

National Aeronautics and  
Space Administration



# Science Committee Report

**Dr. Bradley M. Peterson**  
Chair, Science Committee



# Science Committee Members

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**Dr. Brad Peterson, Chair, The Ohio State University and Space Telescope Science Institute**  
**Dr. Carle Pieters, Vice Chair, Brown University**

**Dr. Steve Running, University of Montana, Chair, Earth Science Subcte**  
**Dr. Scott Gaudi, The Ohio State University, Chair, Astrophysics Advisory Cmte (APAC)**  
**Dr. Jill Dahlburg, Naval Research Laboratory, Chair, Heliophysics Advisory Cmte (HPAC)**  
**Chair, Planetary Science Advisory Cmte (PAC) (NEW)**  
**Chair, Earth Science Advisory Cmte (ESAC) (NEW)**

**Dr. Doug Duncan, University of Colorado**  
**Dr. Mark Robinson, Arizona State University**  
**Dr. Susan Avery, Woods Hole Oceanographic Institute**  
**Dr. Tamara Jernigan, Lawrence Livermore National Laboratory**  
**Dr. Walter Secada, University of Miami**  
**At-Large Heliophysics member (NEW)**  
**At-Large Astrophysics member (NEW)**



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# Heliophysics



# 2016 Solar Storms with NASA/NOAA GOES-R Satellite Primed to Support Space Weather Predictive Capabilities

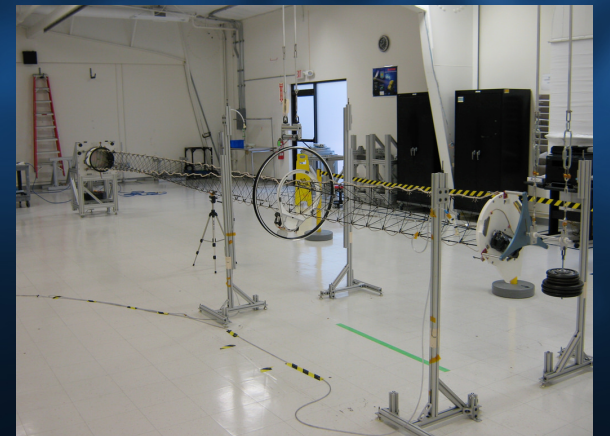


Foto: Laffen Jensen

Icy Polar Stratospheric Clouds (PSCs) seen on 31 December 2016.  
Credit: Laffen Jensen



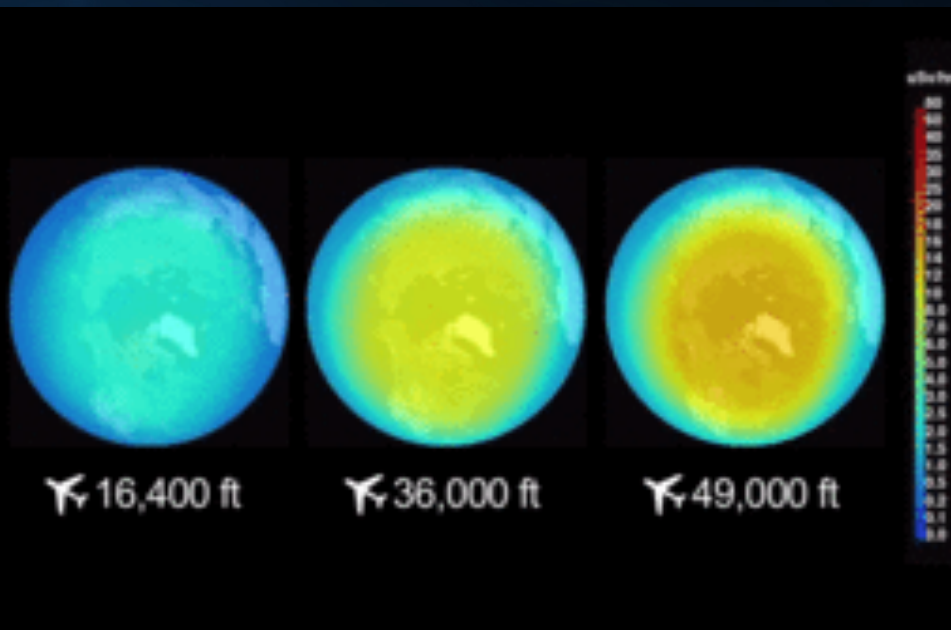
Aurora seen over Iceland on 1 January 2017.  
Credit: Shane Leach



GOES-R MAG instrument fully deployed.  
Credit: NOAA



# NASA Radiation Dosimetry Experiment (RaD-X)

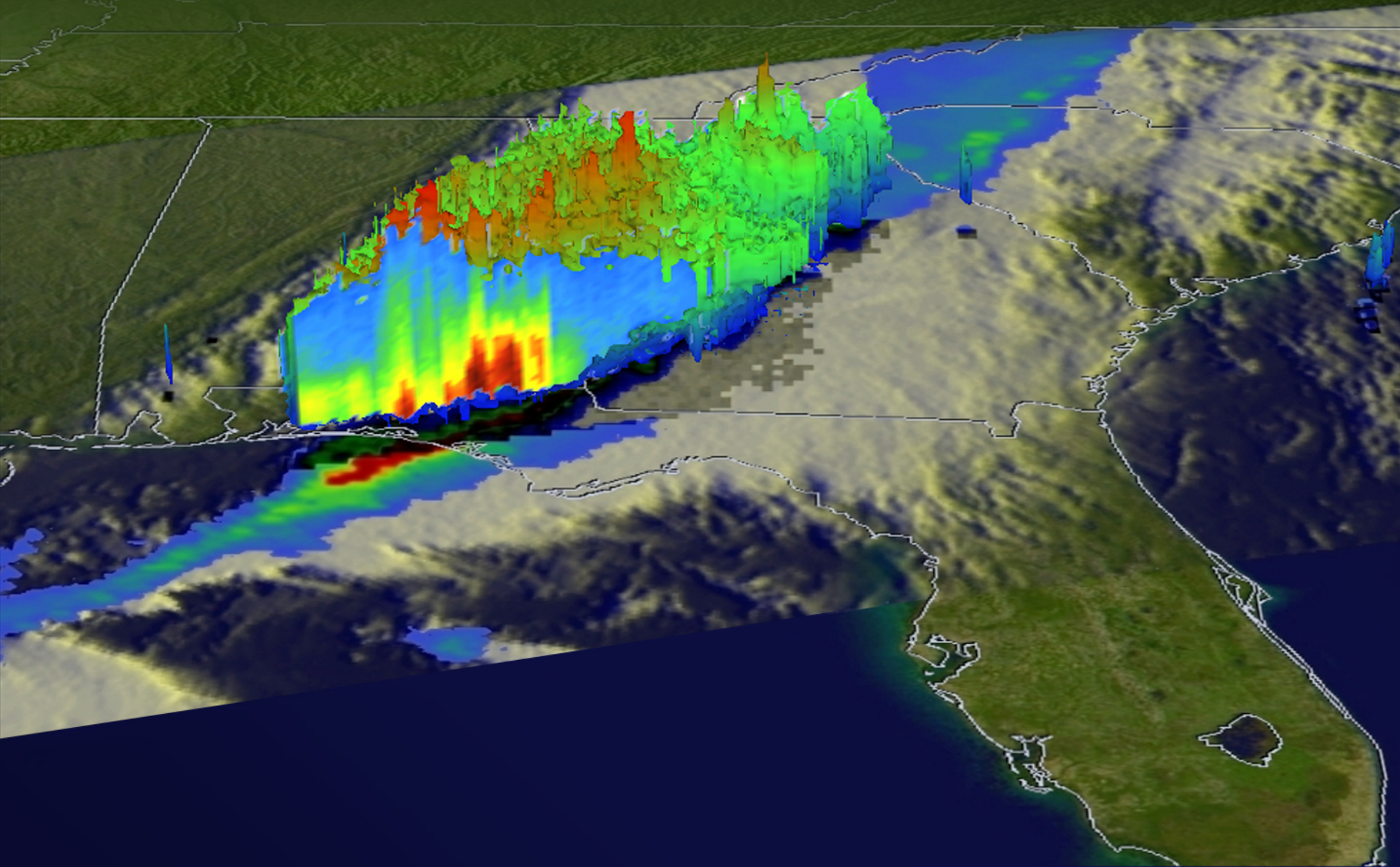


*Credit: NASA/NIRAS*

Results using data from the **NASA Radiation Dosimetry Experiment (RaD-X)** showcase some of the first spectral dose measurements of cosmic radiation at high altitudes in Earth's stratosphere. These results were featured in a special December 2016 issue of the AGU Journal *Space Weather*.

*Right: Rad-X payload ascended into the stratosphere. Credit: NASA*

# EARTH SCIENCE





# World's First 30-m Global Cropland Extent Product

<https://croplands.org/>

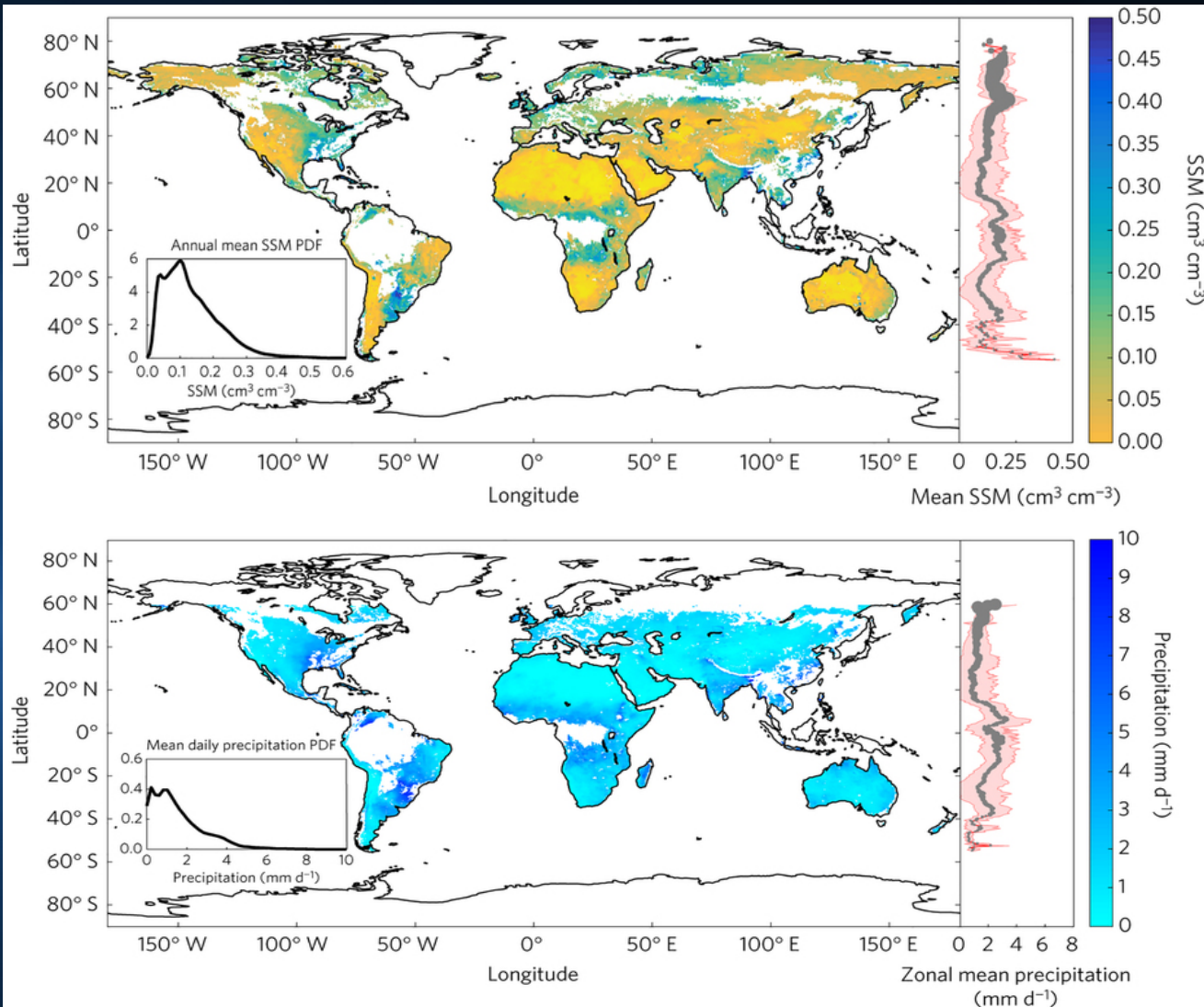


The screenshot shows a web browser window displaying the Global Croplands website. The browser's address bar shows the URL <https://croplands.org/app/map>. The website's navigation menu includes links for Global Croplands, About, Methods, Data, Products, Documents, Mobile App, GFSAD USGS Site, and Login. The main content area features a world map where cropland areas are highlighted in a vibrant green color. The map includes standard Google Maps controls such as zoom in (+), zoom out (-), and a print icon. At the bottom of the map, there is a copyright notice: "Map data ©2017 Imagery ©2017 NASA, TerraMetrics Terms of Use Report a map error".

Above: The above map is an example of the 30 meter Cropland Extent products that are available for inspection on <https://croplands.org/app/map>. Users users have the ability to zoom in to examine individual pixels.

*Monitoring global croplands is imperative for ensuring sustainable water and food security to the people of the world in the Twenty-first Century. Remotely sensed data provide the only source of information to make a complex global agricultural monitoring system feasible by being consistent, repeatable, routine, rapid, and scalable. The world's cropland is classified by the following measures: a) Cropland or NonCropland, b) Irrigation or Rainfed, c) Crop Types and d) Intensity of Cropland. These quantities form the basis for estimating crop productivity (productivity per unit of land) and water productivity (crop per drop or productivity per unit of water).*

# The Global Distribution and Dynamics of Surface Soil Moisture



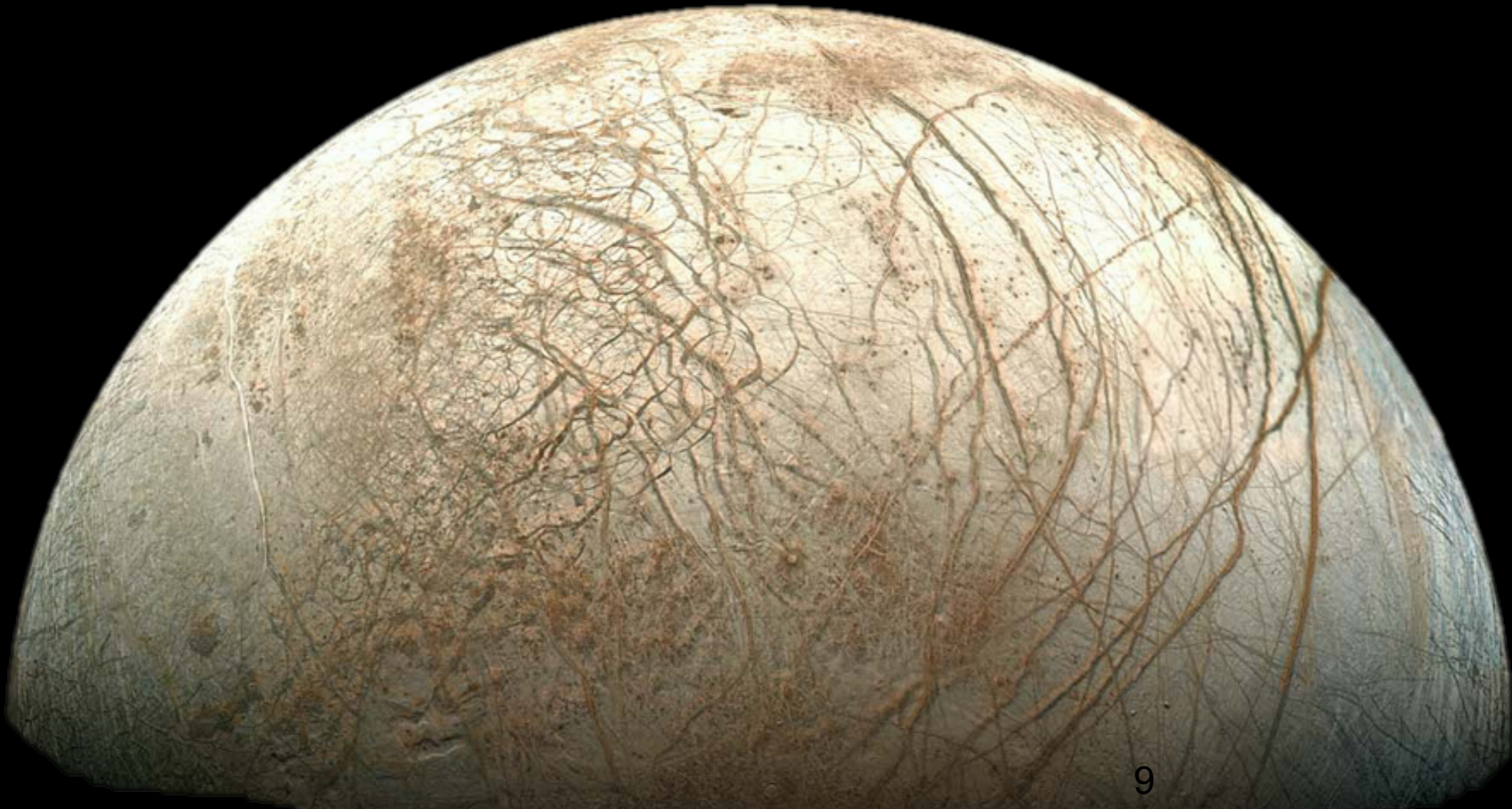
*Quantifying the magnitude and dynamics of the surface soil moisture (SSM) storage is essential for many practical reasons. Soil moisture plays an important role in soil microbial respiration, biogeochemical cycles, streamflow, crop yield, dust generation, and disease transmission. Global observations of SSM are now available from NASA's SMAP satellite mission.*

**Left: (top)** Global map of annual SSM (1 April 2015-31 March 2016) with the probability density function (PDF) shown in the inset, and the zonal mean SSM in the right panel; **(bottom)** Same as in top figure, but for mean daily precipitation.



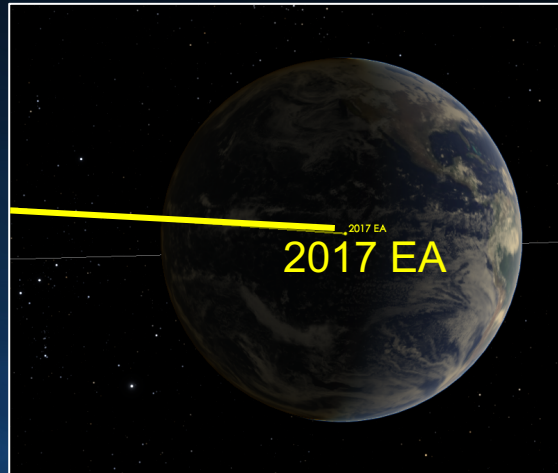


# Planetary Science

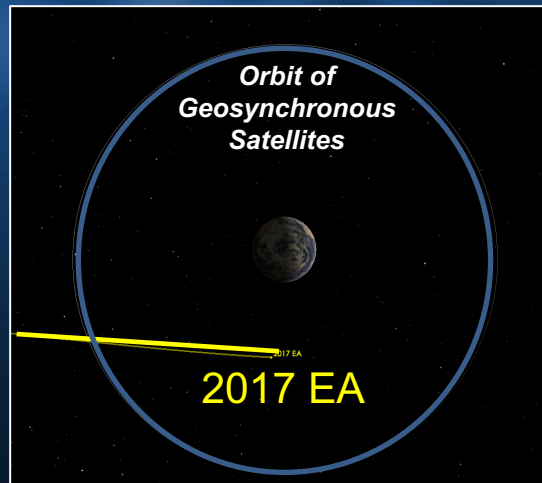


# Small Asteroid (2017 EA) Passes Within Geo Orbit 6 Hours After Discovery

*At point of  
Closest  
Approach  
over the  
eastern  
Pacific  
Ocean*



*View  
from over  
the  
Earth's  
north  
pole*



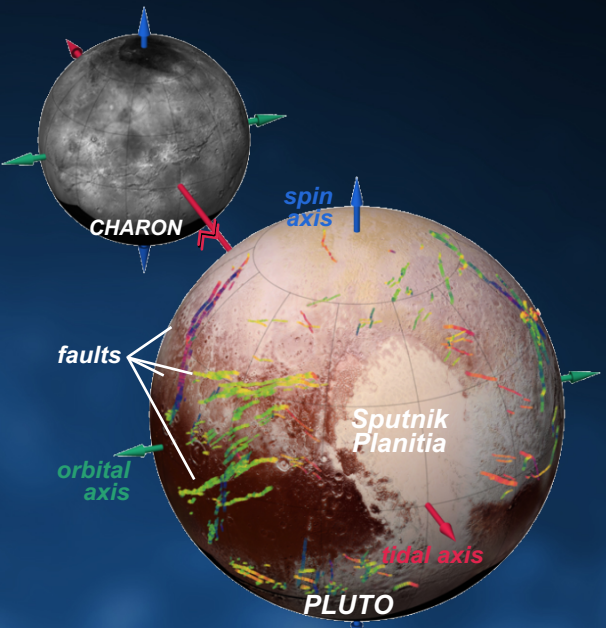
The Catalina Sky Survey 0.7-meter Schmidt discovered 2017 EA about 6 ½ hours prior to closest approach to Earth.



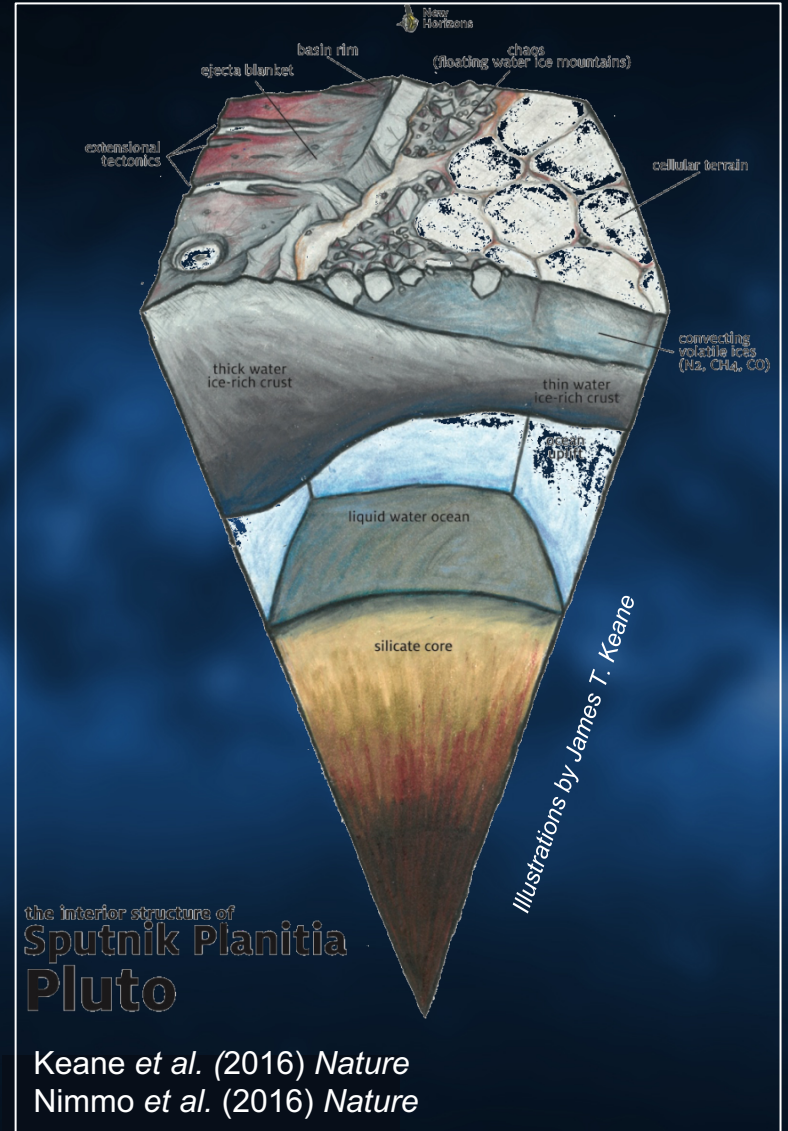
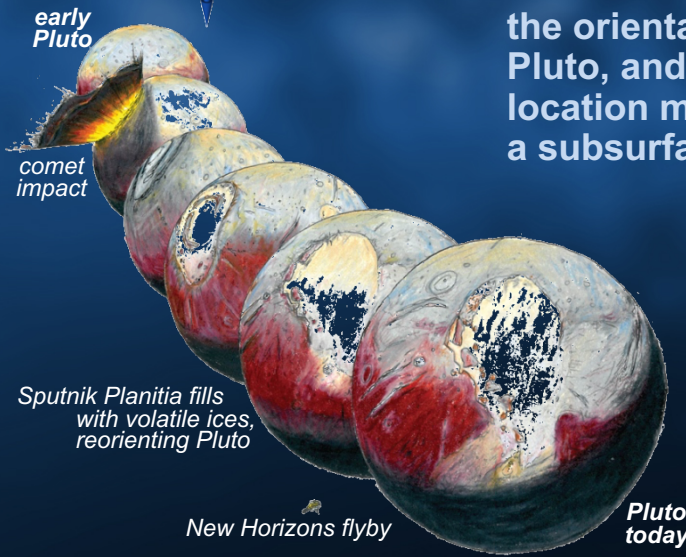
The 2.4-meter telescope at Magdalena Ridge Observatory provided follow-up astrometric observations within an hour.



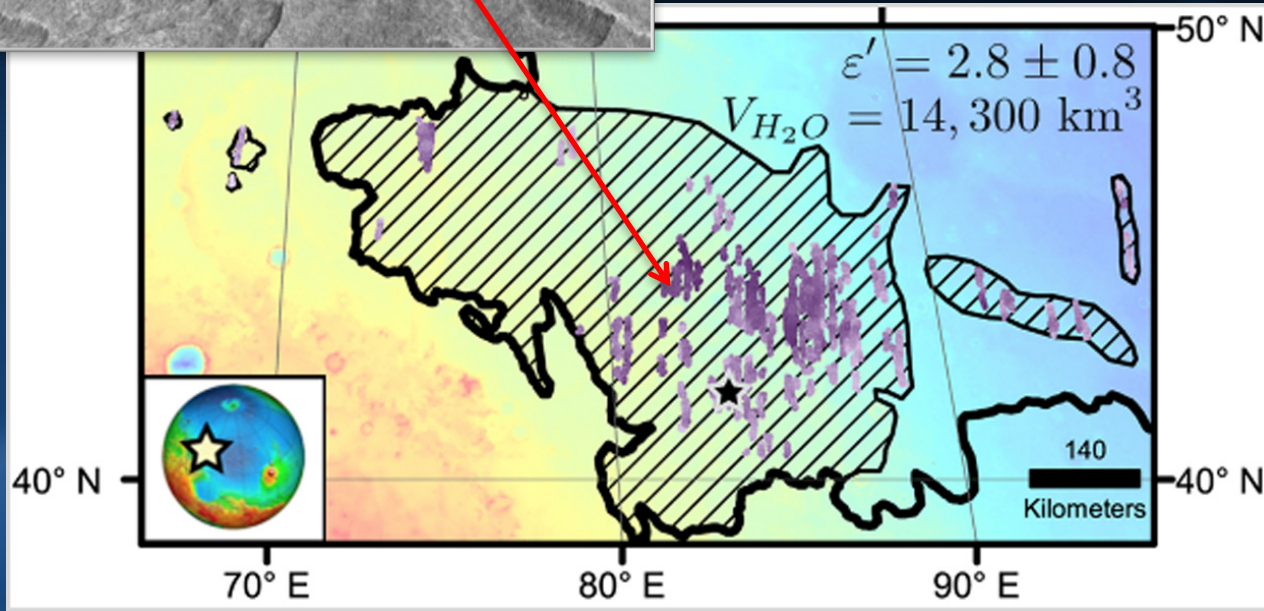
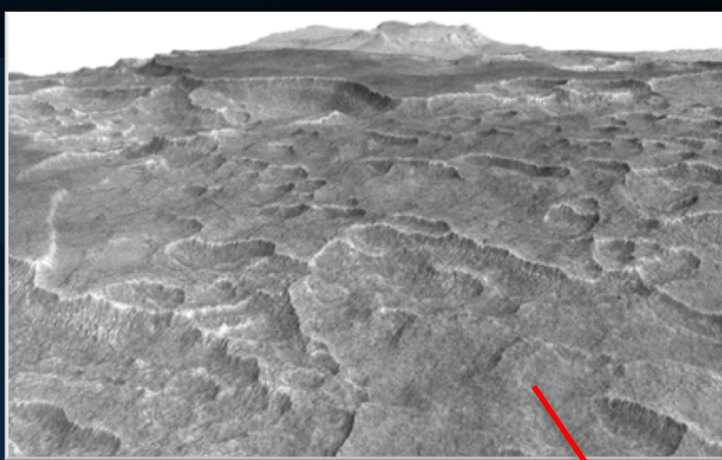
# Reorientation, Faulting, and an Ocean on Pluto



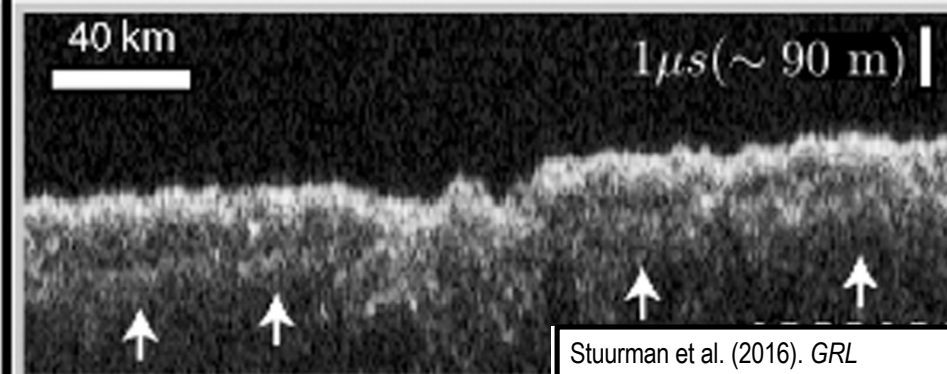
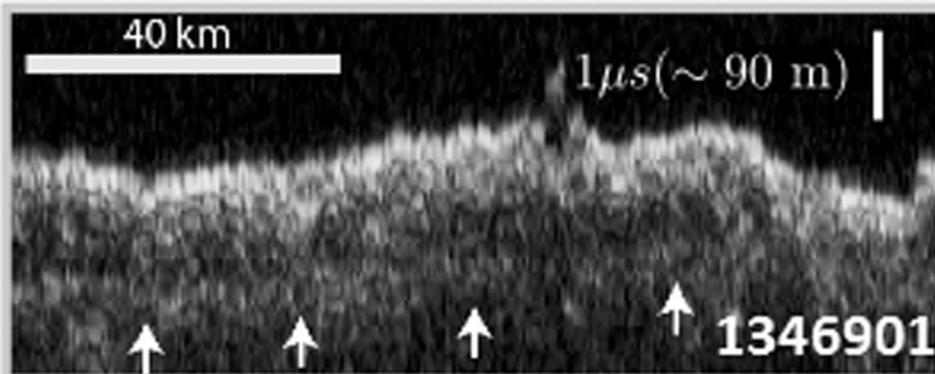
The New Horizons mission has revealed that Sputnik Planitia (left side of Pluto's heart), is probably a 1000 km diameter impact basin that is filled by a thick layer of actively convecting glacial sized nitrogen ice. This unique structure controls the orientation of Pluto, and its location may hint at a subsurface ocean.



# Lake Superior-Sized Ice Deposit on Mars



The Mars Reconnaissance Orbiter has identified a region of Mars called Utopia Planitia (hashed at left) that has significant amounts of subsurface ice.





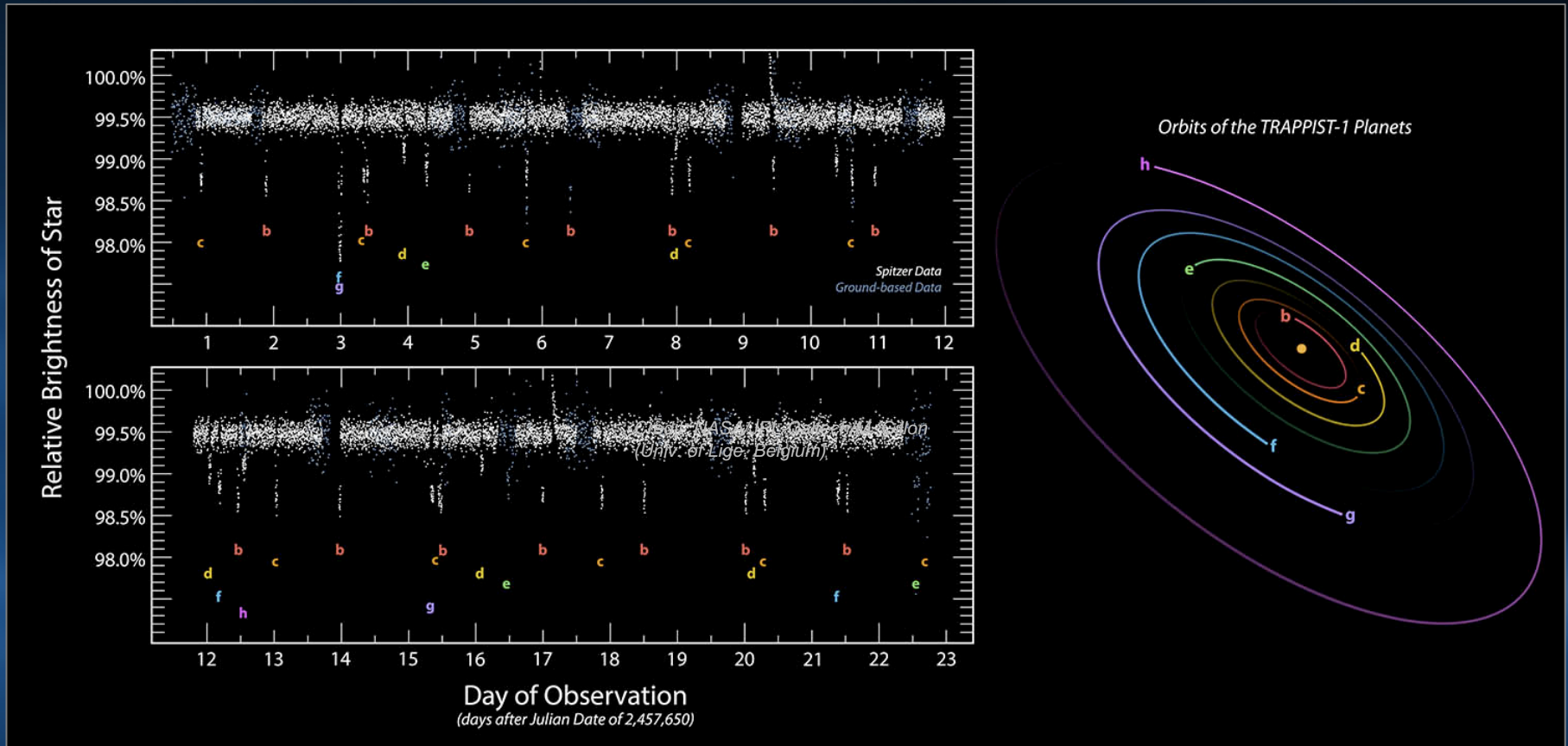
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# Astrophysics



# Largest Batch of Earth-Size Habitable-Zone Planets Around a Single Star



The data plot on the left shows Spitzer infrared observations of a system of seven planets orbiting TRAPPIST-1, an ultracool dwarf star. Over 21 days, Spitzer measured the drop in light as each planet passed in front of the star. Spitzer was able to identify a total of seven rocky worlds, including three in the habitable zone where liquid water might be found. The planets may be tidally locked to their star. A diagram of the layouts of the orbits is shown on the right.





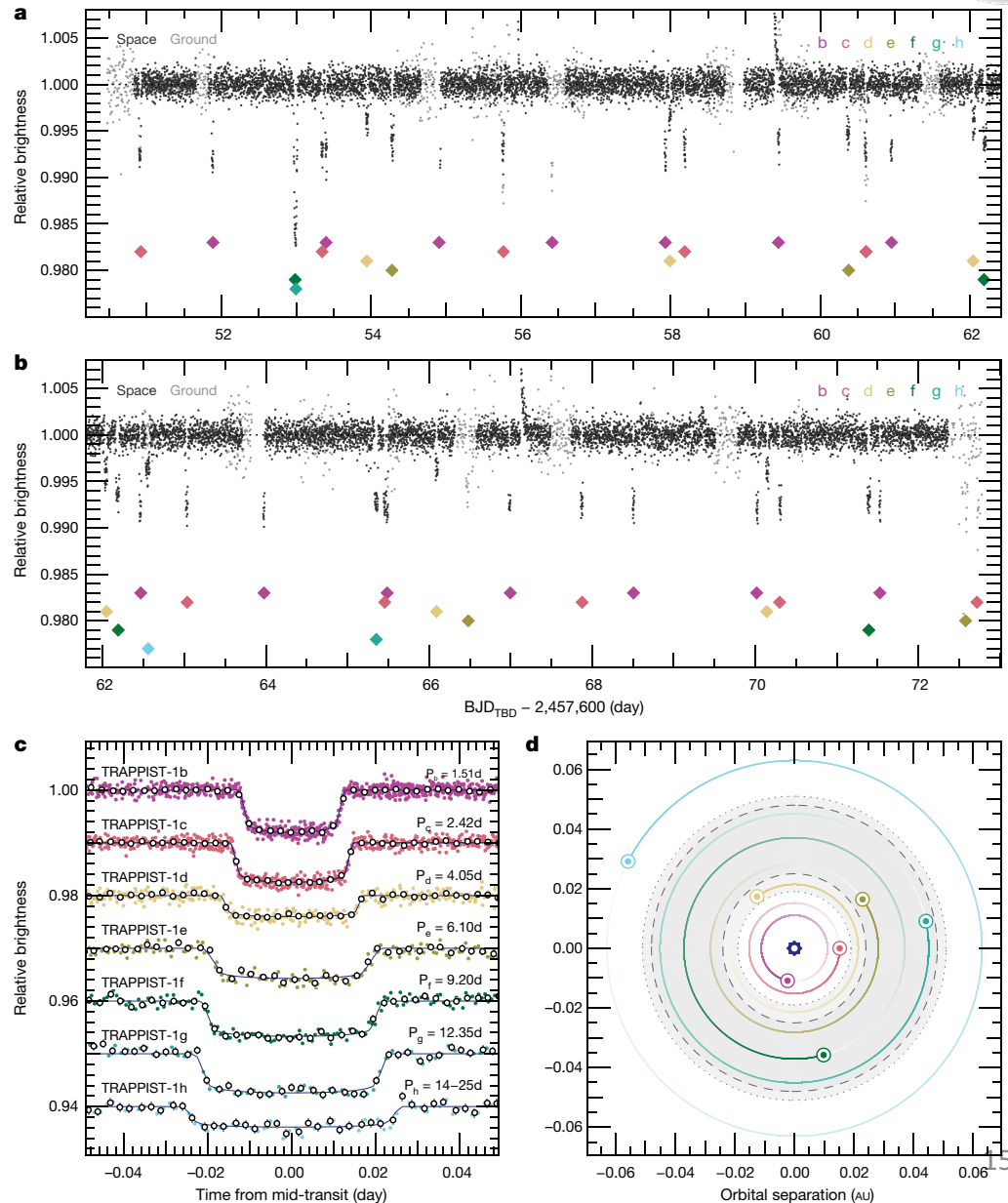
# The TRAPPIST-1 System



## 7 Earth-sized transiting exoplanets in one system!

- TRAPPIST-1 b & c discovered in 2015 by TRAPPIST ground-based survey
- 500 hours of Spitzer observations revealed 5 more earth-sized planets and constrained the masses of 6 of the planets
- Spitzer is currently obtaining another 500 hours of observations to constrain masses of planets to within 15%
- All TRAPPIST-1 planets are amenable to atmospheric characterization studies with HST and JWST

Gillon et al. (2017)

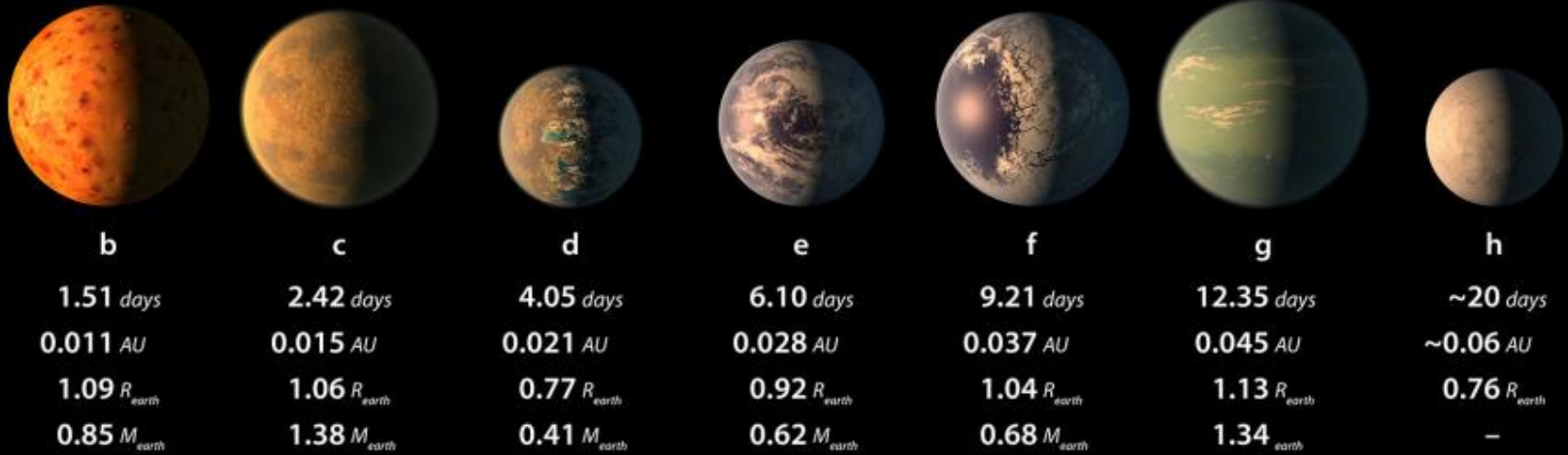




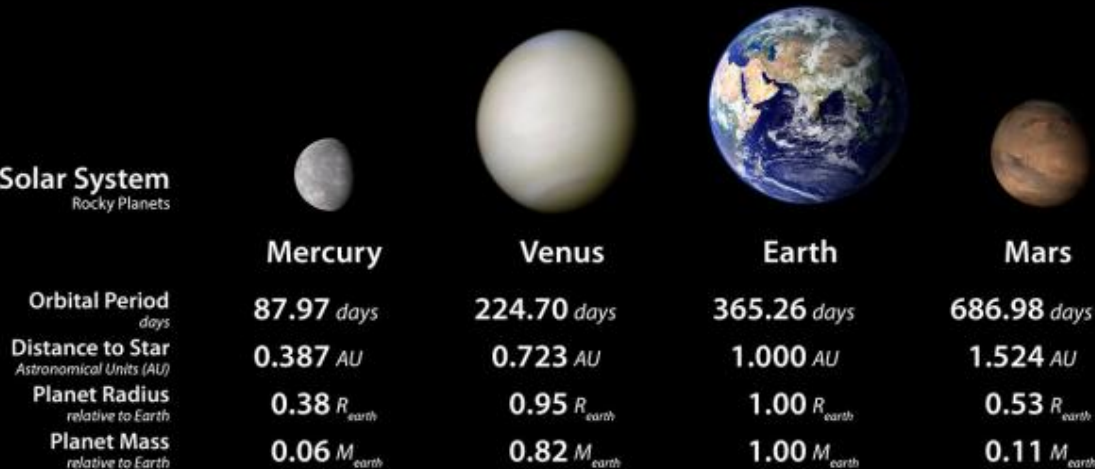
# The TRAPPIST-1 System

Illustrations

## TRAPPIST-1 System



## Solar System Rocky Planets

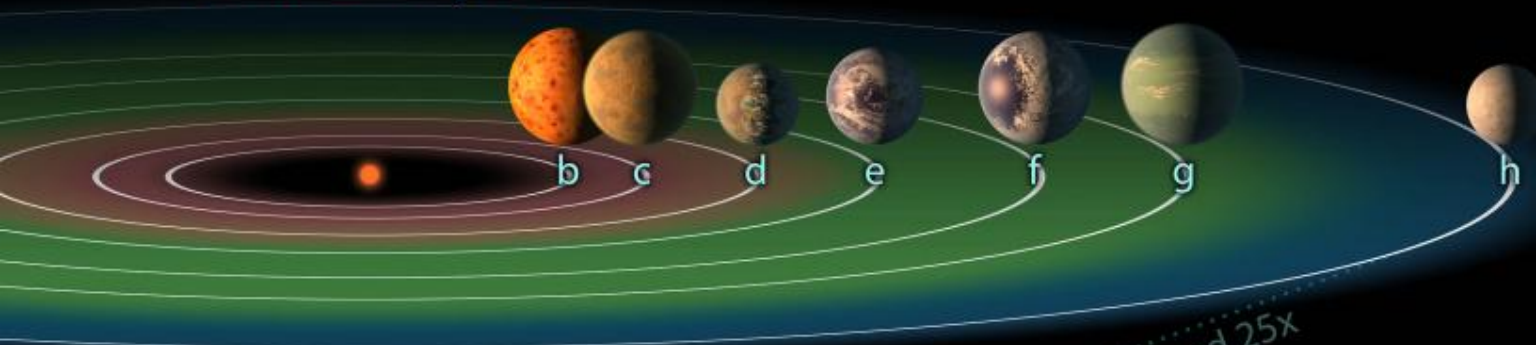




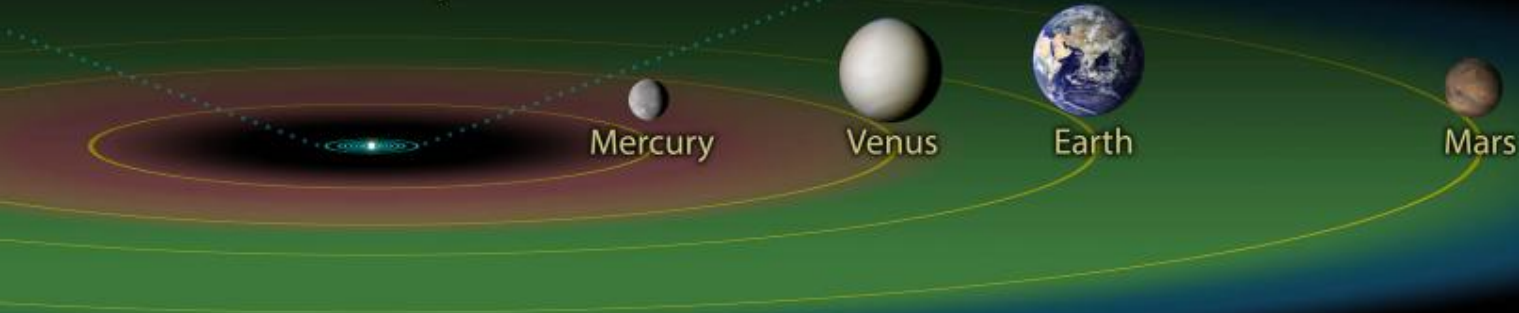


# The TRAPPIST-1 System

TRAPPIST-1 System



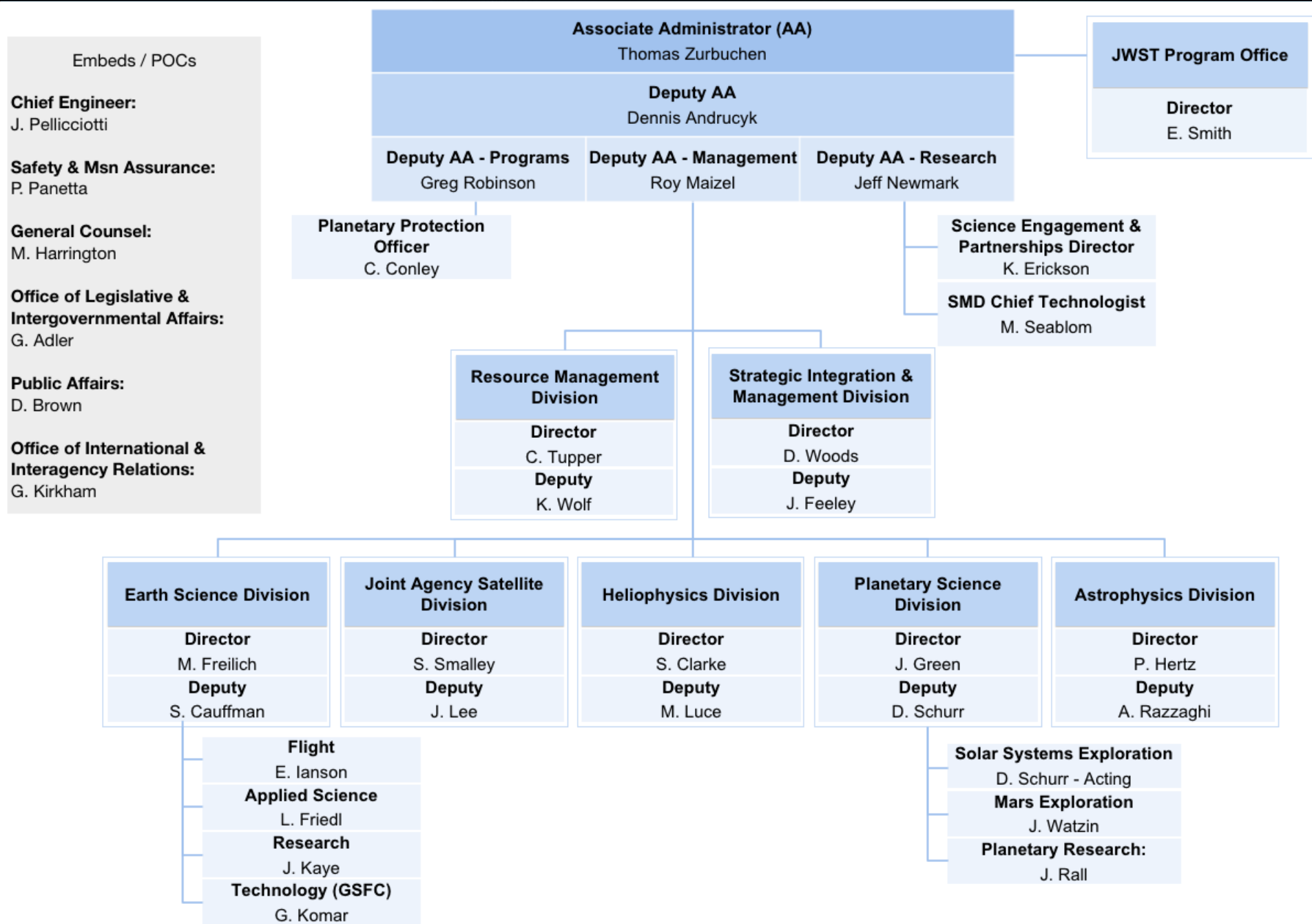
Inner Solar System



Enlarged 25x

Illustration

Credit: NASA/JPL-Caltech/R. Hurt, T. Pyle (IPAC)





# SMD Division Committees Chartered

NASA has replaced the NAC Science Committee's four subcommittees associated with four SMD divisions with stand-alone FACA committees:

**Astrophysics Advisory Committee (APAC)**

**Earth Science Advisory Committee (ESAC)**

**Heliophysics Advisory Committee (HPAC)**

**Planetary Science Advisory Committee (PAC)**

- These cmtes advise the respective SMD Division Director
  - Advice to be delivered and acted upon at the right organizational level
  - Many community-based studies (e.g., Senior Reviews, Science and Technology Definition Teams) will now have a chartered Federal advisory committee to report to
- Committees Established by Charter
  - Charters and membership balance plans reviewed and approved by the General Services Administration (GSA) Secretariat (Sept/Oct, 2016)
  - NASA's 15-day public notification of intent to charter these cmtes published in the Federal Register (December, 2016)
  - NASA Administrator signed cmtte charters and notification was provided to relevant Congressional committees (January, 2017)

# Chartered Committee Implementation

Expertise balance and diversity in all dimensions continue to be primary goals regarding committee membership:

- Annual Call for Self-Nominations published in Federal Register, NASA research and education list serves, and on other websites
- New outreach conducted at Lunar and Planetary Science Conference to recruit candidates for the **PAC**
- Many existing members will serve again on the new committees

Subcommittees of the chartered committees are being set up:

- The Senior Reviews for Earth science and Heliophysics are being formed under the **ESAC** and **HPAC**, respectively

A meeting of the **APAC** has been scheduled for April 24-25 at NASA HQ



# Retool of Science Committee

## **SMD AA and SC Chair-led retool effort for SC to serve as a strategic arm for advice on matters that need input the most**

- Solve problems and complete tasks
- Provide feedback on topical areas, challenges, specific charges (tackle a discrete question and deliver an answer back at the next mtg)
- Emphasize innovative technology, experimentalism

### Mechanisms:

- Findings/Recs - cross-cutting interest, best practices, or high interest one-division topics directed to the SC; all else directed to division FACA chartered cmtc
- Problem-solving sessions - utilize various formats (expert panel, workgroup, etc.)
- Updates - increased focus on reporting back on last mtg's findings/recs
- Briefings - reduced amount on agenda, split of 50% presentation / 50% Q&A
- Big Data Task Force – guidance provided on question formulation and product to deliver

### Membership:

- Maintain expertise balance
- Increase diversity in all dimensions (including thought)

# April 12-13 Science Committee Meeting



## **New Mechanisms:**

- Problem-solving by SC members on how R&A program can include highly innovative, high-impact, or even high-risk endeavors
- One SMD Division briefing only - Joint Agency Satellite Division (JASD)
- Outbrief session for SMD AA added at end of meeting
- Discussion sessions with the SC members on new ideas in charters and SC retool

## **Existing mechanisms:**

- SC Chair requested session: WFIRST update
- Special briefing on a scientific discovery: TRAPPIST-1 Exoplanets
- Discussion/Q&A session with the SMD AA
- Update on a recent NAC, SC and PSS finding: Deep Space Network (DSN)
- Member scientific research lunch presentation

Looking Ahead to a potential Summer Joint Meeting of HEOC/SC