

National Aeronautics and
Space Administration



EXPLORE SCIENCE

LORI S. GLAZE, Ph.D.

Planetary Science Division Director (Acting)
50th Lunar and Planetary Science Conference

March 2019

NASA SCIENCE

AN INTEGRATED PROGRAM

Planetary
Science



Earth
Science



Joint Agency
Satellite Division



Astrophysics



Heliophysics



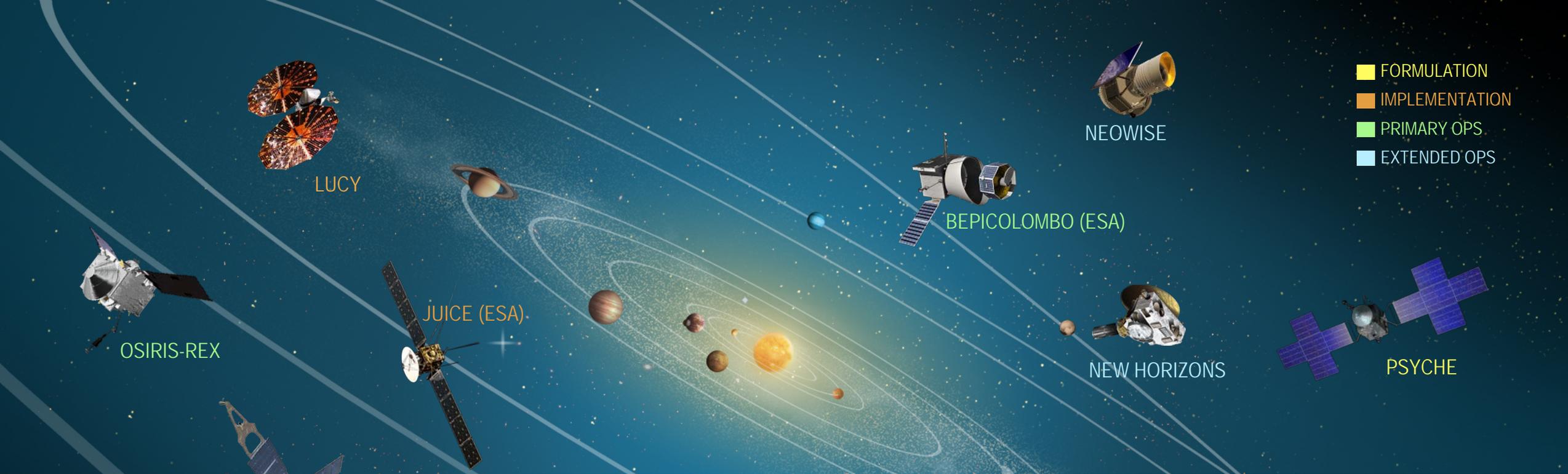
KEY SCIENCE THEMES

Protect & Improve
Life on Earth

Search for
Life Elsewhere

Discover Secrets
of the Universe





- FORMULATION
- IMPLEMENTATION
- PRIMARY OPS
- EXTENDED OPS

LUCY

NEOWISE

BEPICOLOMBO (ESA)

OSIRIS-REX

JUICE (ESA)

NEW HORIZONS

PSYCHE

JUNO

EUROPA CLIPPER

DART

MOON

CHANDRAYAAN-2 (ISRO)

LUNAR RECONNAISSANCE ORBITER

BERESHEET (ISA, SPACE IL)

Rover

MARS

MARS ODYSSEY

MARS EXPRESS (ESA)

MRO

MAVEN

EXOMARS 2016 (ESA)

MMX (JAXA)

CURIOSITY ROVER

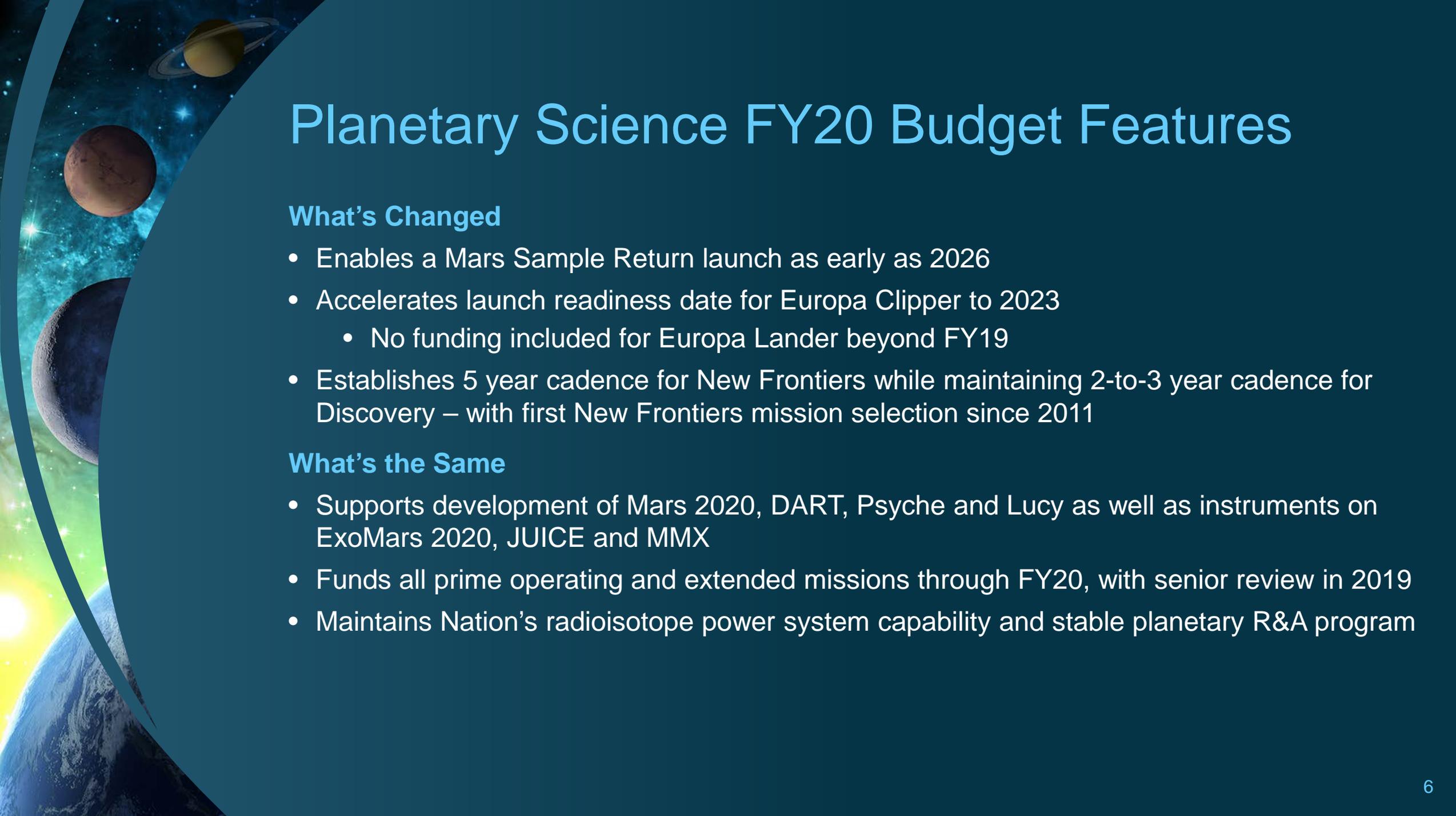
INSIGHT

EXOMARS 2020 (ESA)

MARS 2020 ROVER

FY19 Proposed Operating Plan (\$M)

Planetary Science	2,748.4
Planetary Science Research	236.4
Planetary Defense	150.0
Lunar Discovery and Exploration	188.0
Discovery	409.5
New Frontiers	120.4
Mars Exploration	690.0
Outer Planets	755.6
Technology	198.5

A vibrant space-themed background featuring a curved view of Earth at the bottom left, transitioning into a deep blue space filled with stars, nebulae, and several celestial bodies including Mars, Saturn, and the Moon.

Planetary Science FY20 Budget Features

What's Changed

- Enables a Mars Sample Return launch as early as 2026
- Accelerates launch readiness date for Europa Clipper to 2023
 - No funding included for Europa Lander beyond FY19
- Establishes 5 year cadence for New Frontiers while maintaining 2-to-3 year cadence for Discovery – with first New Frontiers mission selection since 2011

What's the Same

- Supports development of Mars 2020, DART, Psyche and Lucy as well as instruments on ExoMars 2020, JUICE and MMX
- Funds all prime operating and extended missions through FY20, with senior review in 2019
- Maintains Nation's radioisotope power system capability and stable planetary R&A program

APOLLO

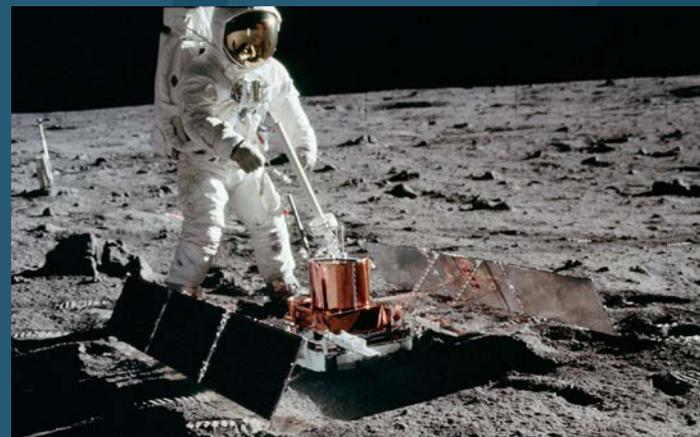
50  NEXT GIANT LEAP





InSight

TAKING THE 'VITAL SIGNS' OF MARS



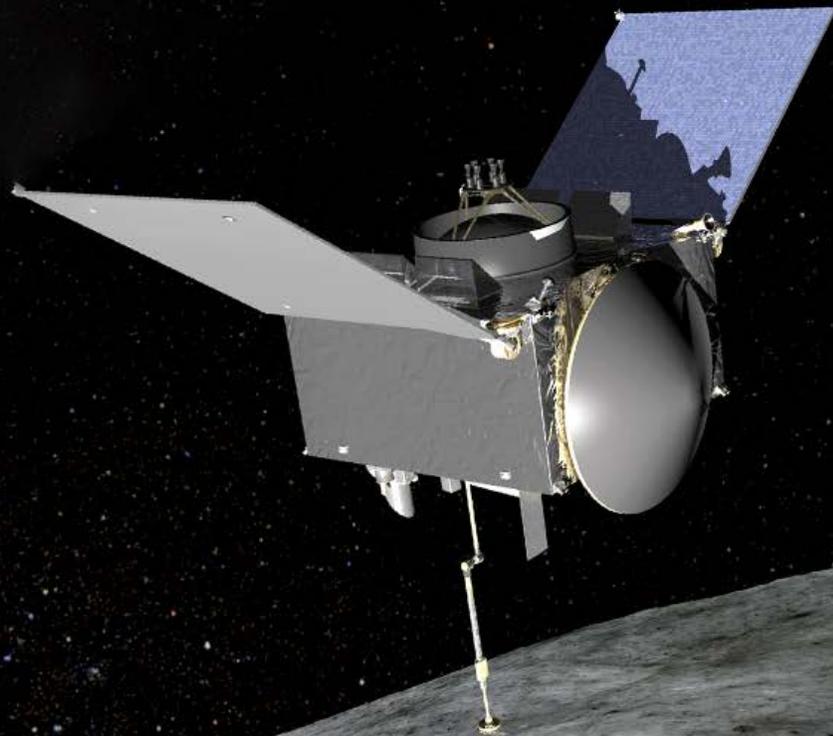
Jul. 20 1969 – Buzz Aldrin with the Passive Seismic Experiment – first seismometer placed on Moon's surface



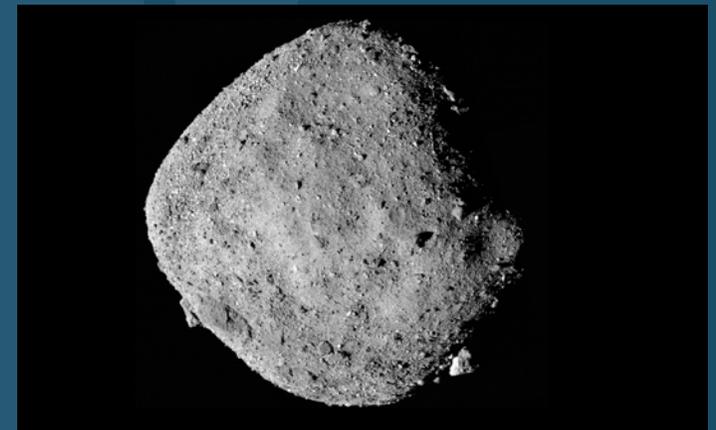
Dec. 19, 2018 – InSight seismometer on Martian surface – first time a spacecraft robotically placed a seismometer onto surface of another planet

OSIRIS-REx

*Bennu Arrival
December 3, 2018*



1972 – Scientist-astronaut Harrison Schmitt using a sampling scoop to retrieve lunar samples during Apollo 17

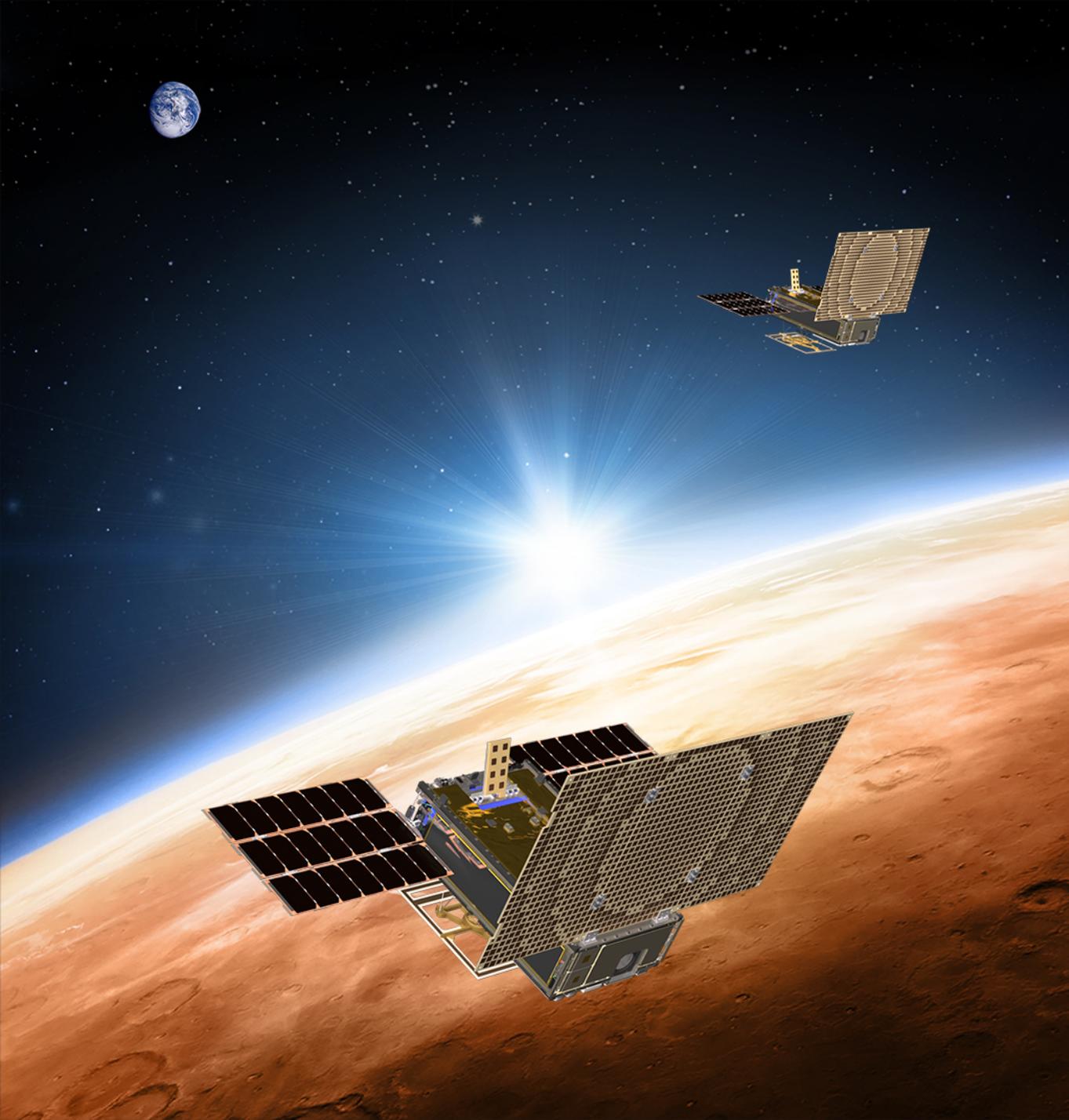


Dec. 3, 2018 – OSIRIS-REx showing Bennu in one full rotation from approximately 80 km away



Apollo Next Generation Sample Analysis

- 9 teams selected to analyze specially curated lunar samples from Apollo, in preparation for next era of exploration of the Moon
- Samples intentionally preserved for posterity
- Many early career scientists and multi-generational teams
- \$8M provided by Lunar Discovery and Exploration program



MarCO Mars Cube One



Nov. 26, 2018 - MarCO image of Mars from about 4,700 miles away during its flyby

SPIRIT AND OPPORTUNITY

By the Numbers

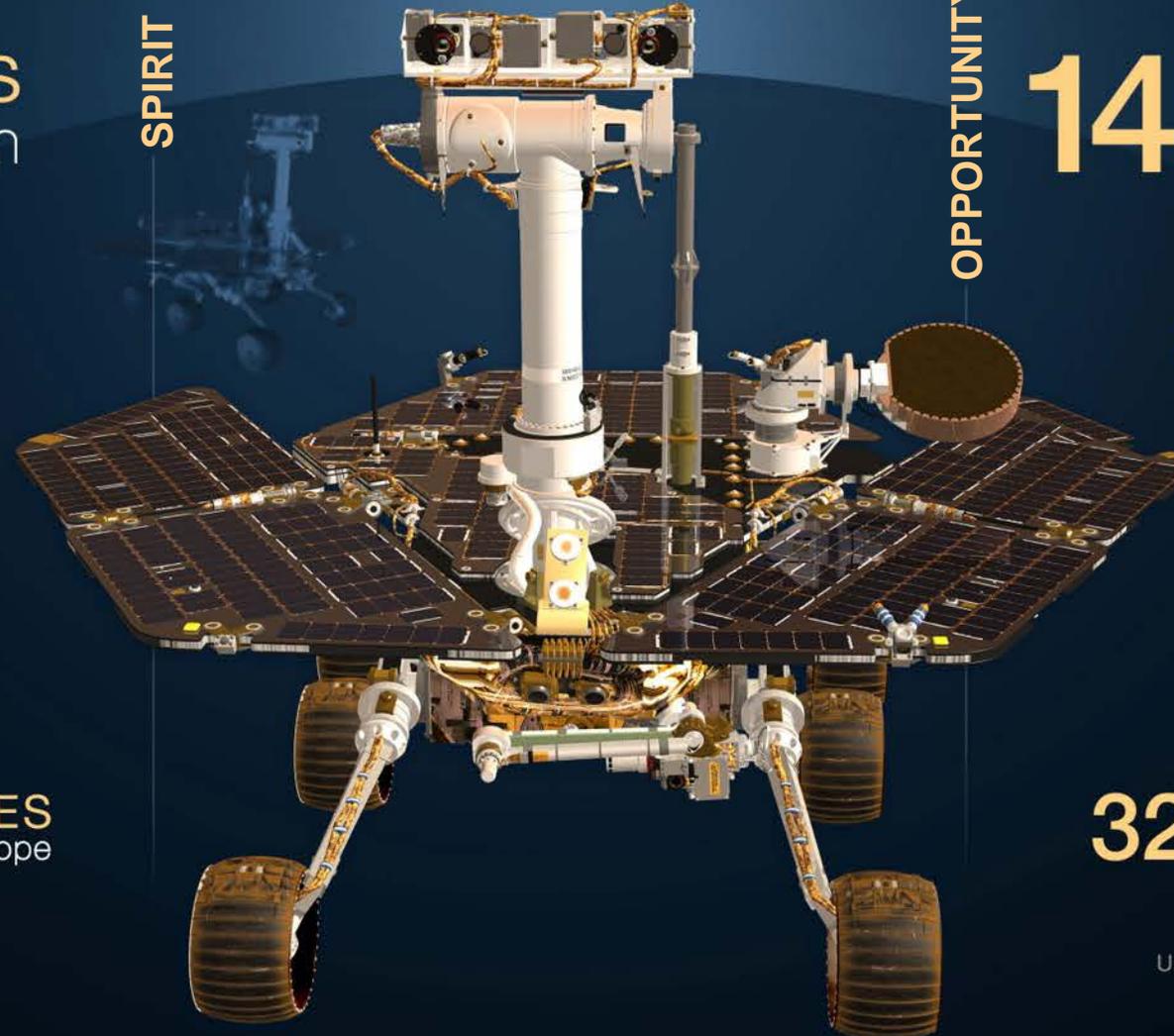
6 YEARS
lifespan

SPIRIT

124,838
raw images

4.8 MILES
traveled

30 DEGREES
steepest slope



OPPORTUNITY

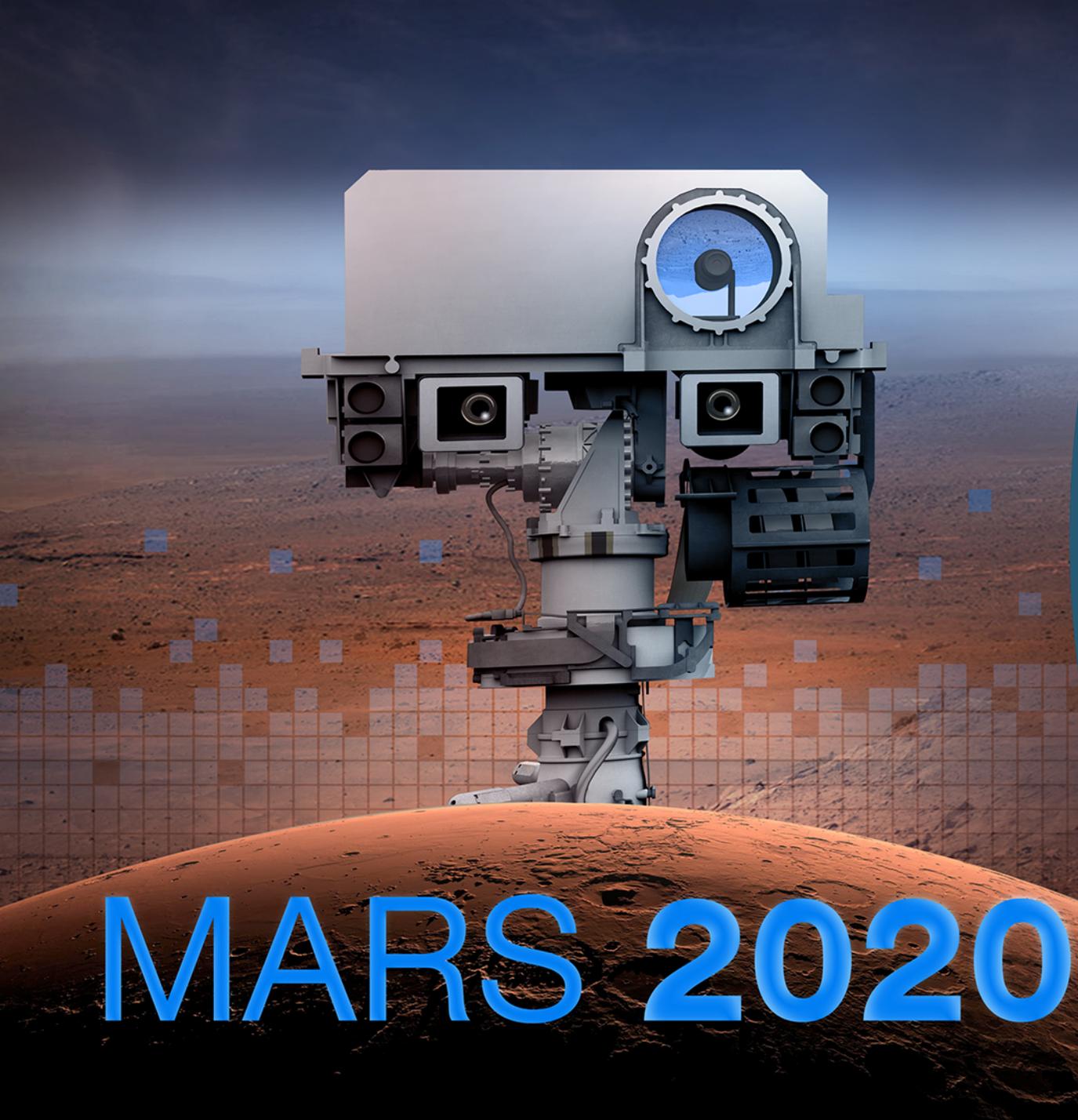
14+ YEARS
lifespan

217,594
raw images

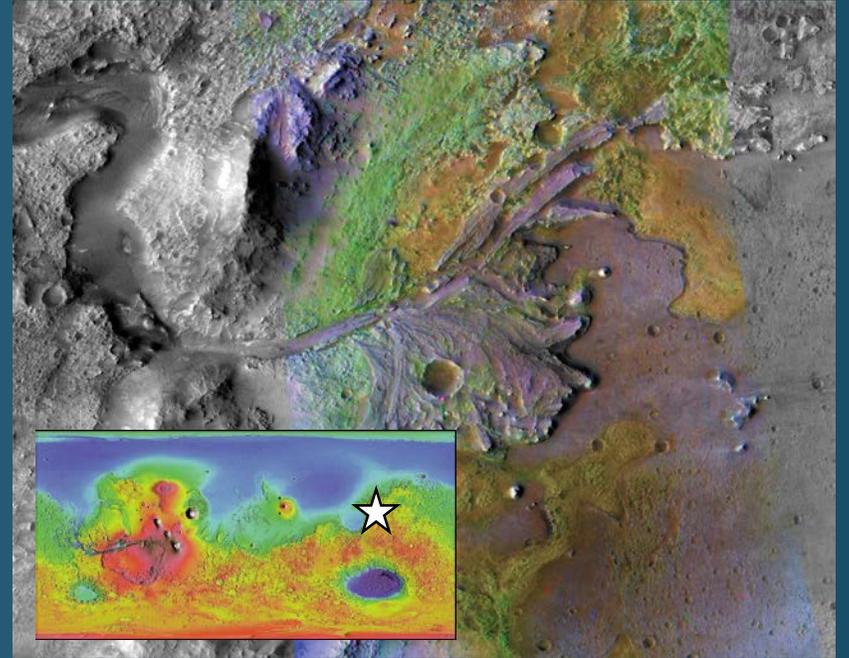
28 MILES
traveled

32 DEGREES
steepest slope

Updated February 4, 2019



MARS 2020



Nov. 19, 2018 - NASA announced landing site for Mars 2020 Rover mission as Jezero Crater

Mars Sample Return (MSR) Concept

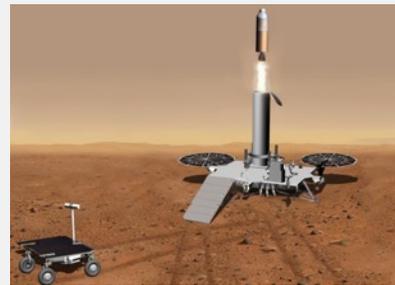
FY2020 Budget Request supports formulation of MSR campaign



Sample Caching Rover (Mars 2020)

- *Sample acquisition and caching*

2020



Sample Retrieval Lander*

- *Fetch Rover*
- *Orbiting Sample container (OS)*
- *Mars Ascent Vehicle*

NET 2026



Earth Return Orbiter**

- *Capture/Containment Module*
- *Earth Return Module*
- *Comm Relay for MSR*

NET 2026

Flight Elements

Future Work



Mars Returned Sample Handling

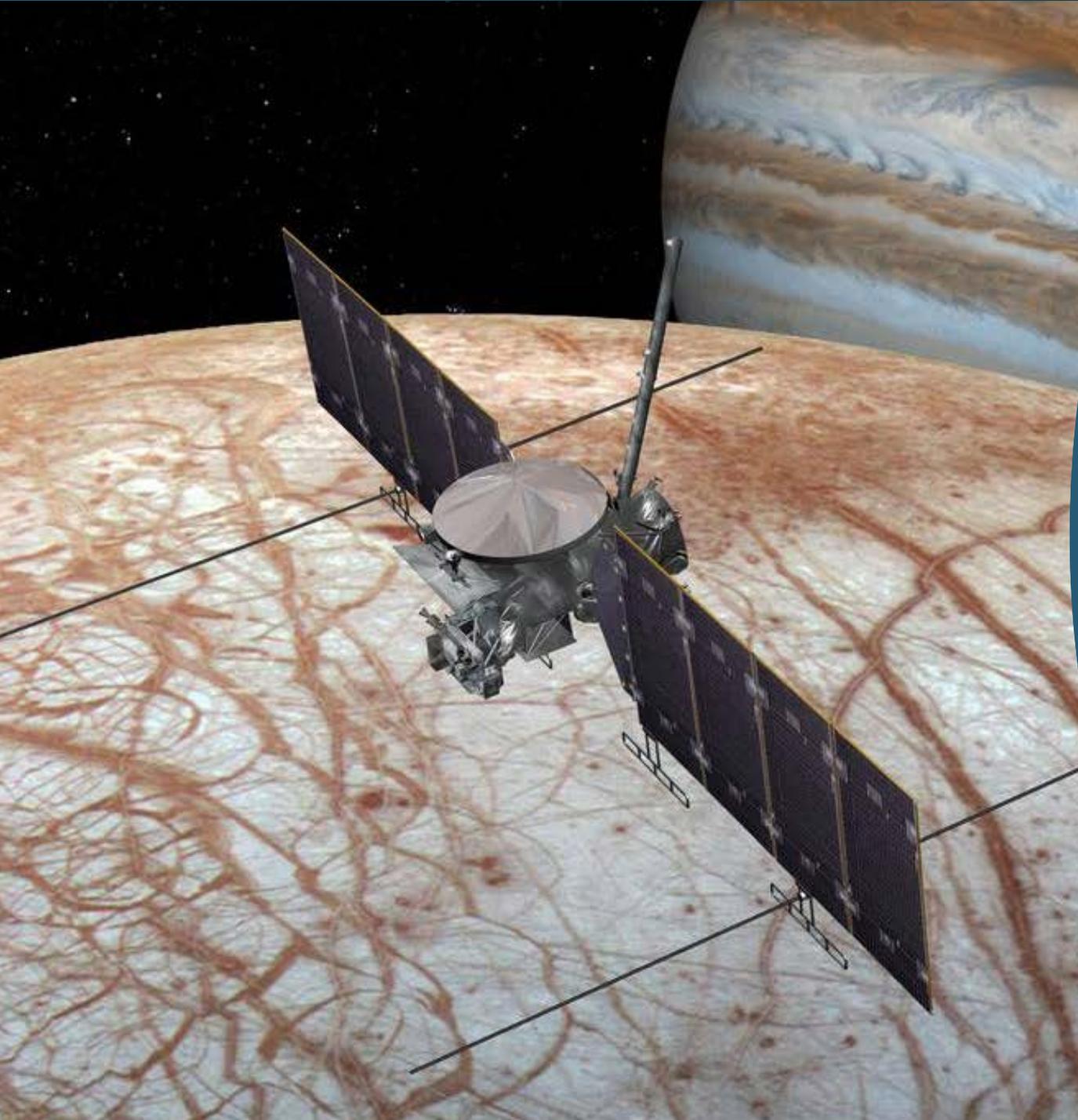
- *Sample Receiving Facility*
- *Curation*
- *Sample science investigations*

2031

Ground Element

**NASA-led*

***ESA-led per April 2018 Statement of Intent*

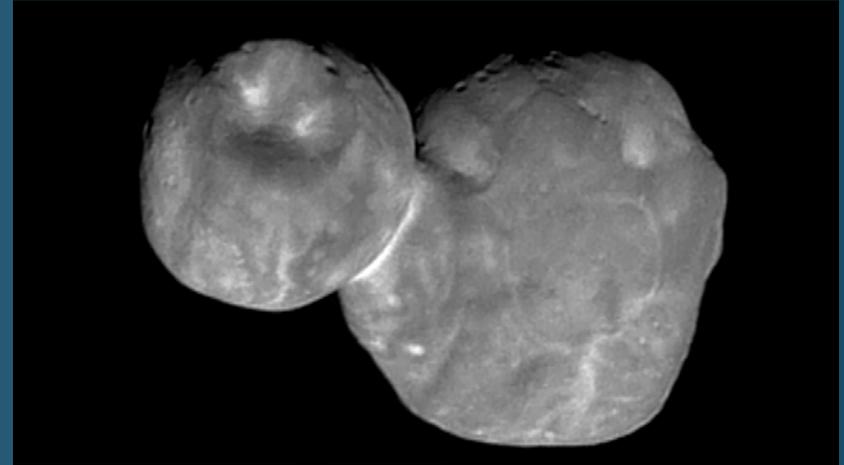


Europa Clipper

- A mission to investigate Europa is one of the highest priorities for a flagship mission in last Decadal Survey
- The Decadal Survey recommended mission's cost and science scope be reduced, which was successfully done
- The Decadal Survey Midterm Review reaffirmed recommendations, and recommended NASA closely monitor cost to ensure it stays within its estimated range

New Horizons

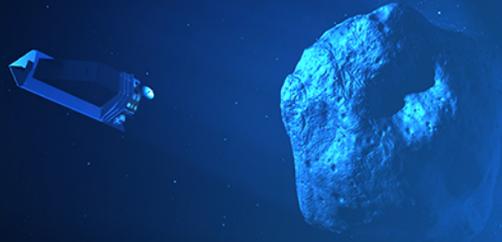
*Arrival at Ultima Thule
January 1, 2019*



Jan. 1, 2019 - New Horizons captures image Kuiper Belt object 2014 MU69 nicknamed Ultima Thule seven minutes before closest approach

ASSESS

[CENTER FOR NEAR EARTH
OBJECT STUDIES]



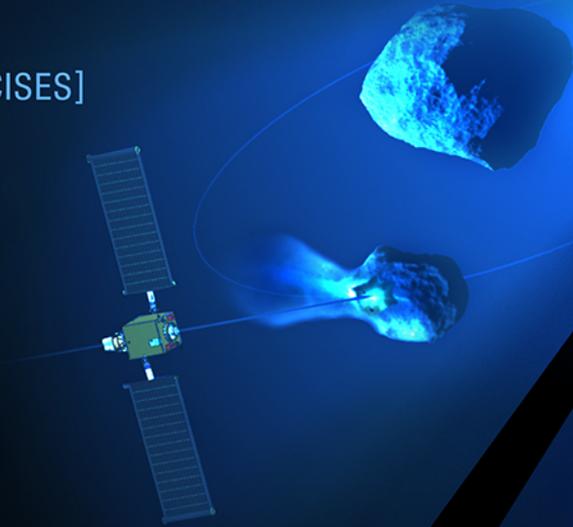
SEARCH, DETECT & TRACK

[GROUND-BASED & SPACE-BASED
OBSERVATIONS, IAWN]



MITIGATE

[DART, FEMA EXERCISES]



PLANETARY DEFENSE

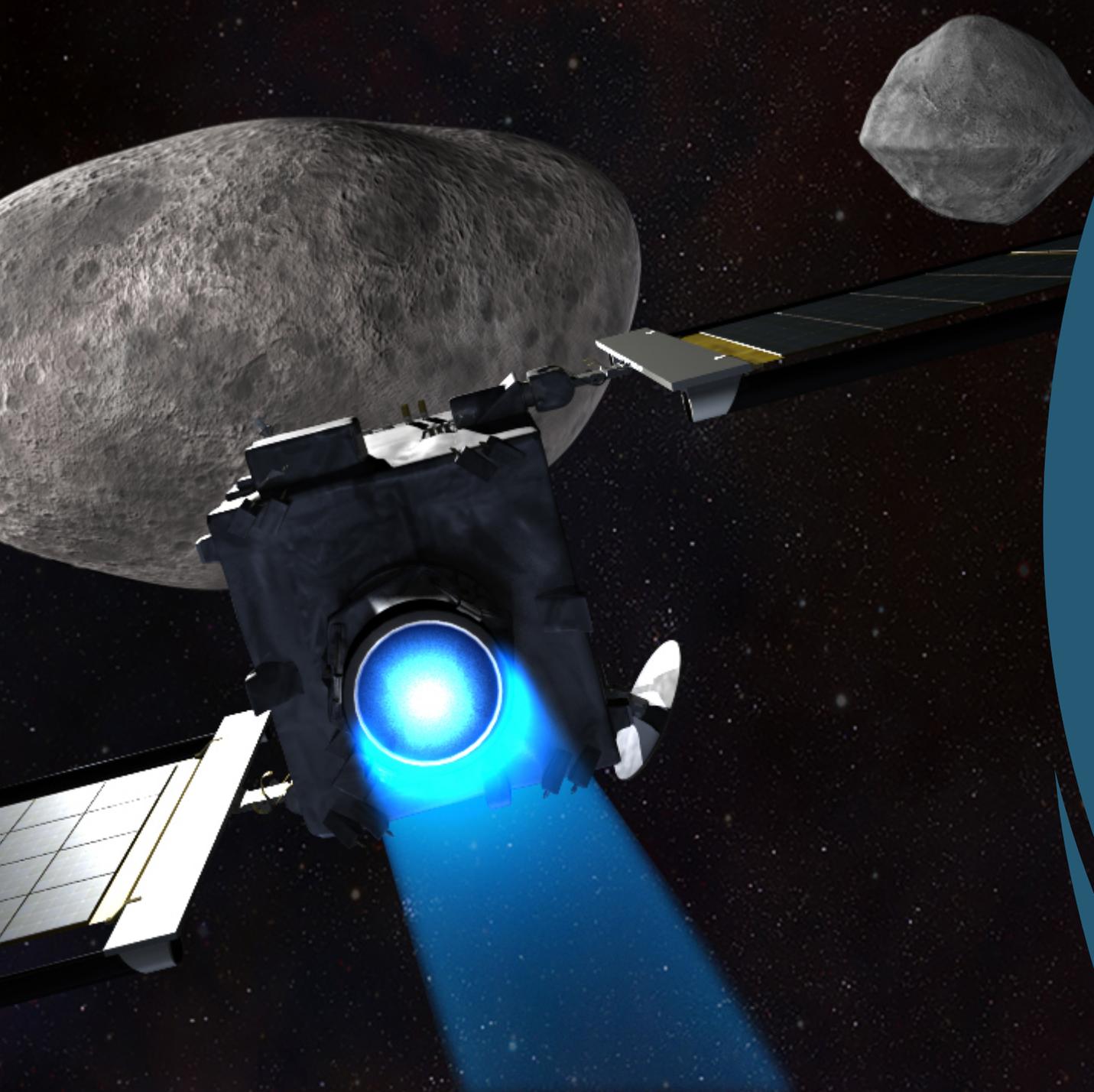
PLAN & COORDINATE

[SMPAG, PIERWG, DAMIEN IWG]

CHARACTERIZE

[NEOWISE, GOLDSTONE,
ARECIBO, IRTF]





Double Asteroid Redirection Test (DART)

- First-ever mission to demonstrate asteroid deflection technique for NASA's Planetary Defense Coordination Office
- Uses kinetic impact to change motion of asteroid in space
- Current DART target, Didymos, will have distant approach to Earth October 2022

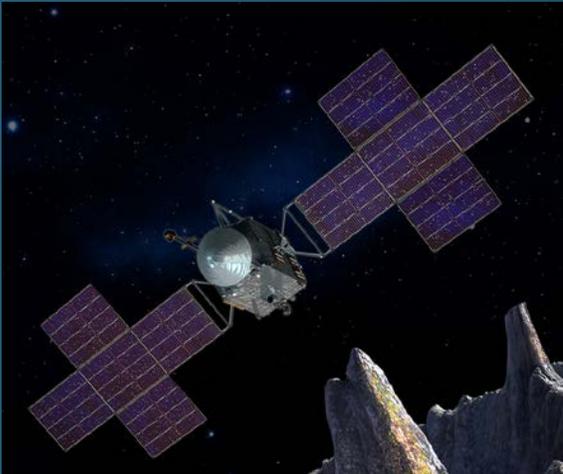
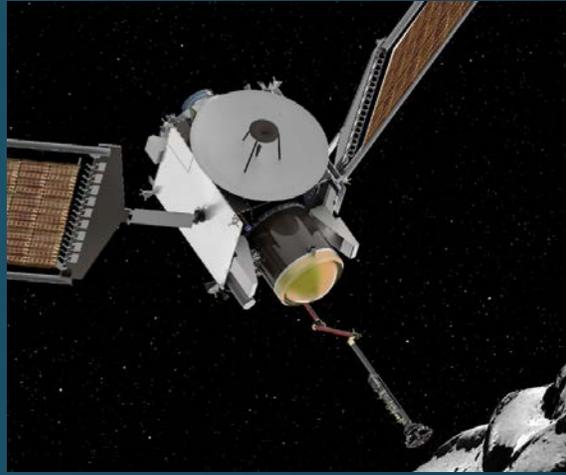
Inspire Future Leaders



- Achieve excellence by relying on diverse teams, both within and external to NASA, to most effectively perform SMD's work
- Attract and retain talent by promoting a culture that actively encourages diversity and inclusion and removes barriers to participation
- Encourage development of future leaders, including the next generation of mission principal investigators, through targeted outreach and hands-on opportunities
- Support early-career scientists to build careers working with NASA
- Engage the general public in NASA Science, including opportunities for citizen scientists



Announcements of Opportunity



Small Innovative Missions for Planetary Exploration (SIMPLEx)

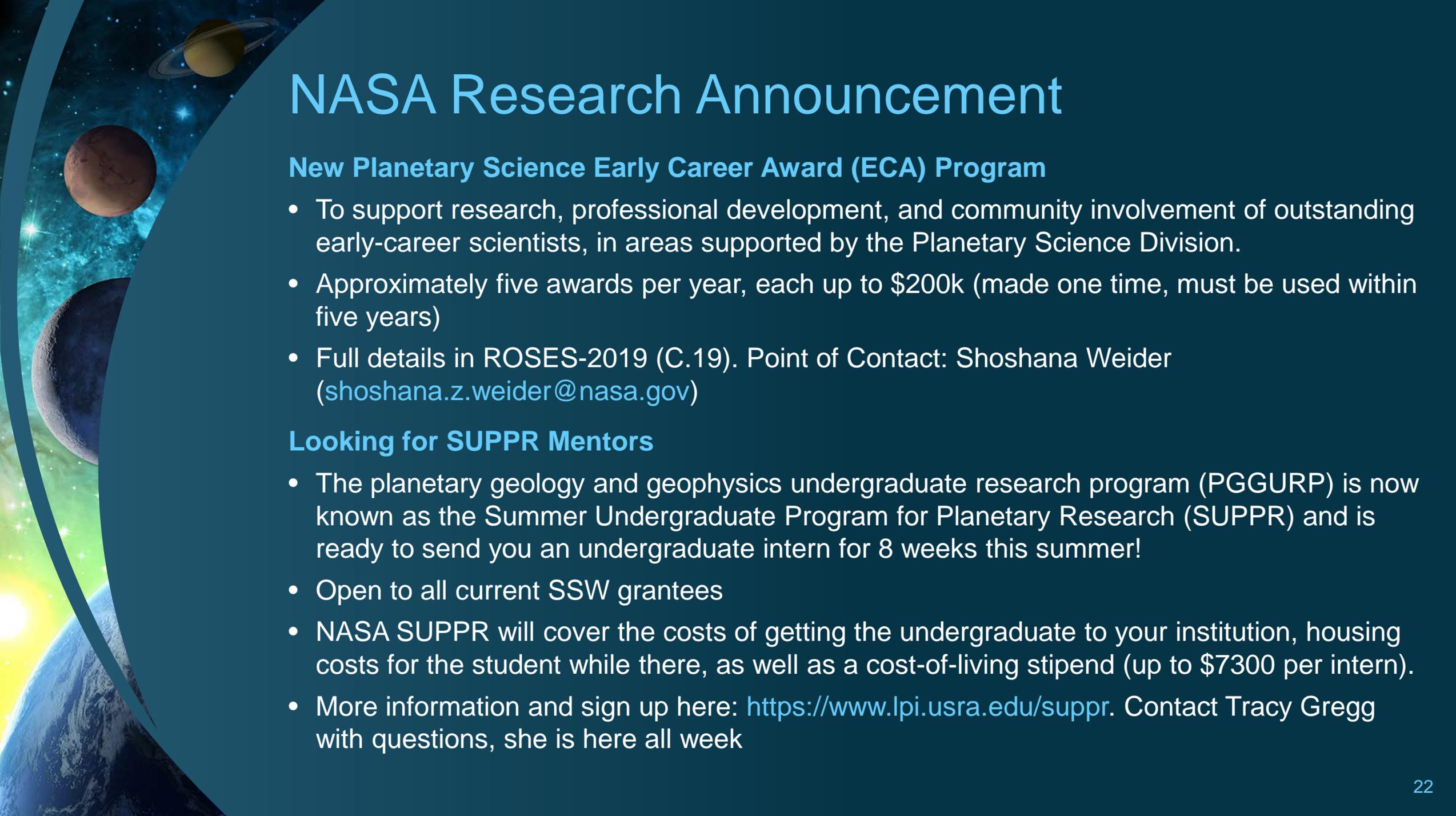
- Step-1 reviews were completed before shutdown
- Step-1 selection to be scheduled NET April 12, 2019

New Frontiers #4 Down-selection

- New Step-2 evaluation schedule incorporates a four-week slip in site visits
- Plenary Meetings have been rescheduled
- Down-selection announcement still expected in July 2019

Discovery 2019

- Draft AO released before shutdown
- Comment period extended to February 11, 2019
- Final AO release expected NLT April 1, 2019
- Step-1 proposal due date rescheduled to July 1, 2019



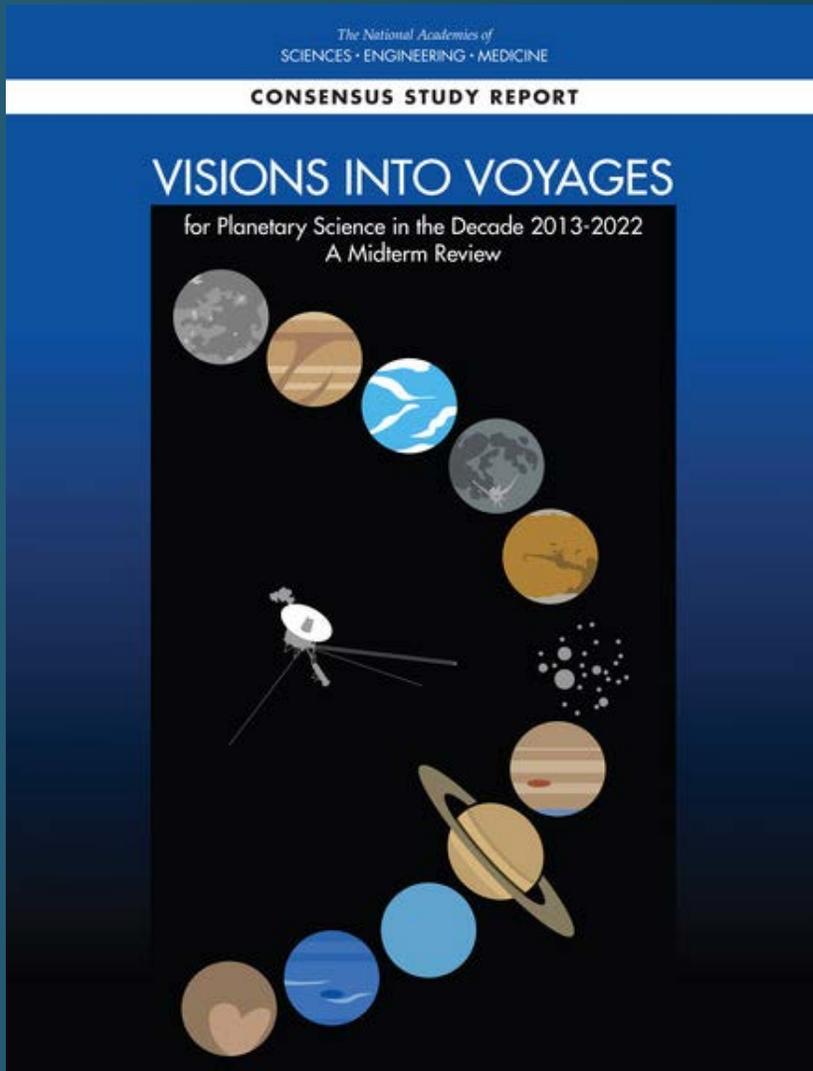
NASA Research Announcement

New Planetary Science Early Career Award (ECA) Program

- To support research, professional development, and community involvement of outstanding early-career scientists, in areas supported by the Planetary Science Division.
- Approximately five awards per year, each up to \$200k (made one time, must be used within five years)
- Full details in ROSES-2019 (C.19). Point of Contact: Shoshana Weider (shoshana.z.weider@nasa.gov)

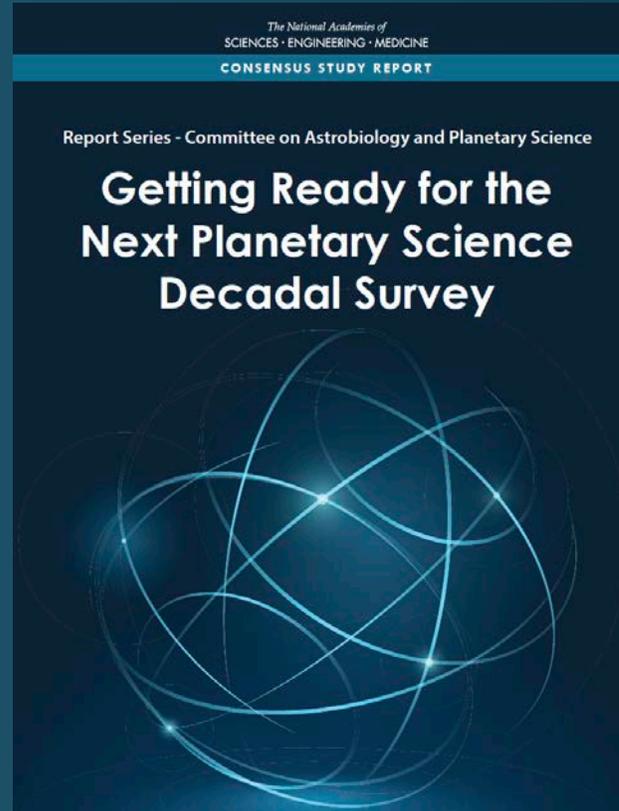
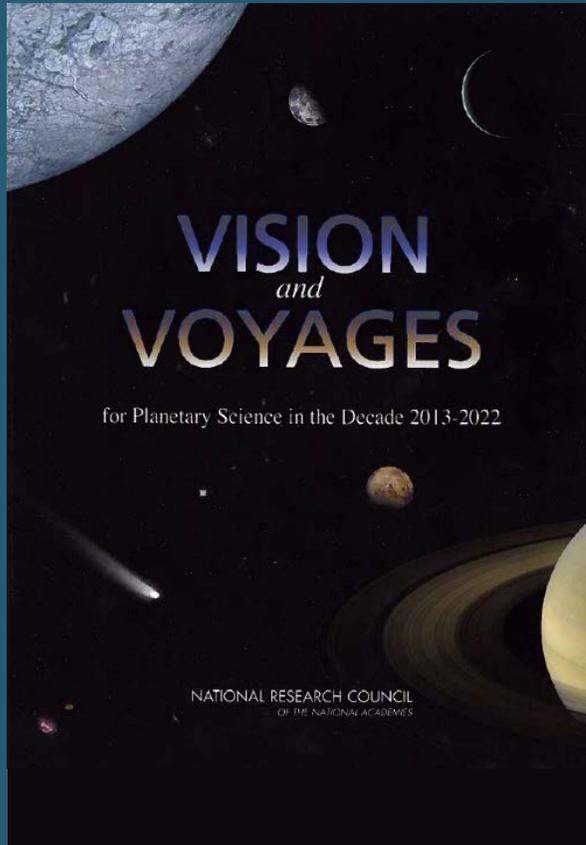
Looking for SUPPR Mentors

- The planetary geology and geophysics undergraduate research program (PGGURP) is now known as the Summer Undergraduate Program for Planetary Research (SUPPR) and is ready to send you an undergraduate intern for 8 weeks this summer!
- Open to all current SSW grantees
- NASA SUPPR will cover the costs of getting the undergraduate to your institution, housing costs for the student while there, as well as a cost-of-living stipend (up to \$7300 per intern).
- More information and sign up here: <https://www.lpi.usra.edu/suppr>. Contact Tracy Gregg with questions, she is here all week



Midterm Evaluation (Aug. 2018)

- Discovery AOs at the Vision and Voyages recommended cadence of ≤ 24 months
- NF 5 AO as soon as possible, but at a minimum no later than 5 yrs after NF 4 AO
- Largely following or exceeding the Vision and Voyages recommended levels of R&A and technology spending
- NASA should sponsor 8 to 10 mission concept studies based on the list produced by the Committee on Astrobiology and Planetary Sciences



Decadal Survey Mission Concept Studies

- Conduct mission concept studies for the next decadal Survey
- Solicitations released February 14, 2019
- FAQs released March 13, 2019
- FAQs will be updated weekly
- Proposals due by May 31, 2019
- Notice of Intent due by April 01, 2019
- For information, visit Nspires website: <https://nspires.nasaprs.com/external/index.do>



EXPLORE
with us