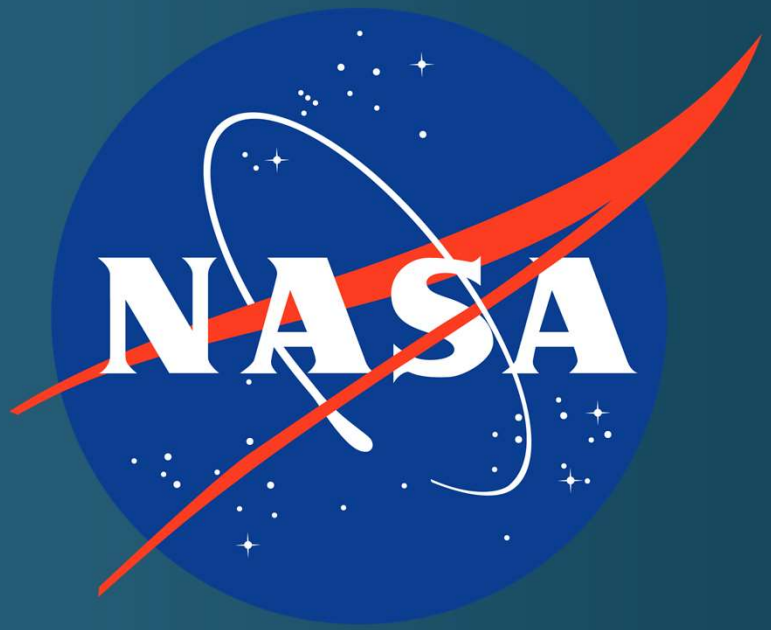
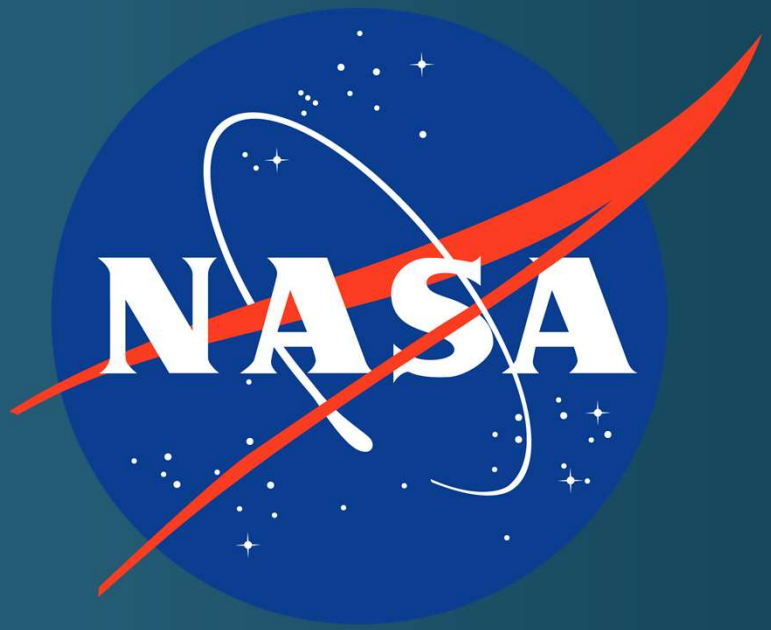

National Aeronautics and
Space Administration
NASA
EXPLORE EARTH
Earth Science Division Community
Forum • November 30, 2022
Karen St Germain



Logistics

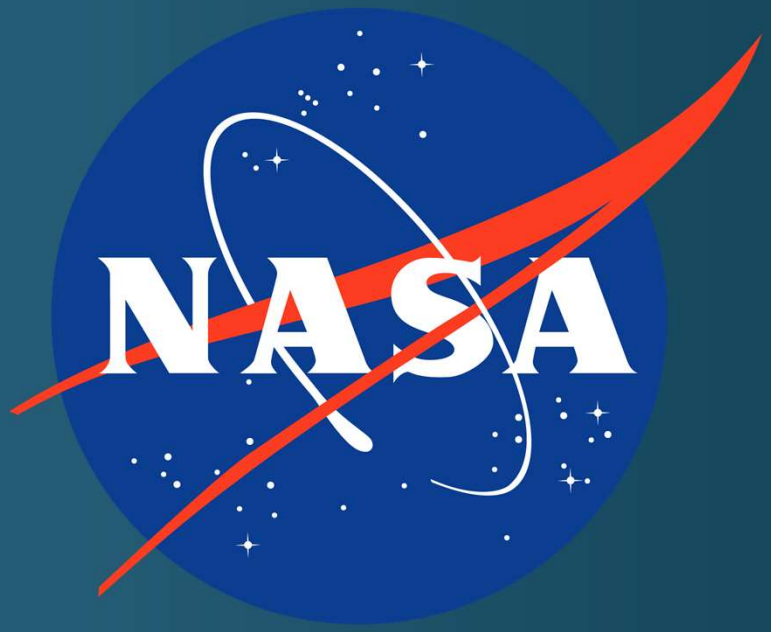
- We are recording today's forum
- Post questions in Q&A box (bottom right)
- Closed captioning available (bottom left)



Agenda

- Response to ESO Independent Review Board recommendations
- GeoCarb Cancellation
- Additional ESD Updates

ESO and IRB Background

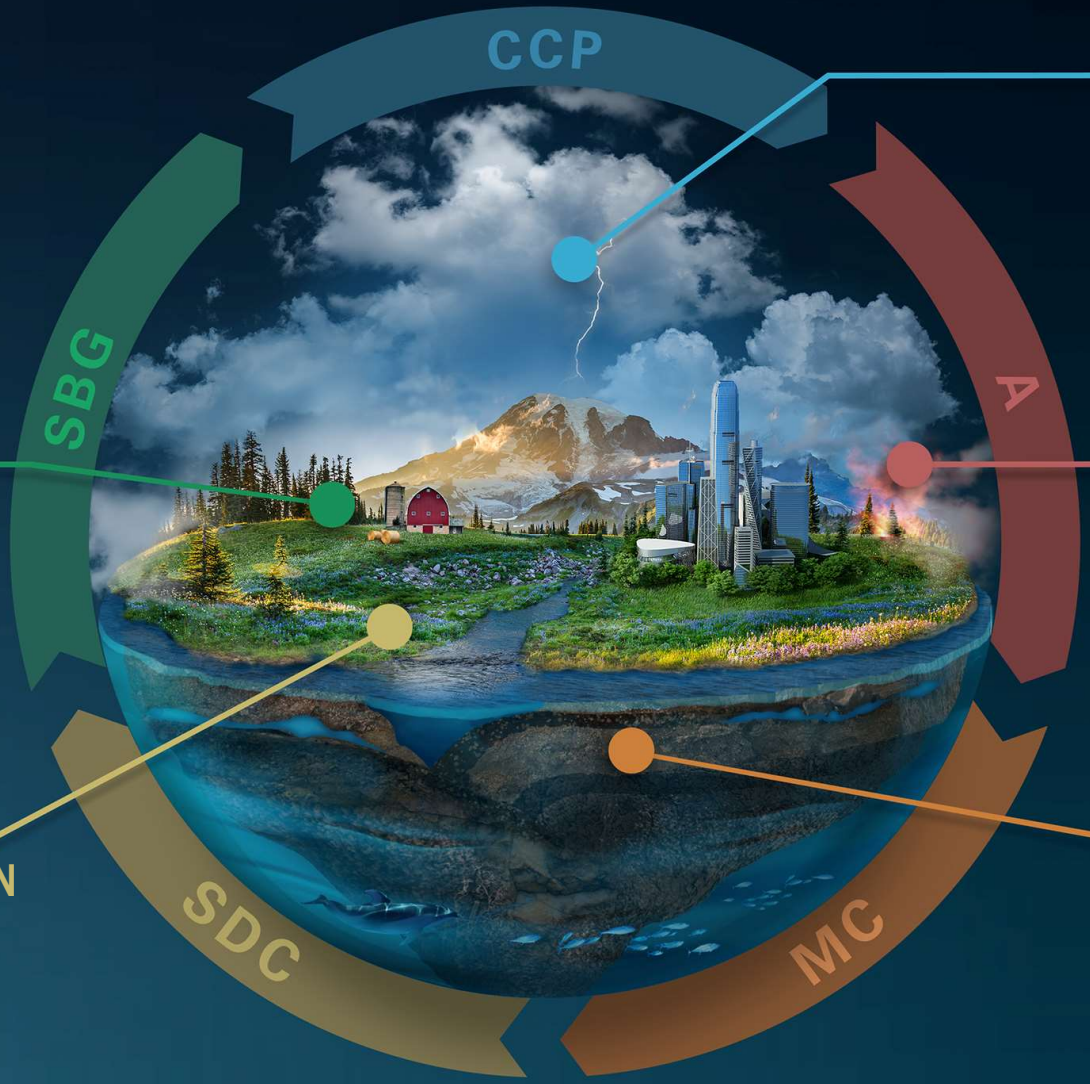


Big-Picture Overview

- ESD believes we can achieve Decadal Survey threshold science requirements within our current appropriations and the President's Budget request
- If critical issues arise, NASA will report back to the Committee on Earth Science and Applications from Space (CESAS) of the National Academies of Science, Engineering, and Medicine (NASEM)

EARTH SYSTEM OBSERVATORY

INTERCONNECTED CORE MISSIONS



CLOUDS, CONVECTION AND PRECIPITATION

Water and Energy in the Atmosphere

AEROSOLS

Particles in the Atmosphere

MASS CHANGE

Large-scale Mass Redistribution

SURFACE BIOLOGY AND GEOLOGY

Earth Surface & Ecosystems

SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics

Earth System Observatory (ESO) Overview

The Earth System Observatory

Developed in response to the National Academies of Sciences, Engineering, and Medicine "Decadal Survey for Earth Science and Applications from Space 2017–2027" (ESAS 2017)

ESAS 2017 recommended NASA implement a set of space-based observation capabilities beyond its current program of record to address Designated Observables (DOs) essential to the overall program

ESO missions to address the DOs:

- Atmosphere Observing System (AOS)
- Surface Biology and Geology (SBG)
- Mass Change (MC)
- Surface Deformation and Change (SDC)

ESO Overview

ESO to operate under SMD's new **Open-Source Science Policy**

Collaborative, accessible, inclusive, transparent, and reproducible from the beginning

ESD initiated two studies on **common data approaches**

- **Data processing study** to examine data system efficiencies and promote Open Science principles, including co-location of mission data to enable Earth system science and applications
- **Latency study** to evaluate flight hardware and ground system architectures to **minimize product latency** and support cross-ESO science product generation

Independent Review Board (IRB) Background

NASA Science Mission Directorate Associate Administrator established an Independent Review Board (IRB) to assess plans and goals for the ESO

IRB chartered to:

- Review technical concepts developed during preliminary formulation to date for robustness
- Review ESO's ability to satisfy mission's essential requirements
- Ensure NASA is adopting lessons learned from experience with previous large, strategic science missions

IRB Findings and NASA Responses

Science Priorities

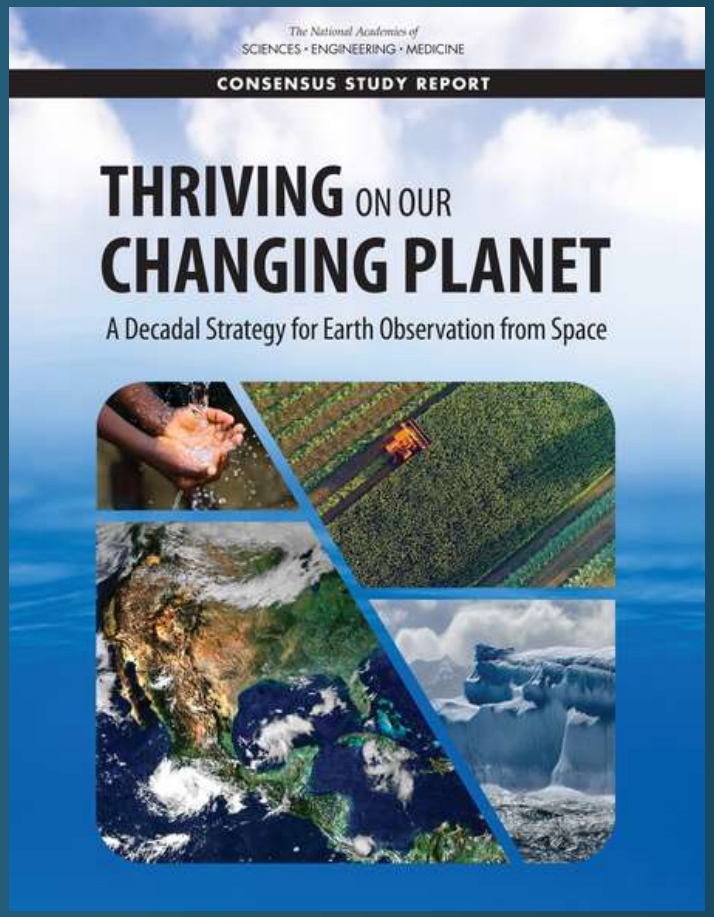
IRB Findings

- Context: missions positioned to deliver important science via combo of advanced capabilities, mature partnerships, and critical continuity
- Challenges
  - Inherent tension between staying within costs targets and advancing capabilities to maximize science
  - Most cost mitigation strategies recommended in the decadal survey have already been exercised
  - May require consultation with NASEM if cost targets and/or science thresholds deviate significantly from the decadal

Science Priorities

NASA Response

- NASA concurs with the IRB assessment that Program of record challenges, COVID, and inflation have strained the budget and delayed the start of the Decadal missions
- NASA has endeavored to put together a program that achieves at least the threshold science anticipated in the Decadal Survey
- NASA concurs: upcoming NASEM mid-term review will provide valuable feedback



Decadal Survey Alignment

IRB Top Findings

- Overall: DS science priorities are met by current plan
- Recommendation: NASA should collaborate with CESAS for community input

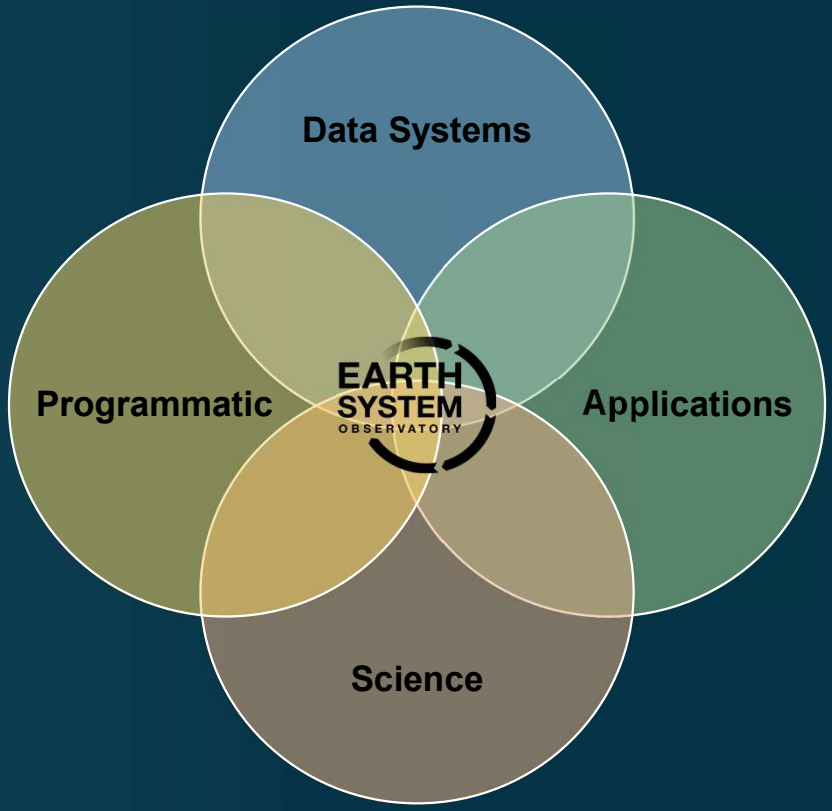
NASA Response

- NASA concurs with recommendation
- NASA will work with CESAS through the midterm review process to solicit community feedback as needed

Integrated ESO Program Structure and Resources

IRB Top Findings

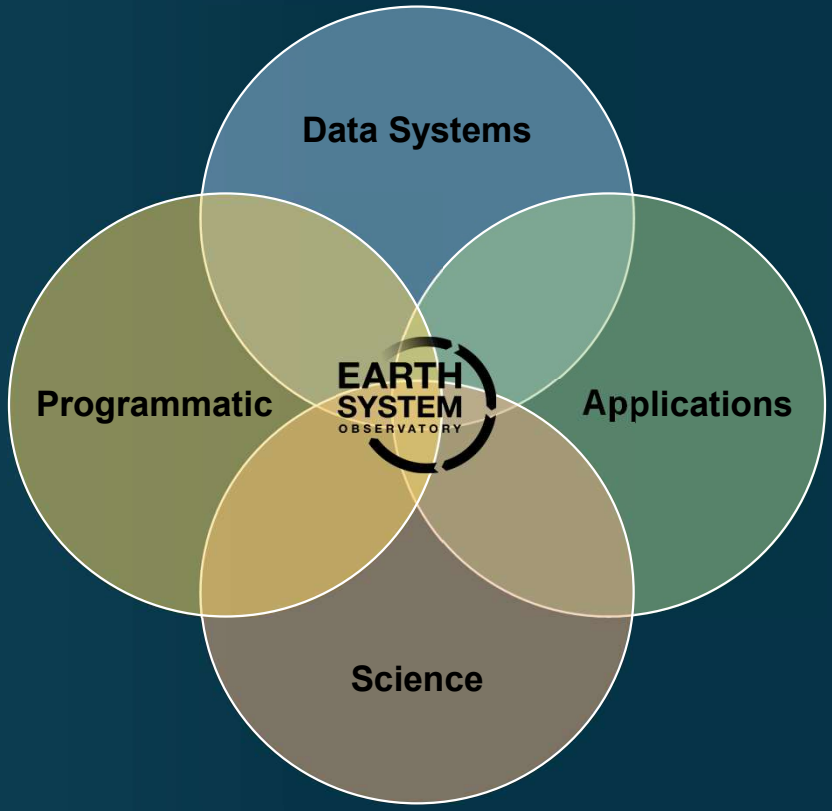
- Overall: encouraged NASA's approach of prioritizing early involvement of integrated science and applications teams, with data management teams also intimately involved in developing policy and technical solutions from the outset
- Recommendation: ESO-wide effort to define data system and software requirements of integrated cross-mission science and applications
- Recommendations: develop solutions for integrating the missions into coherent observatory structure, including programmatic integration, science, data management and utilization and applications
- Recommendation: NASA should seek opportunities to optimize complementarity of observations and consider structural and personnel plans to ensure an integrated ESO

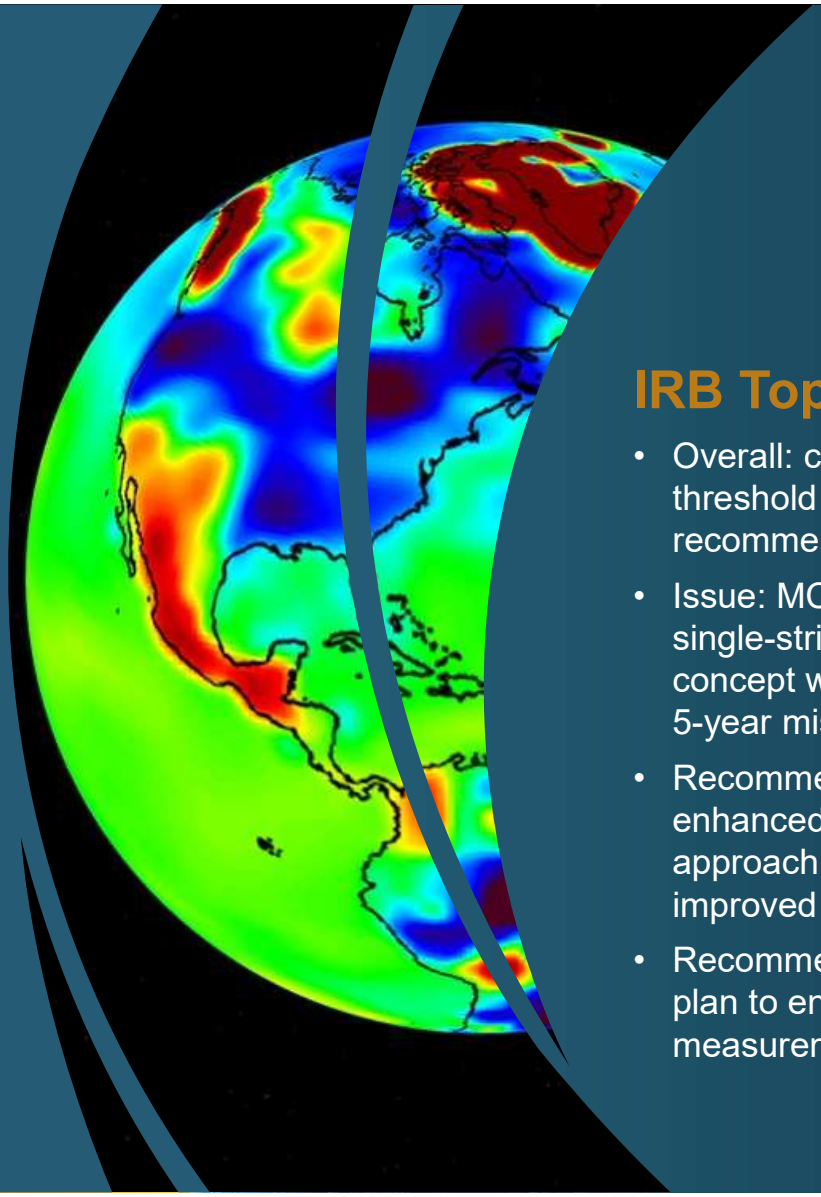


Integrated ESO Program Structure and Resources

NASA Response

- NASA concurs with IRB's recommended approach of prioritizing early involvement of integrated science, application and data management teams, and to achieve the widest use of ESO data as soon after launch as possible, ESD will designate a set of leadership roles focused on integration
- NASA will expand the current coordination across program management, data management, science and applications, ensuring it is well established in Phase A





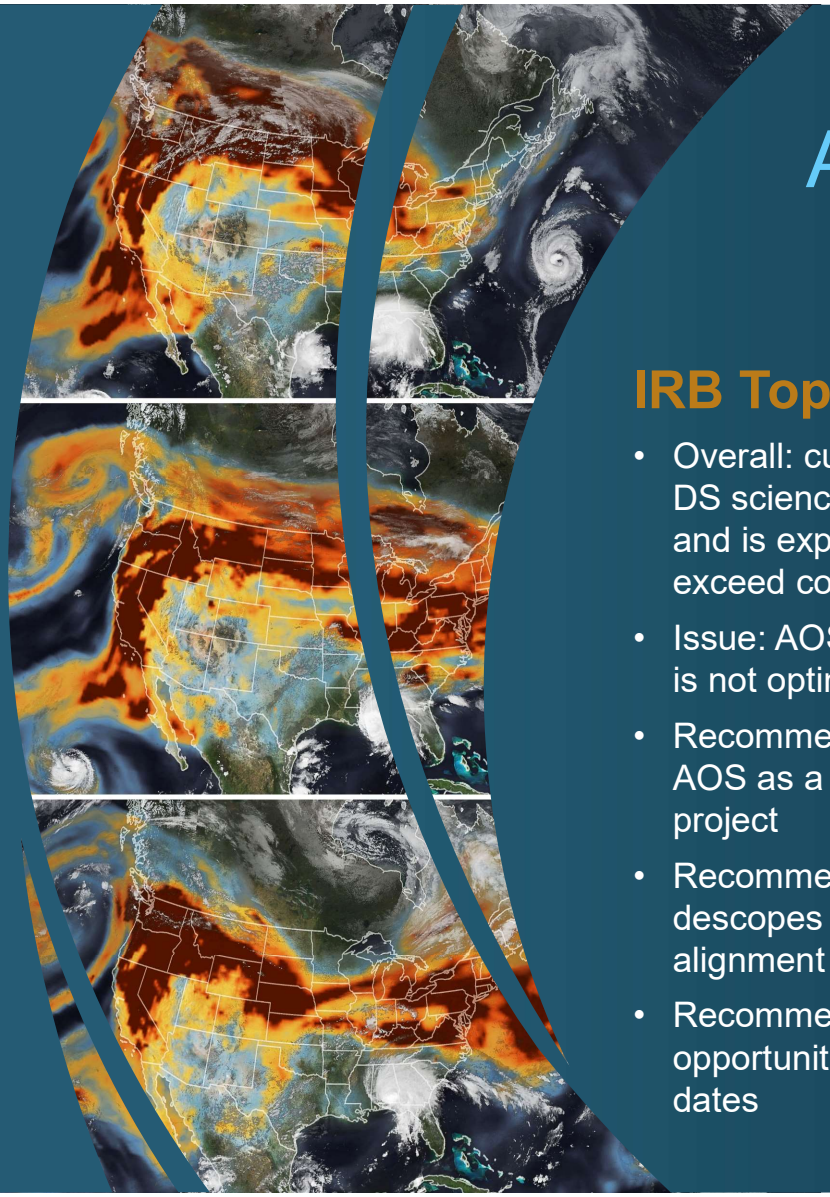
Mass Change (MC) Implementation

IRB Top Findings

- Overall: current plan meets threshold Decadal Survey science recommendations
- Issue: MC approach is a high-risk, single-string, 3-year design life concept which does not meet the 5-year mission requirement
- Recommendation: take an enhanced implementation approach for accelerometers and improved redundancy
- Recommendation: a long-term plan to ensure continuity of the measurement should be pursued

NASA Response

- NASA concurs with these recommendations and is developing plans to address and assess accelerometer and redundancy concerns during Phase A
- NASA recognizes there may be cost and schedule implications for the MC mission, and will socialize with NASEM if necessary
- NASA is engaged with European partners on a longer-term strategy for Mass Change observation



Atmosphere Observing System (AOS) Implementation

IRB Top Findings

- Overall: current plan exceeds DS science recommendations and is expected to significantly exceed cost target
- Issue: AOS-I and -P integration is not optimized for success
- Recommendation: implement AOS as a single integrated project
- Recommendation: consider descopes to bring costs in better alignment
- Recommendation: investigate opportunities for aligning launch dates

NASA Response

NASA partially concurs with these findings and will take the following steps to address them:

- Work to bring costs into alignment with Agency resources through scope adjustments
- Assess design and contracting approaches during Phase A for opportunities to reduce costs for the AOS-I and AOS-P spacecraft
- Address integration and program management in the context of the larger, cross-cutting ESO program management

Surface Biology and Geology (SBG) Implementation

IRB Top Findings

- SBG capabilities as currently planned meet Decadal Survey science recommendations
- Recommendation: investigate opportunities for aligning launch dates
- Recommendation: procure long-lead parts and develop backup solutions for key technologies
- Expand validation efforts with other ESO programs

NASA Response

- NASA agrees with these recommendations and will study options during Phase A

Center and Partner Roles and Responsibilities

IRB Top Findings

- Overall: noted importance of collaborative partnerships and cited the need for SMD to keep collaboration across NASA research centers and partners top-of-mind
- Recommendation: NASA should explore opportunities with traditional and non-traditional domestic and international partners, including the European Space Agency (ESA) with a focus on future mission sustainability
- Recommendation: Review work assignments and perform a workforce availability assessment across centers to achieve best balance of technical capabilities

Goddard SPACE FLIGHT CENTER

NASA Jet Propulsion Laboratory California Institute of Technology

NASA Langley Research Center

esa

Center and Partner Roles and Responsibilities

NASA Response

- NASA concurs with these recommendations.
- NASA is taking steps to review center work assignments, study potential partnerships, and evaluate workforce planning approach to ensure alignment of content and programs

Goddard SPACE FLIGHT CENTER

NASA Jet Propulsion Laboratory California Institute of Technology

NASA Langley Research Center

esa

Lessons Learned and General Comments

IRB Findings

- ESD should charter review of past Lessons Learned with recommendations for how to apply toward ESO
- Review strategies for improving team morale such as science lectures
- Assign an SRB chair for each mission during pre-formulation to start working with IRB for successful handover of information
- Develop common understanding of SRB engagement in addition to formal KDPs
- Start the communications plan now with emphasis on the observatory philosophy to help with sustainability.

Lessons Learned and General Comments

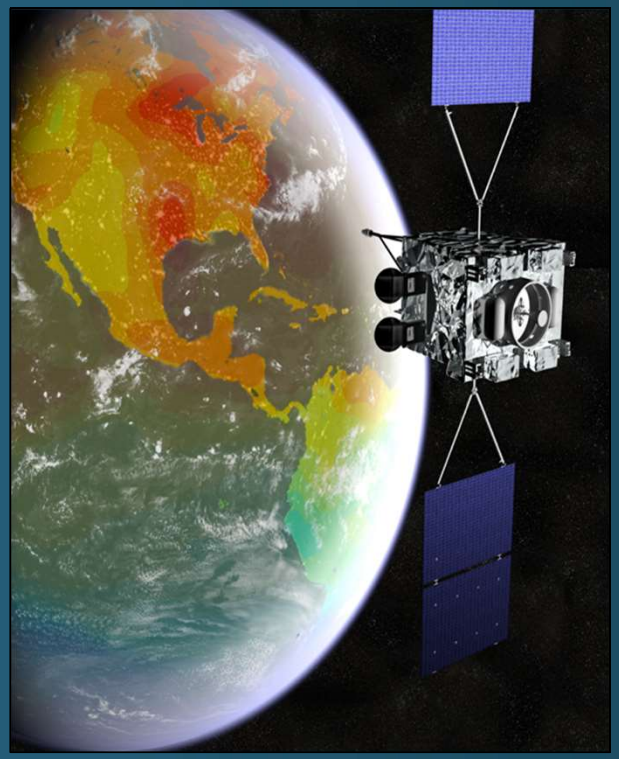
NASA Response

NASA concurs these recommendations and will take the following steps to address them:

- ESD and ESM Program Staff will review Lessons Learned with an eye to implementation of the ESO
- NASA is currently reviewing strategies for improving team morale such as periodic science lectures, etc.
- ESD is in the process of establishing SRBs for the ESO missions, starting with appointment of SRB chairs
- ESD's communications team will establish an ESO-level communications plan

GeoCarb Cancellation

NASA's Decision to Cancel the GeoCarb Mission and Expand Greenhouse Gas Portfolio



Driving factors

- Technical concerns
- Cost performance
- Availability of new data sources

Continuing commitment to GHG

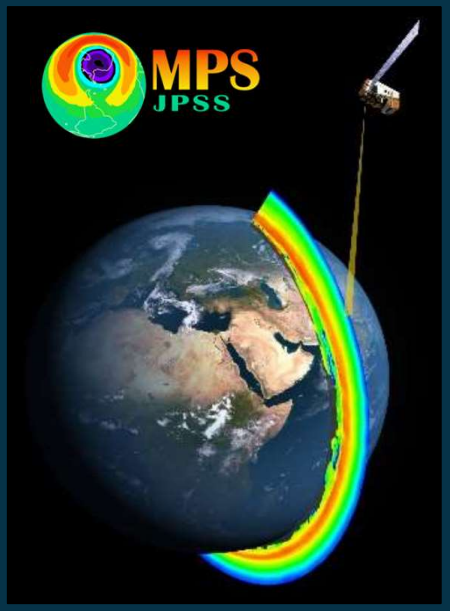
- EMIT: methane
- Orbiting Carbon Observatory-3 on ISS
- Earth System Explorers mission
- ESO and whole-of-government approach to GHG observation
- Continued collaboration with Oklahoma partners

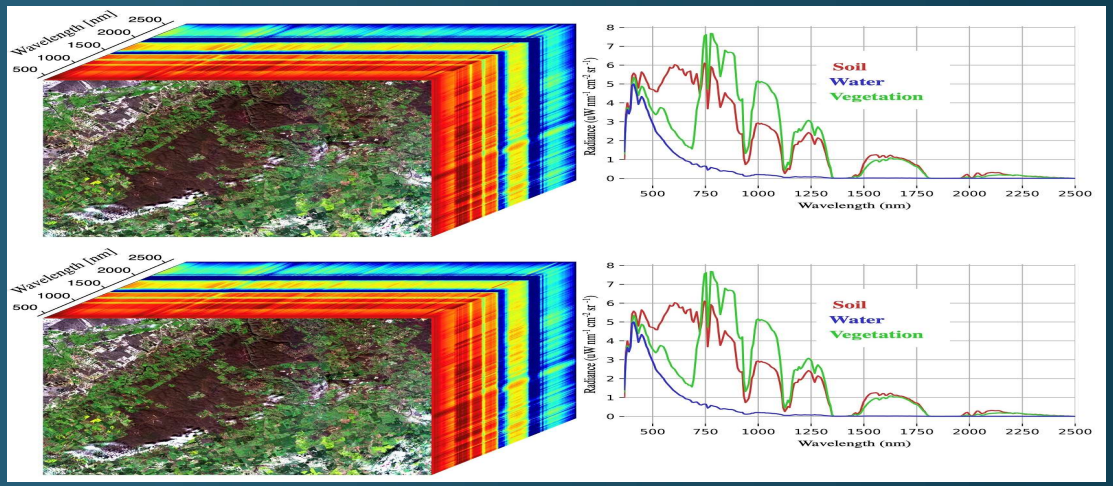
Additional ESD Updates

Recent Launches

OMPS-Limb on JPSS-2

- JPSS-2 successfully launched Nov. 10, 2022 from VSFB
- **O**zone **M**apping and **P**rofiler **S**uite-**Limb** (OMPS-Limb) will provide high resolution ozone and aerosol profiles and contribute to understanding ozone trends and how they relate to changes in climate
- ESD is also contributing OMPS-Limb for JPSS-3 and JPSS-4



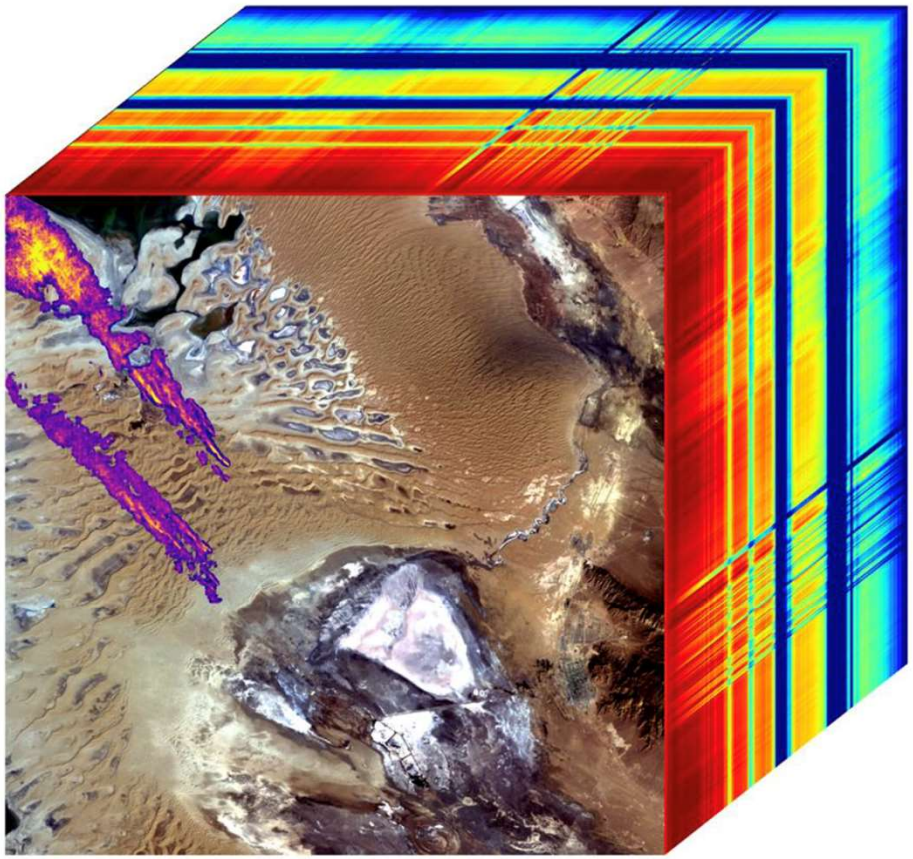


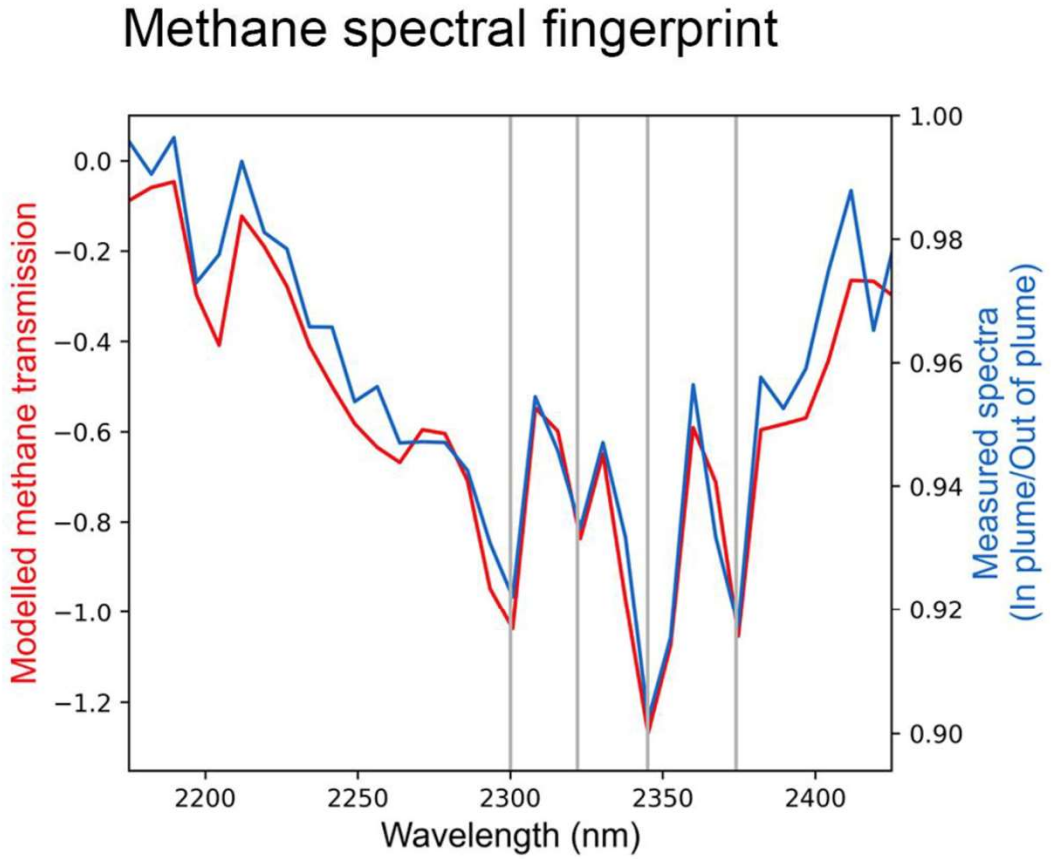
EMIT First Spectral Light
15:21 UTC, 28 July 2022 North of Perth, Australia
Spectral, radiometric, spatial, and uniformity characteristic meet or exceed expectations.

EMIT to ISS (EVI-4)

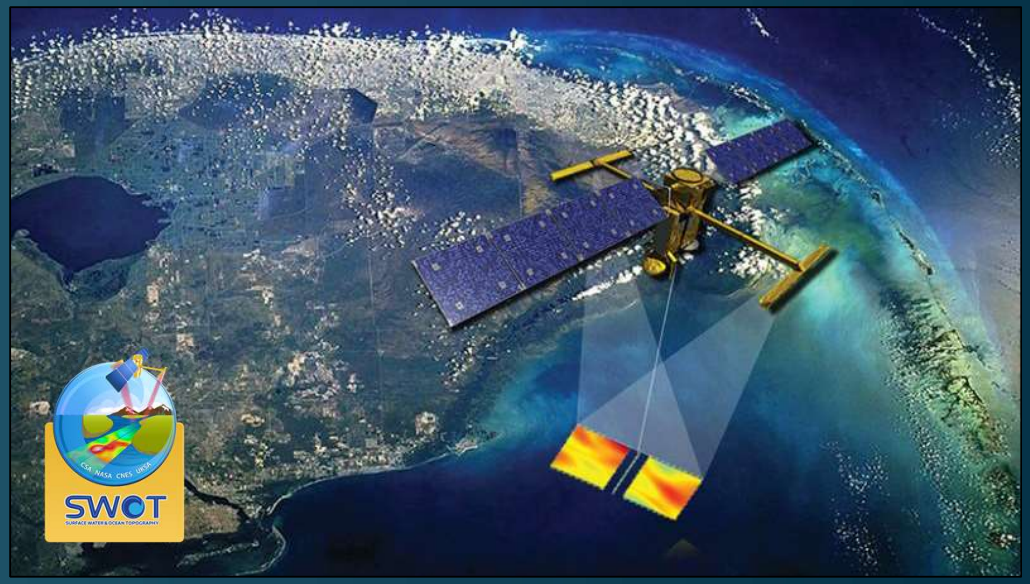
- Launched aboard SpaceX CRS-25 on July 14, 2022 from KSC
- Earth Surface Mineral Dust Source Investigation (EMIT) is designed to analyze airborne dust to see how it might affect climate

Methane plumes and spectral fingerprint measured by EMIT from the International Space Station





Upcoming Launches



SWOT

Will observe Earth's surface water, fine details of the ocean's surface topography, and changes in water bodies

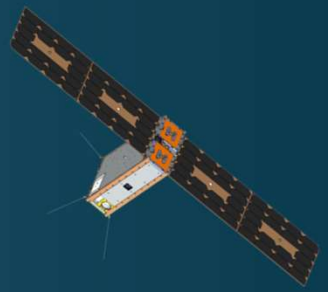
TEMPO

First space-based instrument to monitor air pollutants hourly across the North American continent during daytime

Recent and Upcoming Tech Demo Launches

CTIM-FD: Compact Total Irradiance Monitor – Flight Demonstration

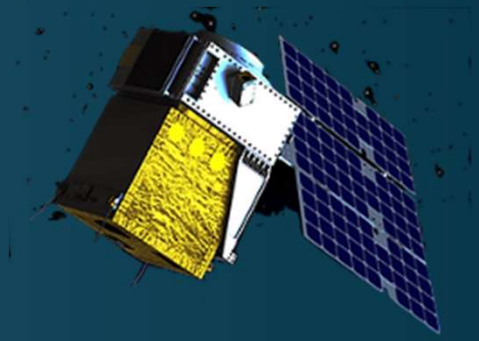
- Launched July 1, 2022
- Will demonstrate carbon nanotube-based bolometers that dramatically reduce size and weight and enable the measurement of total solar irradiance from a 6U CubeSat



CTIM Video

MURI-FD: Multi-band Uncooled Radiometric Imager – Flight Demonstration

- Launch NET December 1, 2022
- Will demonstrate a 2 band LWIR radiometric imager using uncooled FPA, piezo stage image stabilization, and performance compared to Landsat TIRS



EARTH SYSTEM OBSERVATORY

INNOVATION & COMPETITION
EARTH EXPLORER MISSIONS

Greenhouse Gases

Ozone and Trace Gases

Atmospheric Winds

Ice Elevation

Snow Depth and Water Content

3D Ecosystem Structure

Ocean Surface Winds and Currents

ESO Updates: Earth System Explorers

Community Announcement released Oct. 4

AO will be open to all observation types recommended by the Decadal

- Greenhouse Gases a likely emphasis

Targeting first launch by 2029 and second by 2031

ESE brings innovation to the ESO and augments the ESO core missions

Earth System Explorers (ESE)

- PI-Managed Mission Cost (PIMMC) cap of $310M (FY24 $)
- NASA will provide launch vehicle services
- Two-step selection process currently planned

Step 1 Selection

- Up to 4 Proposals
- 9-month Phase A concept studies

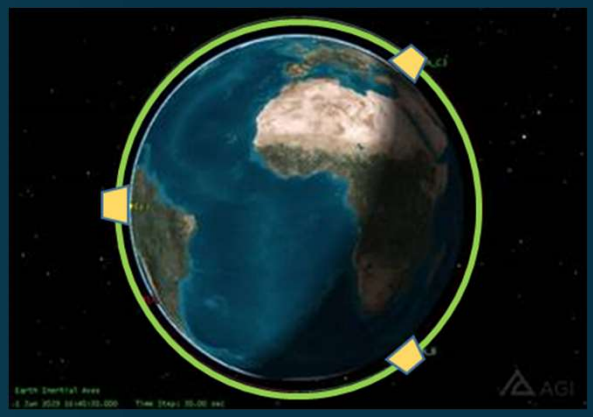
Step 2 Selection

- Up to 2 Missions
- Staggered phasing and funding

Landsat Next

Landsat Next Mission is a constellation of three identical observatories, approximately equally distributed in orbit

- 9-day global land revisit frequency
- 26 spectral bands (21 VSWIR; 5 TIR)
- Launch Readiness date: November 2030



Status and Next Steps:

- Held KDP-A Program Management Council on November 29
- LandIS Community Forum: December 8
- RFPs for instruments anticipated Spring 2023

Landsat Next will provide more than twice as many spectral bands, with resolution improved by a factor of 2, and with the repeat coverage of Landsats 8 and 9, *combined*

2023 is NASA's Year of Open Science

TOPS will energize and uplift open science across the scientific community through:

Visibility

Publishing articles, appearing on podcasts, developing targeted communication that expands footprint

Integrating Open Science into themes at large-scale events and conferences

Capacity Sharing

Producing online, free, Open Science curriculum on Open edX

Hosting workshops, events, cohorts, science team meetings, hackathons

Constructing multiple pathways to Open Science Badge

Incentives

Developing Open Science Badge/Certification

Sponsoring high profile prizes and challenges

Establishing high profile awards in support of open science research

Moving Towards Openness

Recognizing open science practices

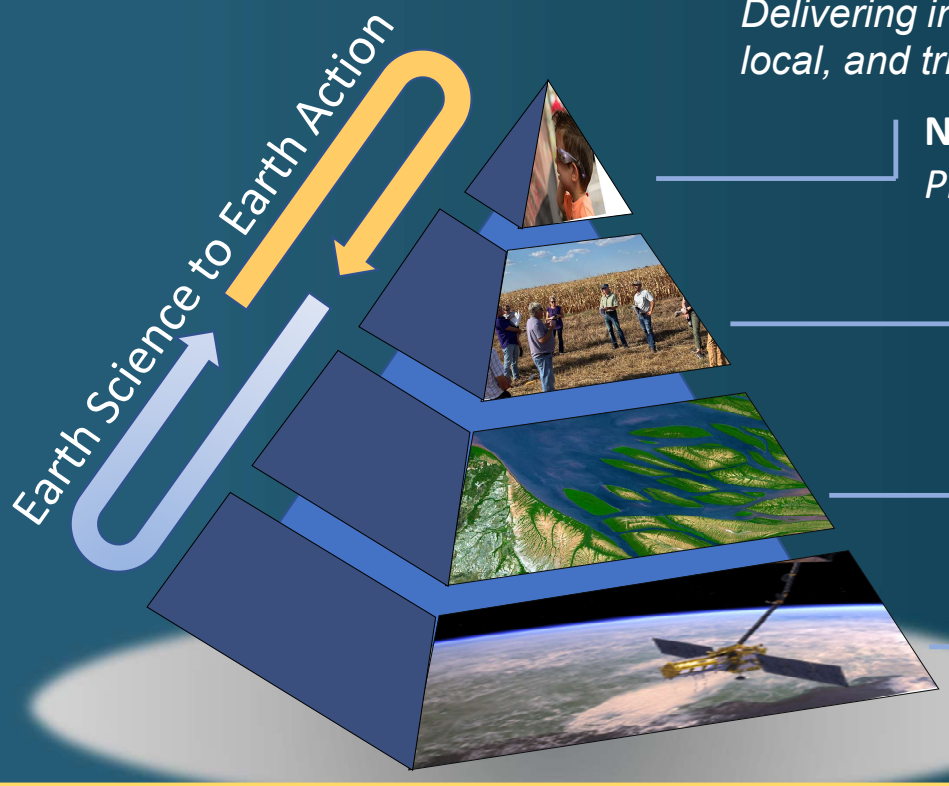
Holding open meetings

Sharing hidden knowledge

Inclusive collaboration

NASA Earth Action Strategy

Driving impact from $1.5 B in NASA observations and research
Delivering impact to meet the needs of Federal agencies, state, local, and tribal governments



New Earth Information Center
Physical and Virtual Engagement

Earth Action Solutions
Scaling NASA science and tools for climate response through National and International partnerships

Earth System Science & Tools for Impact
Research, Analysis, Modeling, Applications Incubation

Earth System Observations
Observation of Earth from Space, Air and Ground

Major Applications Themes and Needs (under evaluation)

- GHG Monitoring (new)
- Wildfire risk (developing)
- Health & Air Quality (developing)
- Sea level & coastal risk (mature)
- Energy efficiency & infrastructure (new)
- Agriculture & crops (developing)
- Disasters (mature)
- Water Resources (developing)
- Biodiversity/Ecosystems(developing)

Pam Millar Heading to LASP

Pam Millar has been named the Laboratory of Atmospheric and Space Physics' first deputy director for strategic development and communications

Pam has successfully led the Earth Science Technology Office (ESTO) for the last five years

Pam is the recipient of two NASA Goddard Space Flight Center Director’s Awards and the agency’s Exceptional Achievement Award for Diversity & Equal Employment Opportunity


NASA EARTH
Your Home. Our Mission.