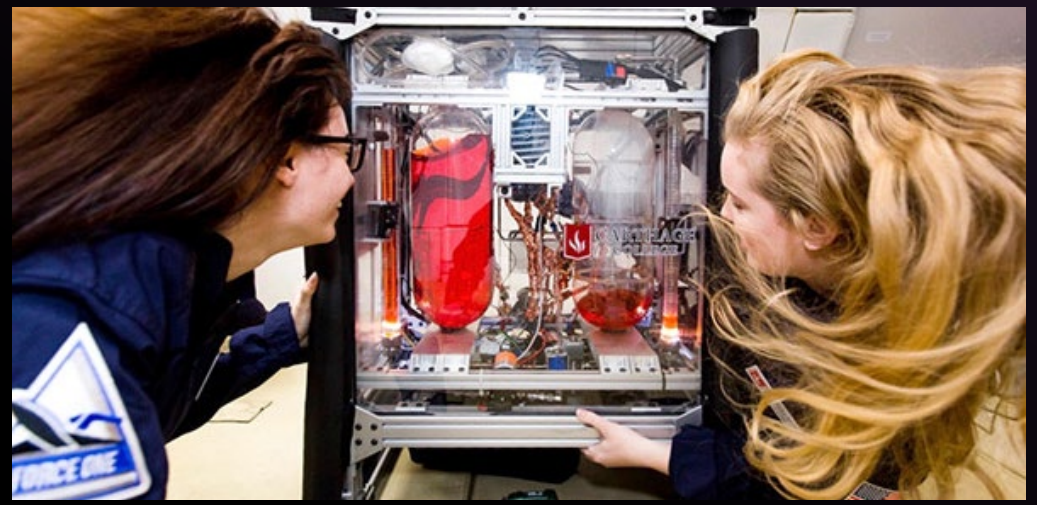
CubeSat Launch Initiative (CSLI)

NASA's CubeSat Launch Initiative (CSLI) provides launch opportunities to a variety of U.S. CubeSat developers who build small satellite payloads that fly as auxiliary payloads on previously planned launches or commercial missions to low Earth orbit and deep space destinations as well as International Space Station deployments.

https://www.nasa.gov/content/about-cubesat-launch-initiative

Flight Opportunities Mission

The Flight Opportunities program facilitates **rapid demonstration** of technologies for space exploration, discovery, and the expansion of space commerce through **suborbital testing with industry flight providers**.



www.nasa.gov/directorates/spacetech/flightopportunities

NASA TECHFLIGHTS

Includes topic areas that address agency and mission goals; up to $750K to purchase flights on suborbital or hosted orbital platforms directly from any eligible U.S. commercial flight provider

NASA TechLeap PRIZE

Challenges addressing specific NASA technology needs; previous awards have been up to $650K to build payloads, plus access to a suborbital flight test

NASA TECHRISE STUDENT CHALLENGE

Competition to inspire the next generation of space researchers; offers hands-on insight into the design and test process used by NASA-supported researchers

FLIGHTS OF OPPORTUNITY

Through collaborative internal and external relationships, the program takes advantage of opportunities to flight test valuable space technologies

Agency Initiatives

To increase access to test opportunities in relevant environments, Flight Opportunities collaborates with other NASA initiatives like **SMD's ROSES and SOMD's SubC** to help them leverage the commercial flight ecosystem

Flights of Opportunity Examples:

- In-Space Manufacturing/ ISS Program Office
- SBIR/STTR
- Intergovernmental support (Department of Defense, USDA)
- TechFlights Reflights

Small Spacecraft Systems Virtual Institute (S3VI)

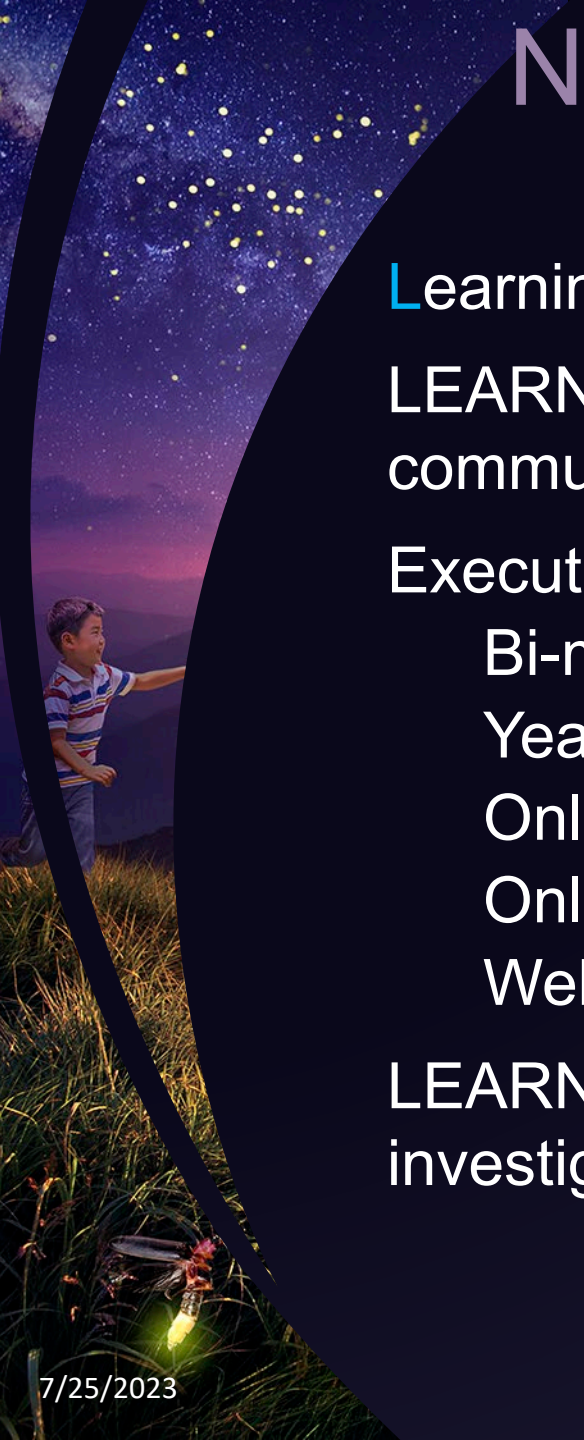
The Small Spacecraft Systems Virtual Institute (S3VI) is chartered to perform the following:

- Establish effective conduits for collaboration and the dissemination of information to increase overall awareness of NASA small spacecraft programs, opportunities and activities;
- Capture and share best practices, emerging technology opportunities, and data; facilitate and execute special studies; and
- Conduct external workshops and public events to share mission-enabling information with the small spacecraft community.
- Body of Knowledge

Activities

- Community Engagement with PI communities
  - SmallSat LEARN “Learning from Experiences, Achievements, and Resolution Navigation” Forum
  - SmallSat CoP, Science, and Industry Webinars
- Release of Small Spacecraft Technology Plan
- Occasional Technology Expo https://www.nasa.gov/smallsat-institute/2022-techexpo-agenda
- State of The Art Report at S3VI https://www.nasa.gov/smallsat-institute
- 2021 Virtual SmallSat Forum Report https://science.nasa.gov/science-red/s3fs-public/atoms/files/2021_SmallSat_Virtual_Forum_Report_final_TAGGED.pdf
- SmallSat Reliability Institute Website https://s3vi.ndc.nasa.gov/ssri-kb/
- Access to Space Opportunities (VADR, FOP, CSLI)

NASA SmallSat LEARN Forum



Learning from Experience, Adversity and Resolution Navigation

LEARN is a comprehensive approach to information exchange, community discussions and networking

Execution of LEARN

- Bi-monthly virtual mission introductions and community discussions
- Yearly in-person gathering for information exchange and networking
- Online platform for community engagement
- Online repository of issues, risks and lessons learned
- Website

LEARN Forum is primarily for NASA-funded missions principal investigators, systems engineers and project managers

The Future is Bright with SmallSats

SmallSats are now an integral part of NASA science strategy

"Destination drives the Science" and the "Science determines the platforms"

We continue to invest in technologies and partner with industry to develop reliable flight systems while maintaining a culture of innovation

SmallSats is a a way of growing science community and is an innovation that broadens thought horizons of the science community


florence.w.tan@nasa.gov
"Twenty years from now you will be more disappointed by the things that you didn't do than by the ones you did do. So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore. Dream. Discover." Mark Twain

Virtual Meeting

Frequency: every 2 months

Format: 1.5-hour meeting

- 15 min: Mission 1 introduction, issues, risks and lessons learned
- 15 min: Mission 2 introduction, issues, risks and lessons learned
- 15 min: Mission 3 introduction, issues, risks and lessons learned
- 45 min: Open community discussion and missions Q&A

Attendance: request invitation and access using the LEARN Forum website

https://www.nasa.gov/smallsat-institute/LEARN

In-Person Forum

Frequency: once a year around October

Location: varies every year (WFF 2022, LaRC 2023)

Format: 2 days of presentations, panel discussions, classes, workshops and facility tours

Attendance: request invitation using the LEARN Forum website. Registration not open yet for 2023. An email will be sent to the distribution list for once registration is open.

2022 In-Person Forum @ Wallops Flight Facility

PSYCHE

Challenges

Increasing popularity on LEO destinations

Orbital Debris

Spectrum Licensing

Cybersecurity

Access to space to the “hard” destination Secondaries are beholden to primary’s launch schedule, cleanliness, C3 e.g. Janus targets not accessible because Psyche delayed

Supply Chain issues

subsystems and parts

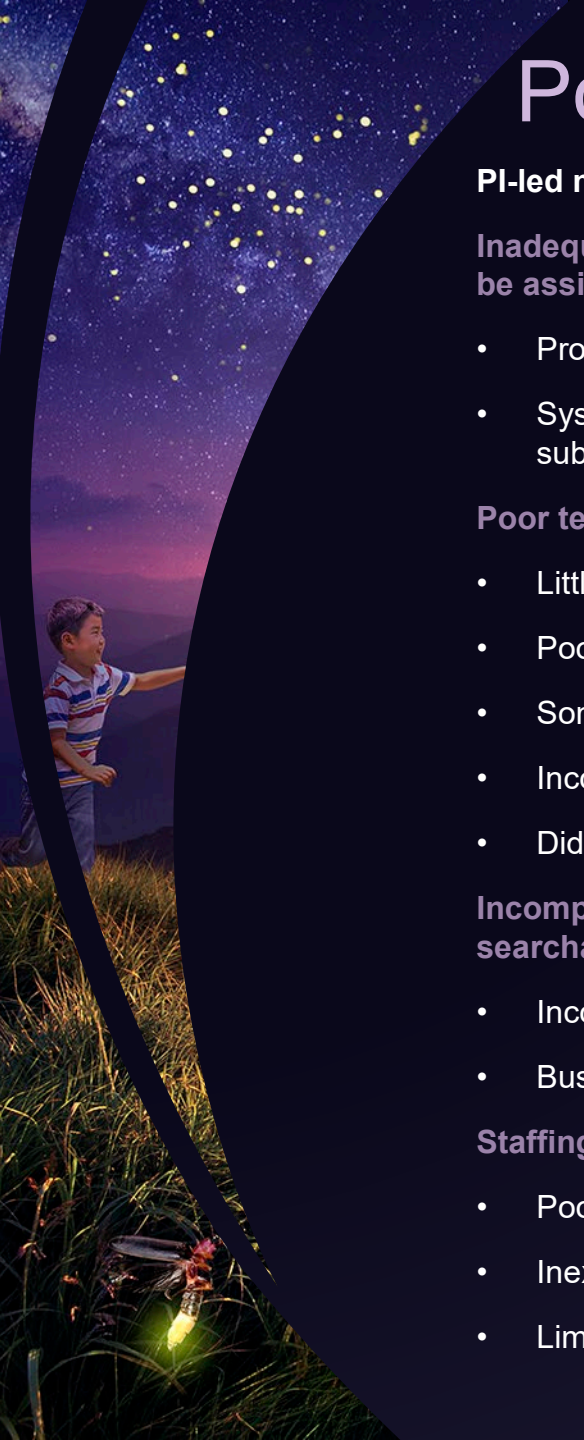
Training the next generation

Reliability of key components

especially deep space, GEO, cis-lunar

Lessons Learned for mission success

- **Active management** of gate reviews, adequate staffing, robust documentation process, and proper funding levels, experience mentors essential to provide guidance for Test Planning and Good systems engineering are keys to mission success, provide effective balance of insight vs oversight, flexibility in baseline vs threshold requirements
- **Access to Space policies** provide rapid access to space
- **Coordination of Intentional investments** in key low SWaP technologies accelerate science discoveries with SmallSats
- **Community of Practice** to build a robust and vibrant community of SmallSat practitioners to keep abreast of industry services/offerings for science investigations and technology demonstrations
- **Supportive policies** to provide "**institutional scaffolding**" such as policy guidance on spectrum licensing, conjunction analysis, cybersecurity planning are critical for small teams



Possible Reasons for Failure/On-Orbit Anomalies

PI-led missions and PIs have full discretion of mission build and operation:

Inadequate gate reviews/systems engineering challenges ➔ recommend minimum gate reviews, senior experienced personnel to be assigned at the inception for best "setup for success"

- Project planning and scheduling and resource loading (missions work on limited funds);
- System engineering design planning – e.g. understand grounding, intentional state of health HK data collection to identify the minimum subset needed at right sampling cadence; test data analysis planning/trending, test setup planning (eg plan to have a testbed)

Poor test planning and Incomplete and inadequate testing campaign ➔ Recommend minimum test criteria and end-to-end testing

- Little to no workmanship inspection
- Poor subsystem testing (including risk reduction subsystem environmental tests)
- Some missions did not perform complete End to End testing including comm testing
- Incomplete or no environmental testing
- Did not achieve minimal On-Orbit Anomaly free hours of operation (some missions shipped w 0)

Incomplete or poor documentation process (hard to test and understand test results) **➔ recommend be sustainable/ searchable/accessible configuration management setup (doesn't have to be expensive)**

- Inconsistent test documentation
- Bus manufacturer went bankrupt, delivered system that had inadequate documentation

Staffing Irregularities ➔ Recommend Assignment

- Poor staffing coverage – competition other higher priority missions
- Inexperience Staff
- Limited Mentoring connections

2022 In-Person Forum Agenda

October 25 Agenda

TIME	SESSION	SPEAKER(S)
7:30-8:30 AM	REGISTRATION/CHECK-IN	
8:30-8:45 AM	WELCOME AND WALLOPS FLIGHT FACILITY OVERVIEW	DAVID PIERCE
8:45-8:50 AM	SAFETY, LOGISTICS, SCHEDULE	ERIN MAJEROWICZ
8:50-9:05 AM	LEARN INTRODUCTION	FLORENCE TAN
9:05-9:15 AM	ANNOUNCEMENTS	BRUCE YOST
9:15-9:45 AM	SMALLSAT SPACECRAFT BUS STATE-OF-THE-ART	LUIS SANTOS
9:45-10:00 AM	BREAK	
10:00-11:00 AM	SMALLSAT ENGINEERING PANEL	MODERATOR: LUIS SANTOS PANELISTS: ALAN RHODES, GREG DECHAINE, DAVID HINKLEY, KERRY GONZALES and MICHAEL SAING
11:00-11:30 AM	SPECIAL TOPIC 1: SMD RIDESHARE	ALY MENDOZA-HILL
11:30-1:00 PM	LUNCH	
1:00-2:00 PM	SMALLSAT PI/PM PANEL	MODERATOR: EFTHYIA ZESTA PANELISTS: RICK KONHERT, AMIR CASPI, DANIEL KOCEVSKI, ANH NGUYEN and WILLAM BLACKWELL
2:00-2:30 PM	SPECIAL TOPIC: CARA INTRODUCTION	JOSHUA KRAGE
2:30-2:45 PM	BREAK	
2:45-3:30 PM	STMD SPECIAL TOPIC	JUSTIN TREPTOW
3:30-4:00 PM	SPECIAL TOPIC 3: COSTING TOOLS	MICHAEL SAING
4:00-5:00 PM	OPEN FORUM	MODERATOR: FLORENCE TAN

October 26 Agenda

TIME	E-104, ROOM 116	E-104, ROOM 214	E100 AUDITORIUM
8:30-9:30 AM	RADIATION EFFECTS & EEE PARTS SELECTION *MICHAEL CAMPOLA*	F PRIME OPEN-SOURCE FLIGHT SOFTWARE PRODUCT LINE *TIM CANHAM & JEFFREY LEVISON*	WALLOPS ISLAND TOUR
9:30-10:30 AM	GUIDE TO WORKING WITH THE NASA SHARED SERVICES CENTER (NSSC) *JIM HIBBS*	MISSION CORNER: ACTIVE THERMAL CONTROL FOR MULTISPECTRAL EARTH SENSORS (ACME) *LUCAS ANDERSON*	
10:30-11:30 AM	SAFETY AND MISSION ASSURANCE FOR SMALLSATS *JESSE LEITNER*	ANOMALIES REPORTING *CRAIG BURKHARD & VICKY LE*	
11:30-12:30 PM	*LUNCH AT THE ROCKET CLUB*		
12:30-1:30 PM	INTRODUCTION TO SMALL SPACECRAFT SYSTEMS VIRTUAL INSTITUTE (S3VI) TOOLS *CRAIG BURKHARD & ROBBIE ROBERTSON*		
1:30-2:30 PM	CONJUNCTION ASSESSMENT RISK ANALYSIS (CARA) IMPLEMENTATION *JOSHUA KRAGE*	COMMUNICATIONS LICENSING 101 *WILLIAM HORNE*	MAIN BASE TOUR
2:30-3:30 PM	ORBITAL DEBRIS ASSESSMENT REPORT (ODAR) OVERVIEW *CHRISTOPHER OSTROM*	CYBERSECURITY/ ENCRYPTION *REYNALDO ANZALDUA*	
3:30-4:30 PM			CLOSING SESSION: HQ OFFICE HOUR & LEARN FORUM FEEDBACK *FLORENCE TAN*

Online Community Engagement

Linked-In group by the community for the community

Single place to engage with the NASA SmallSat community

- Ask questions
- Share information
- Create new contacts

https://www.linkedin.com/groups/14097449/

Online Repository

IN THE WORKS

The main purpose is to collect issues, risks and lessons learned into a single online searchable tool

Most likely will be tied with the Small Satellite Reliability Initiative (SSRI) Knowledge Base website

LEARN Forum Website

https://www.nasa.gov/smallsat-institute/LEARN

LEARN Forum Overview – registration link

Upcoming Session information

In-Person Forum information

Contact Us

Session Archive