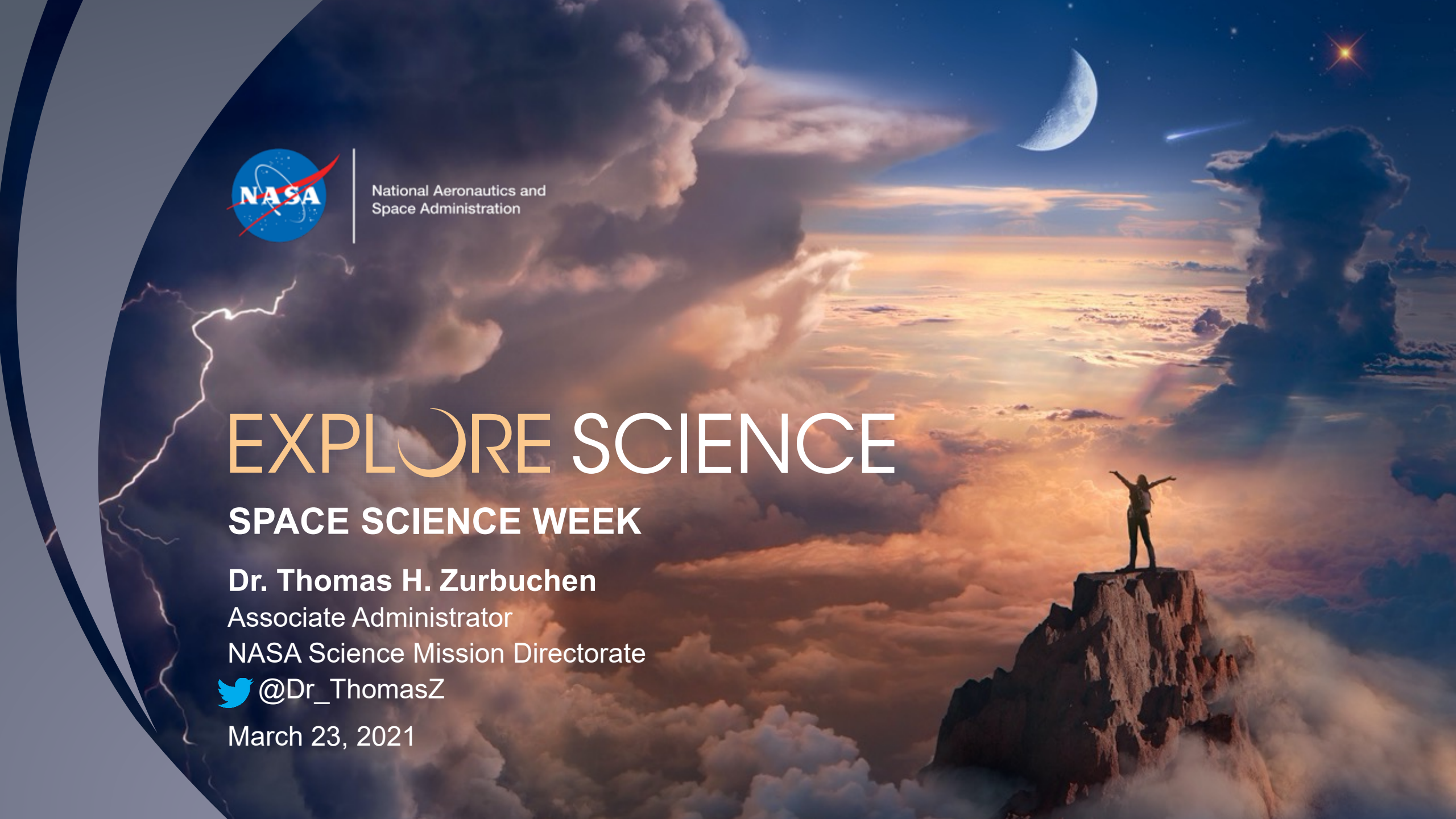

NASA
National Aeronautics and
Space Administration
EXPLORE SCIENCE
SPACE SCIENCE WEEK
Dr. Thomas H. Zurbuchen
Associate Administrator
NASA Science Mission Directorate
@Dr_ThomasZ
March 23, 2021

KEY SCIENCE THEMES

PROTECT AND IMPROVE LIFE ON EARTH AND IN SPACE

SEARCH FOR LIFE ELSEWHERE

DISCOVER SECRETS OF THE UNIVERSE

NASA Science Strategic Approach

VISION

Lead a globally interconnected program of scientific discovery that encourages innovation, positively impacts people's lives, and is a source of inspiration

MISSION

Discover the secrets of the universe

Search for life elsewhere

Protect and improve life on Earth and in Space

VALUES

Excellence

Inclusion

Leadership

Integrity

Teamwork

Safety

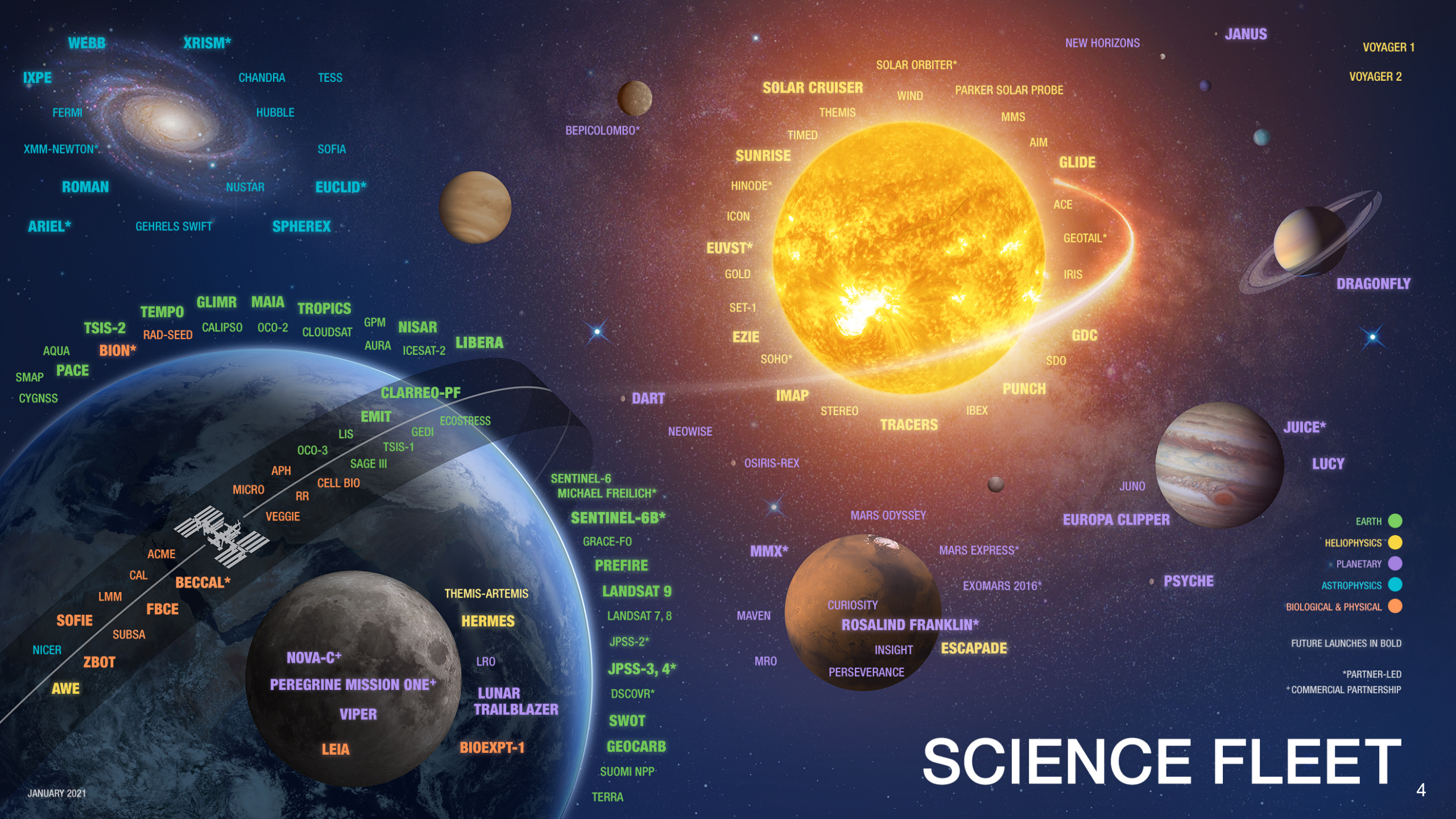
PRIORITIES

Exploration and Scientific Discovery

Innovation

Interconnectivity and Partnerships

Inspiration



SCIENCE FLEET

Mars 2020

Landsat 9

DART

Webb

IXPE

2021 – A Year of Science

O-REx

Lucy

Peregrine

Nova-C

GOES-T

- LAUNCH
- LANDER
- DEPARTURE

Agenda

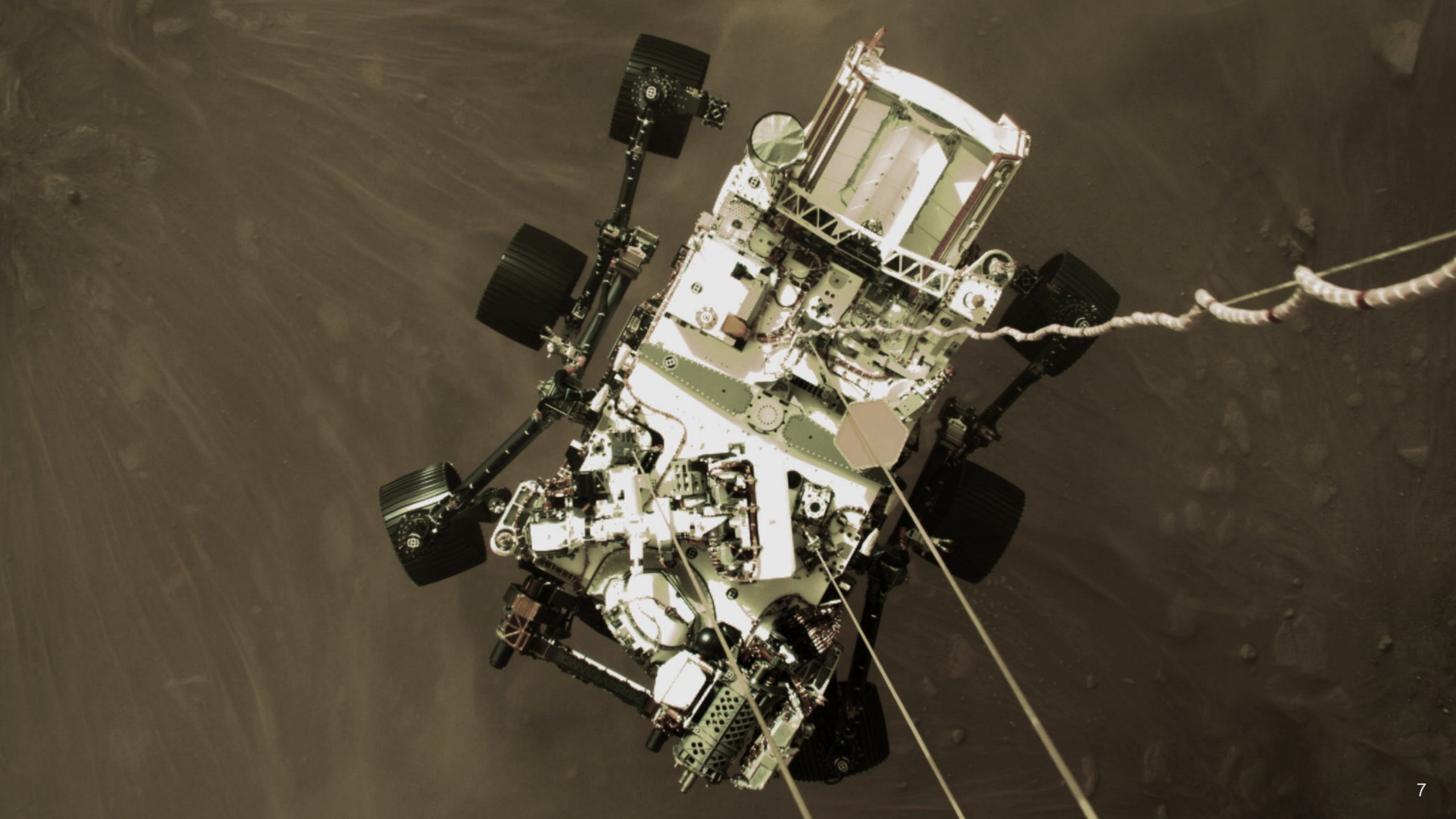
Mars 2020 Perseverance Lessons Learned

Inclusion, Diversity, Equity and Accessibility

SMD’s Commercial Partnerships

New Opportunities for International Partners

NASA Earth System Science; The Urgent Need




180

Agenda

Mars 2020 Perseverance Lessons Learned

Inclusion, Diversity, Equity and Accessibility

SMD's Commercial Partnerships

New Opportunities for International Partners

NASA Earth System Science; The Urgent Need

Science Vision 2020-2024

Excellence Through Inclusive, Diverse Teams

SMD believes its ability to build excellent teams – where diversity of thought, backgrounds and perspectives are welcomed and celebrated - is critical to mission success.

As articulated in the 2020-2024 Science Vision and in alignment with the NASA Core Values, SMD seeks to increase the diversity of thought and backgrounds represented across the entire SMD portfolio and models the principles of inclusion, diversity, equity and access (IDEA) in all policies, systems, and programs.

IDEA Into Action

- **Anti-Racism Action Group (ARAG):** Short-term effort aimed at addressing the lack of equity and inclusion of the Black, Indigenous and People of Color community in SMD and across SMD stakeholders
- **Inclusion, Diversity, Equity and Accessibility (IDEA) Working Group:** Long-term group that builds on the work of ARAG to address lack of equity and inclusion across all axes of diversity in SMD, its stakeholders, the scientific community, and beyond
- **SMD Engagement Strategy:** SMD-wide focus as an opportunity to expand our strategy through intentional engagements with more diverse audiences
- **SMD Division & Program Workshops:** IDEA-focused Planetary Undergraduate Student Program, Astrophysics Black, Indigenous and People of Color Engagement Workshop, PI Launchpad Workshop
- **Research & Analysis Changes:** Working group modifying requirements for Announcements of Opportunities to align with NASA's new core value of Inclusion; Dual Anonymous Peer Reviews, offering Planetary Science ROSES-2021 programs without due dates, etc.
- **Community Discussions:** Partnering with AGU, Aerospace Scholarships to Challenge and Educate New Discoverers Guiding Coalition, Association of American Universities, National Academies, and others to understand gaps and address career inequity across the space science community
- **And more…**

SMD Anti-Racism Action Group (ARAG)

- Identified eight quick-win actions for immediate implementation; progress on select actions noted below:

Update all supervisor performance plans with examples for how to make meaningful progress in IDEA-relevant performance goals

SMD Supervisor Workshop on IDEA conducted in late January to craft performance plan language; follow-on discussions ongoing to finalize

Establish engagement committee to build relationships with under-represented groups

2021 SMD Engagement Strategy developed to intentionally and thoughtfully engage underserved and underrepresented communities

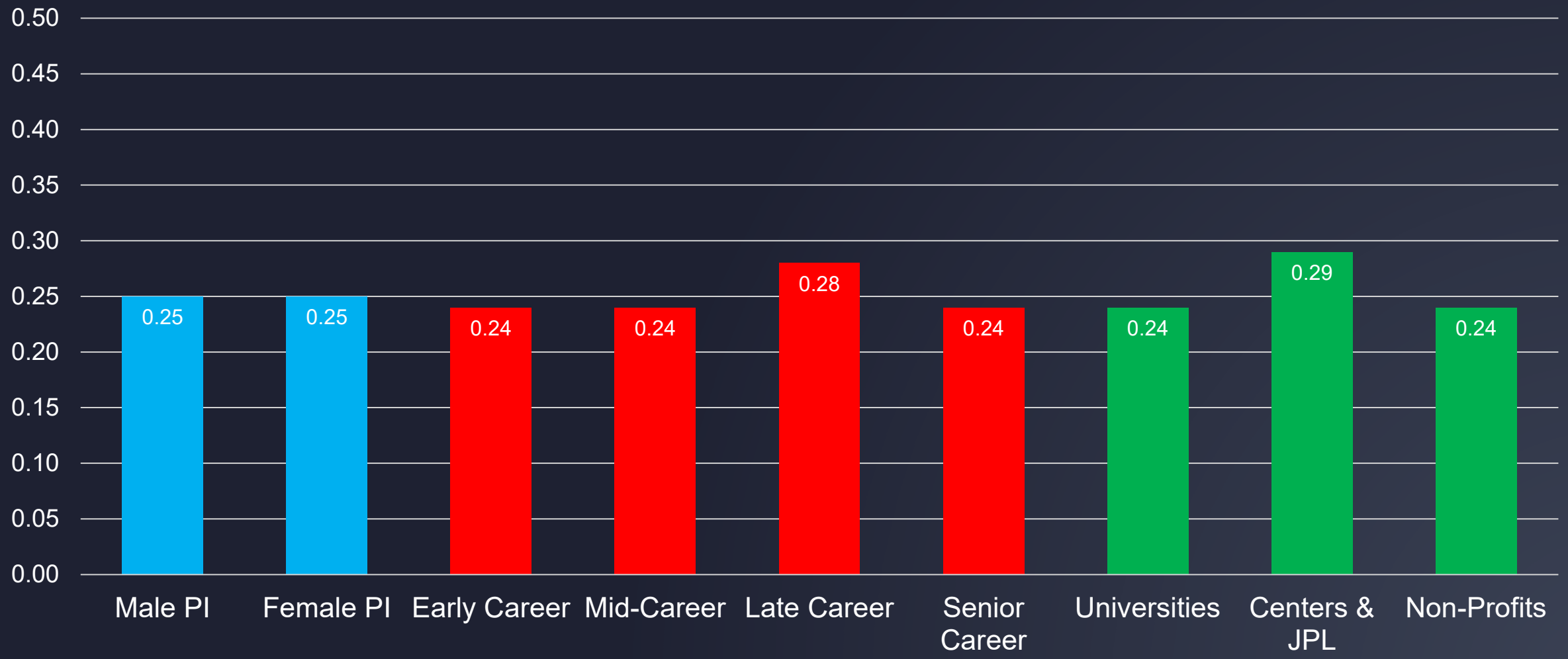
Collect and publicize current and historic aggregate demographic data of ROSES awardees

Analysis completed for SMD-level data; dedicated webinar in April will allow in-depth discussion across SMD

Require that all panel reviews adopt code of conduct that reflects commitment to a diverse and inclusive working environment

Code of Conduct developed; drafting updates to SMD Policy on Management of ROSES Peer Review and Selection Progress

Announcements of Opportunity Diversity Success Rates



Division Workshops and Trainings

- **Astrophysics** – Piloting an inclusion plan as a requirement in a ROSES element and planning a summer workshop on how to grow participation in astrophysics by underrepresented groups
- **Biological and Physical Sciences** – Partnering with the American Society for Gravitational and Space Research (ASGSR) to conduct a series of town hall meetings and "MicroLabs", including a town hall and follow-up Microlab on “Education, Diversity, Equity, and Inclusion”
- **Earth Science** – Reviewing panel diversity, increasing participation in Earth Science surface-based measurement networks RFI, and is developing a remote sensing and environmental justice workshop and future program concept
- **Heliophysics** – Encouraging IDEA-based outreach activities for missions in development, developing a community mentoring program in partnership with community partners, and developing a targeted R&A solicitation for ROSES-22
- **Planetary Science** – Hosting staff trainings focused on IDEA, including Bystander intervention, Critical Teamwork in a Virtual World – focused on increasing participation within a group and hearing all voices, and Fostering Innovation in Risky Environments (FIRE)

Agenda

Mars 2020 Perseverance Lessons Learned

Inclusion, Diversity, Equity and Accessibility

SMD’s Commercial Partnerships

New Opportunities for International Partners

NASA Earth System Science; The Urgent Need

SMD Principles for Commercial Partnerships

- Develop strategic partnerships that leverage unique strengths of contributors to drive scientific progress
- Actively pursue partnerships that innovate both in *what* we do with commercial partners and *how* we do it
- Continually assess and evolve partnership models, recognizing experimentation is key and some experiments may fail
- Evaluate the success of traditional and non-traditional partnerships by determining if these result in “enabling new science” and in “more science per dollar”
- Encourage and assess potential obstacles to Principal Investigator adoption of commercial solutions to illustrate market demand from science community
- Leverage existing commercial capacity, demand, and expertise, while exploring emerging business areas where early adoption can support domestic growth and competitiveness
- Build on investments in partnerships across NASA and other parts of the government, sharing our own best practices
- Accept some additional risk responsibly in the interest of establishing affordable, high-value domestic capabilities

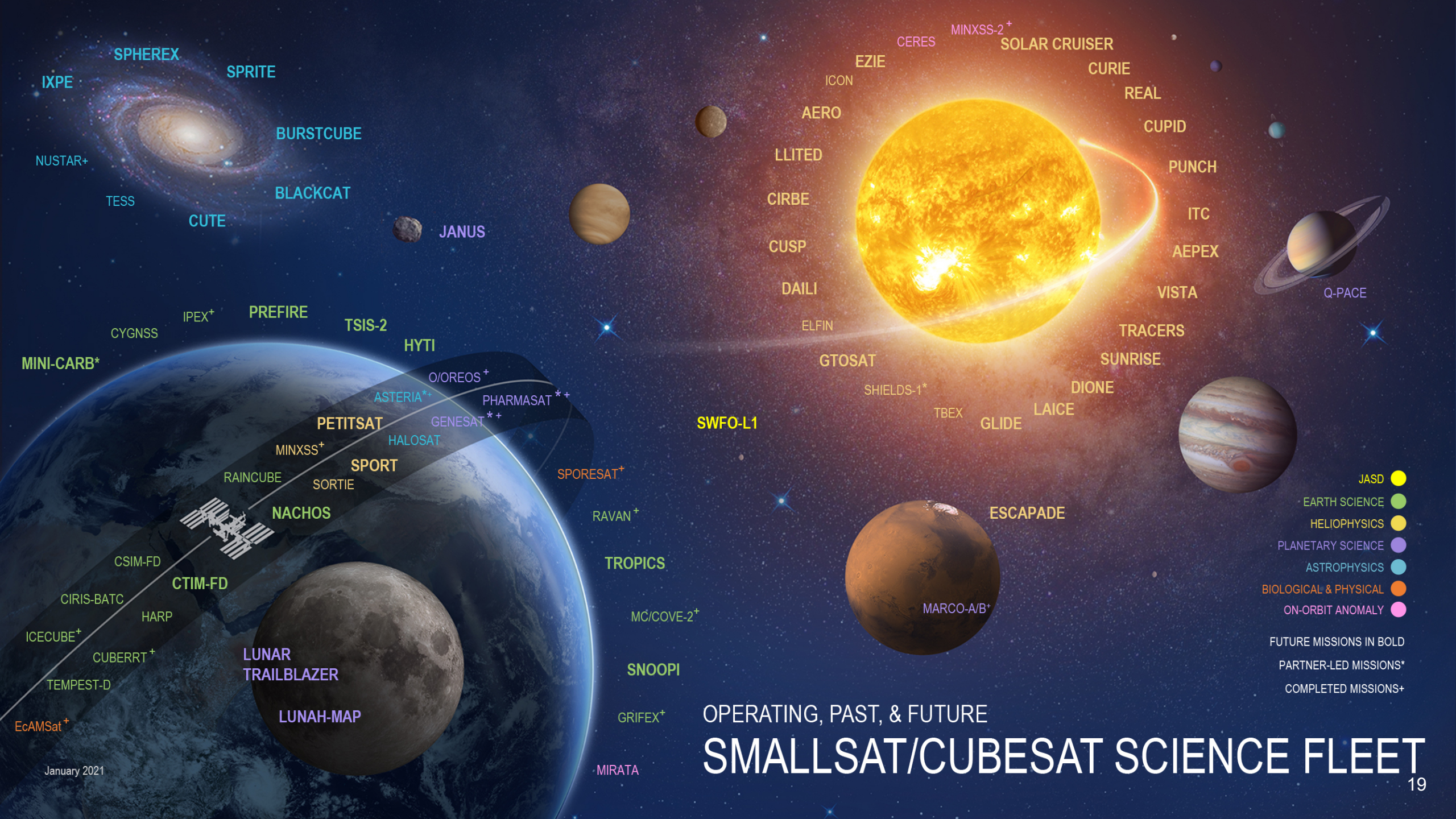
Maximizing Science Per Dollar

PRINCIPLE: Continually assess and evolve partnership models, recognizing that experimentation is key and that some experiments may fail

PRINCIPLE: Evaluate the success of traditional and non-traditional partnerships by determining if these result in “enabling new science” and in “more science per dollar”

EXAMPLE: SmallSats/CubeSats, Venture Class Launch Innovations

- We have continually practiced these principles
- We have had some successes, and also some failures
- This approach has significantly shaped the opportunity space for all of NASA Science

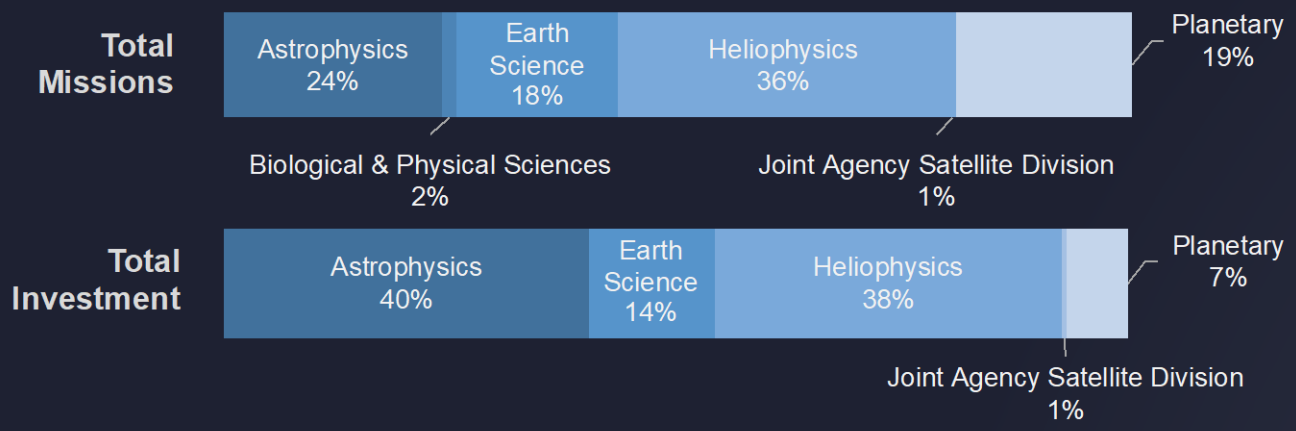


OPERATING, PAST, & FUTURE

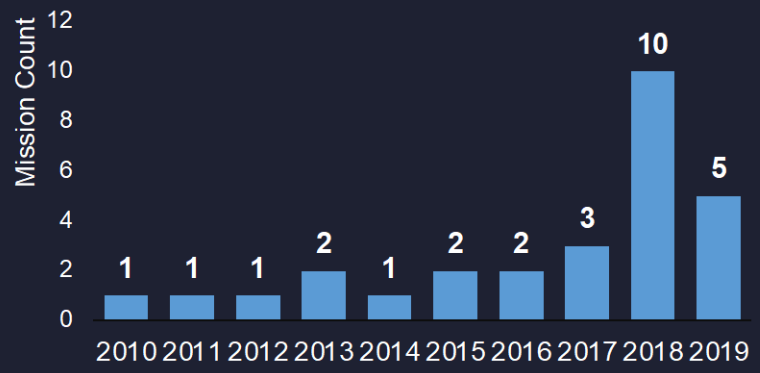
SMALLSAT/CUBESAT SCIENCE FLEET

NASA's Small Satellite Missions at a Glance

SmallSat/CubeSat Missions & Investment by SMD Division



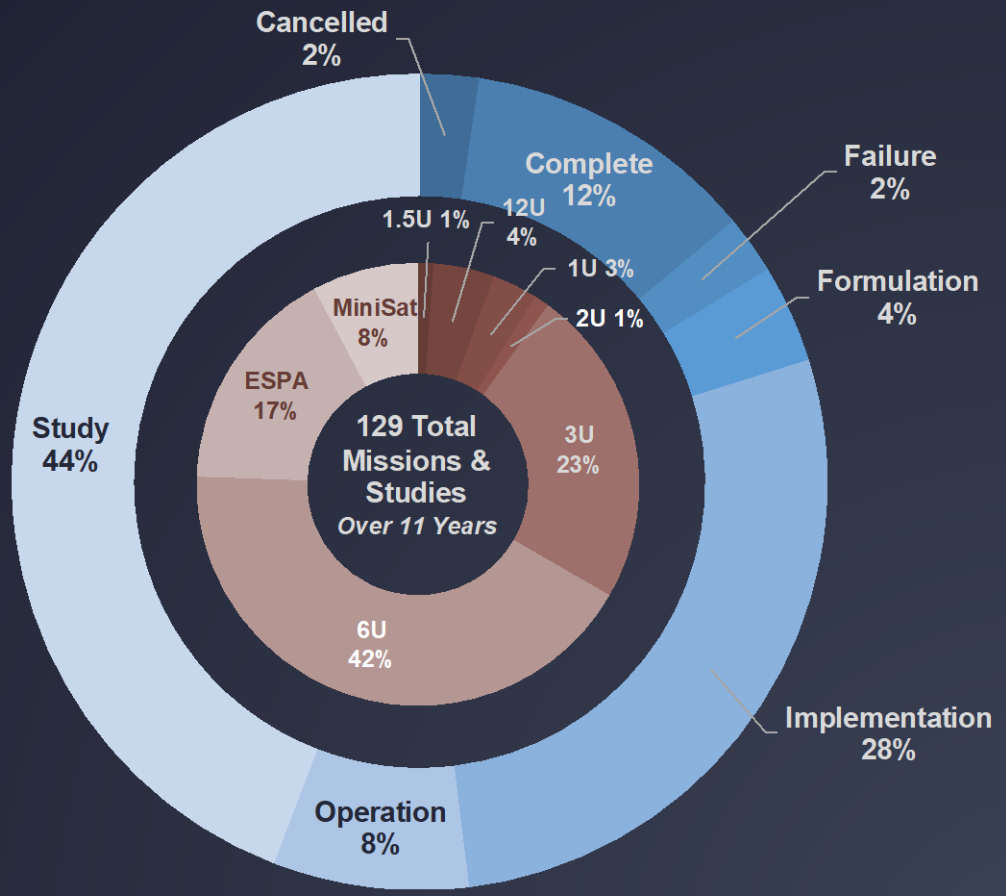
Mission Launch Timelines



$2.27 B
Total Investment over 11 Years

41 SMD SmallSat Missions
(64 Spacecraft)
in Implementation
2021 and beyond

Mission Phase and Satellite Size



Experimenting With Novel Partnerships

PRINCIPLE: Continually assess and evolve partnership models, recognizing that experimentation is key and that some experiments may fail

EXAMPLE: Earth Science Data Buys, Entrepreneurs Challenge

- Though many commercial companies identify this as a normal venture model, we still struggled with this both within NASA and in the commercial sector – not all ”commercial companies” are the same
- Continue to learn how to adapt our procurement processes to be responsive to these needs
- Ended up canceling ideas as a result of this, and backing off when we felt that we did not have an understanding partner

Commercial Satellite Data Acquisition

This image of sea ice in the Gulf of Bothnia off the coast of Lulea, Sweden was taken on April 26, 2013 by the Planet Labs Dove 2 satellite.

- Awarded contracts to three companies for pilot activity: Digital Globe (now Maxar), Planet, and Spire
- Pilot extremely successful; transitioned to the Commercial SmallSat Data Acquisition Program
- Released second RFI (October 2019) to onramp qualified vendors; anticipate contracts to be awarded in June 2021. Third RFI to on-ramp a third batch of vendors closed January 2, 2021; contract awards anticipated in Fall 2021
- Released Commercial SmallSat Data Analysis solicitation (ROSES A.42)
- Data licensing remains problematic; coordinating with U.S. Government Agencies to develop standardized scientific licenses; discussions are ongoing

Things That Did Not Work

- Could not find commercial partner for Spitzer operations even though multiple parties initially expressed interest
- Could not complete partnerships with big foundations due to ultimate inability to raise or prioritize funds
  - Mission to Enceladus
  - Mission in Astrophysics
  - Mission to Mars
  - Mission to discover Near Earth Objects
- Major market shift in GEO hosting leaving two missions stranded and/or with lots of extra cost (TEMPO, GeoCarb, etc.)
- Negative experiences that did not go anywhere: companies looking for NASA to fully fund missions are pre-seed stage and/or of companies not having any customers or market opportunities outside of government

Areas of Opportunity

- Creative collaboration with partners (SpaceX Starlink example)
- Fostering expansion of CLPS Services to perhaps include mobility, on-orbit delivery, and night survival/operation
- International partnerships to expand the use of domestic commercial services
- Novel cooperative efforts for service-based deliveries to LEO and Lunar orbits
- Better connect PIs to emerging commercial capabilities, especially novel microgravity platforms

Agenda

Mars 2020 Perseverance Lessons Learned

Inclusion, Diversity, Equity and Accessibility

SMD's Commercial Partnerships

New Opportunities for International Partners

NASA Earth System Science; The Urgent Need


Sentinel-6 Michael Freilich
NASA
NOAA
esa
EUMETSAT
European Union

Request for Information: Emerging Partners

- NASA seeks to be the partner of choice for emerging spacefaring nations, to…
  - Bring these new countries into our norms and way of doing things in space in order to enhance safety
  - Increase the capacity of these programs to partner on missions with NASA
- As part of this goal of increased capacity, NASA released a Request for Information (RFI) last week on Development of Flight Capacity Building Programs for Emerging International Partners; RFI responses due May 21, 2021
- We are seeking innovative ideas from U.S. universities and institutions on how we can ensure the best and brightest in emerging spacefaring nations learn how to effectively partner with NASA

Agenda

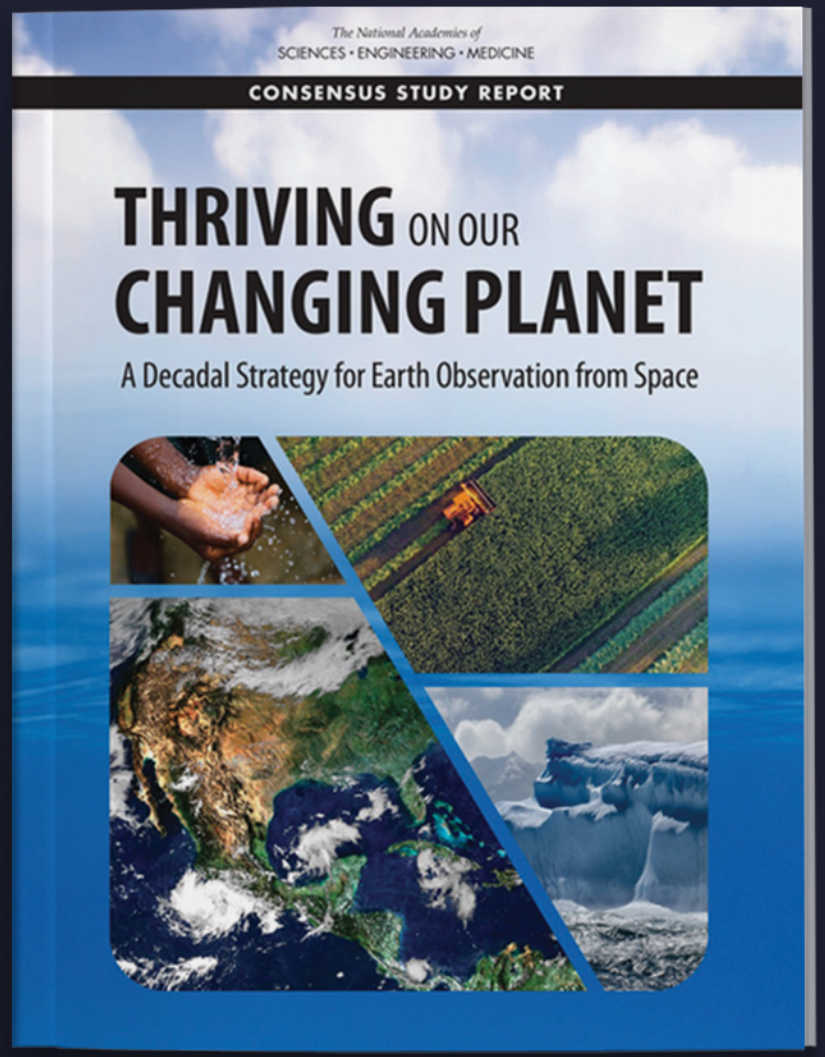
Mars 2020 Perseverance Lessons Learned

Inclusion, Diversity, Equity and Accessibility

SMD's Commercial Partnerships

New Opportunities for International Partners

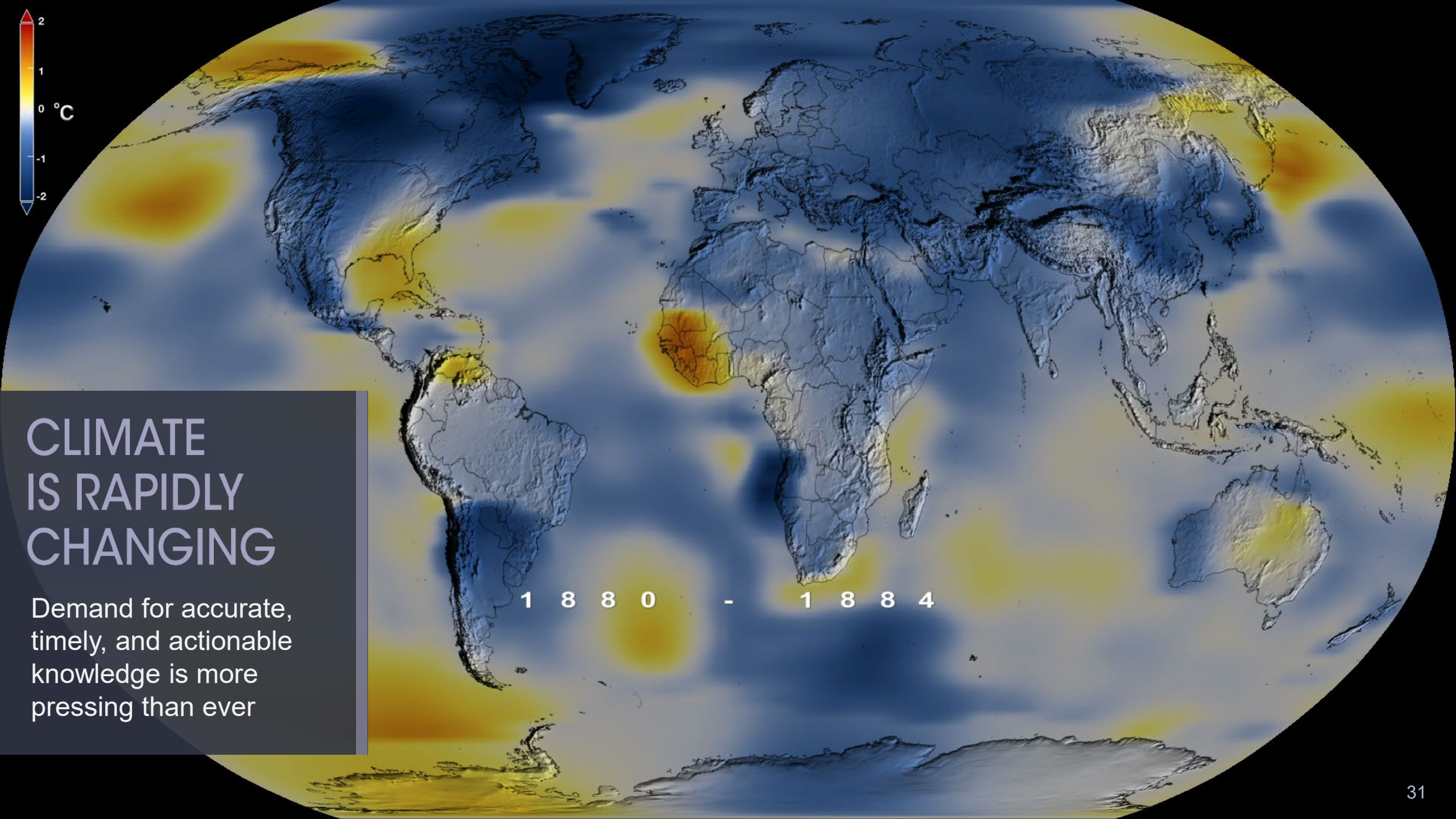
NASA Earth System Science; The Urgent Need



2017 Earth Science Decadal Survey

- A guiding framework for space-based Earth science
- Emphasizes partnerships and innovation
- Identifies key questions and observations for:
  - Climate variability and change
  - Weather and air quality
  - Hydrogeological cycles and water resources
  - Ecosystems and natural resource management
  - Solid Earth dynamics and hazards

OUR CHALLENGE

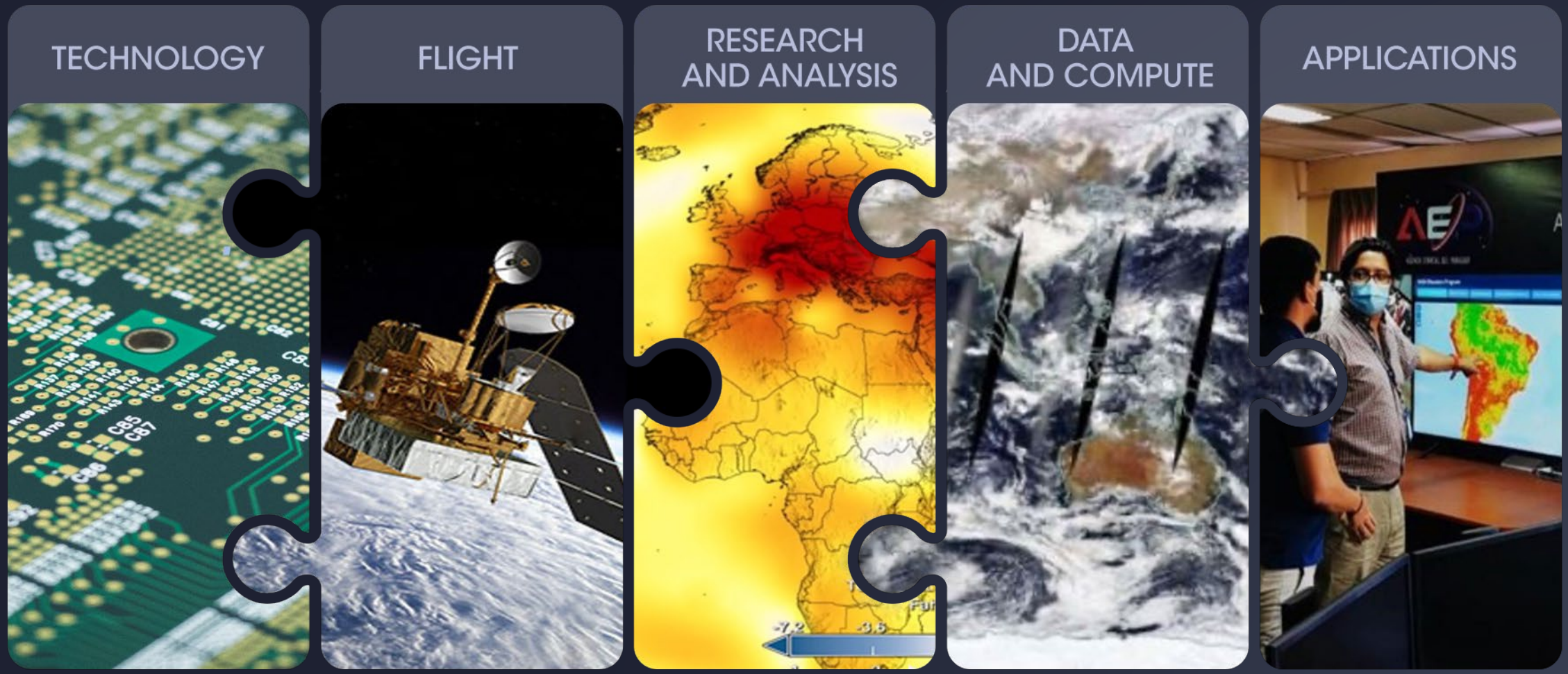


CLIMATE IS RAPIDLY CHANGING

Demand for accurate, timely, and actionable knowledge is more pressing than ever

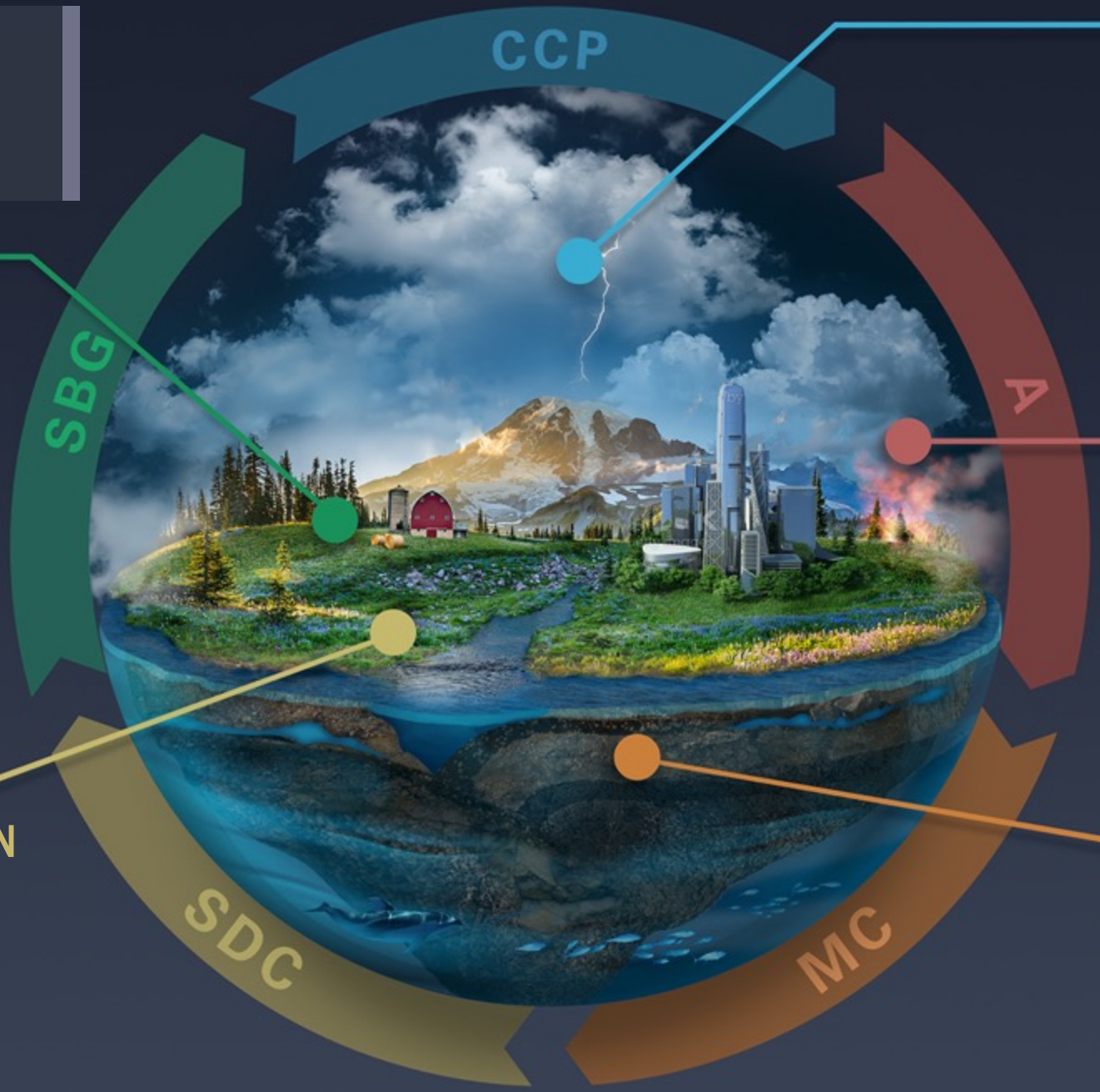
Earth System Science Informs Global and Regional Solutions

Advancing Earth System Science End-to-end



WHAT'S NEEDED

EARTH SYSTEM OBSERVATORY



CLOUDS, CONVECTION AND PRECIPITATION

Water and Energy in the Atmosphere

AEROSOLS

Particles in the Atmosphere

MASS CHANGE

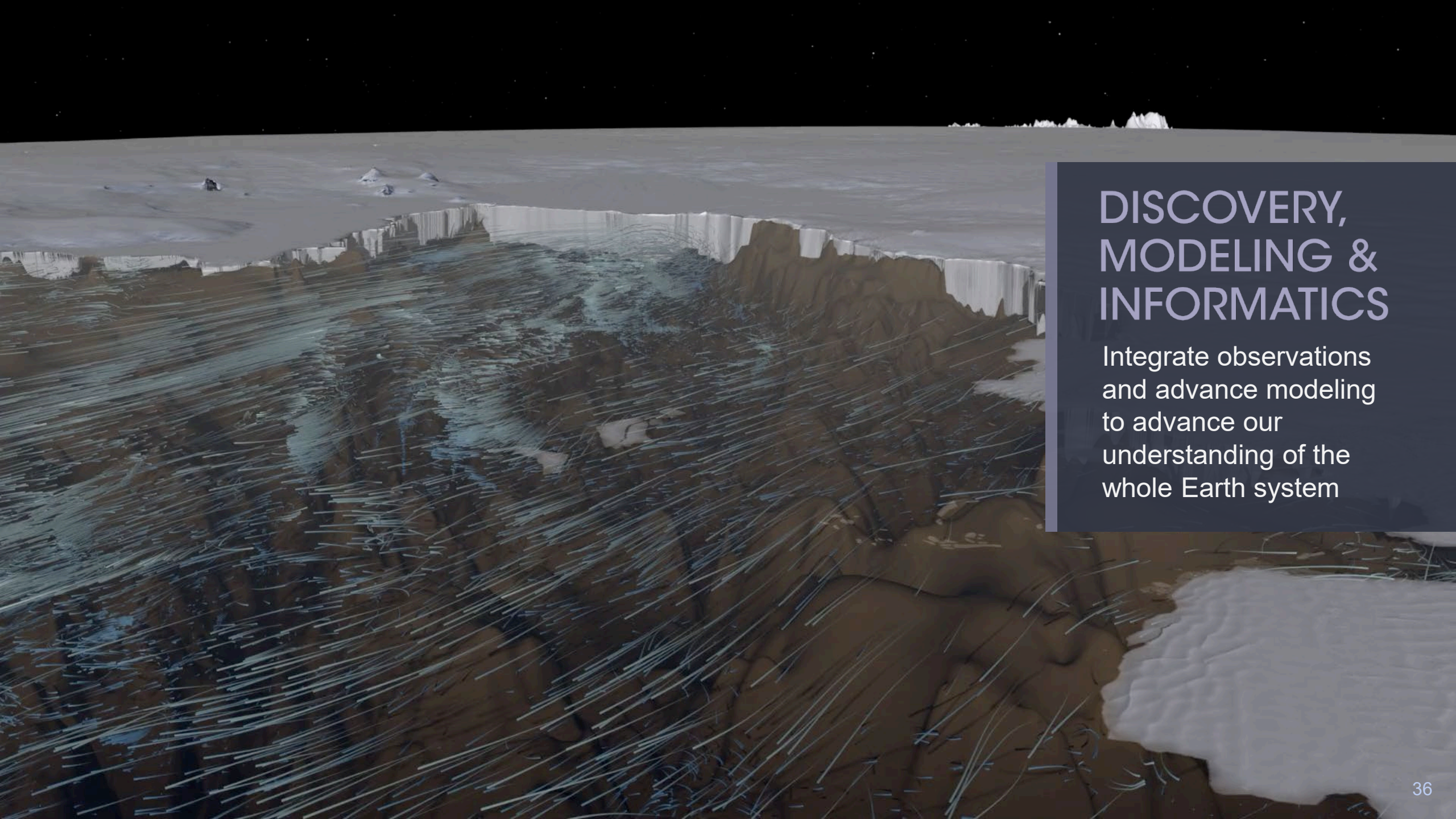
Large-scale Mass Redistribution

SURFACE BIOLOGY AND GEOLOGY

Earth Surface & Ecosystems

SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics



DISCOVERY, MODELING & INFORMATICS

Integrate observations and advance modeling to advance our understanding of the whole Earth system

APPLICATIONS & DISSEMINATION

Accelerate the uptake of scientific understanding and deliver information in scalable ways

SDA CROPLANDS DATA LAYER
1997-2018—Field and Tree Crops

THE PATH FORWARD

Urgency Demands Action and Innovation

Our Shared Future

- Accelerate our ability to understand and predict the Earth system to meet the urgent demands of climate change
- Harness new technologies and partnerships to accelerate and advance science
- Embrace Open Science principles and practices to bring data and analytics to more scientists and users for more rapid discovery and expansive application
- Foster a science community with voices and ideas from a truly diverse and inclusive workforce


National Aeronautics and
Space Administration
NASA
with us
COME