LORI S. GLAZE, Ph.D.
Planetary Science Division Director (Acting)
Committee on Astrobiology and Planetary Science

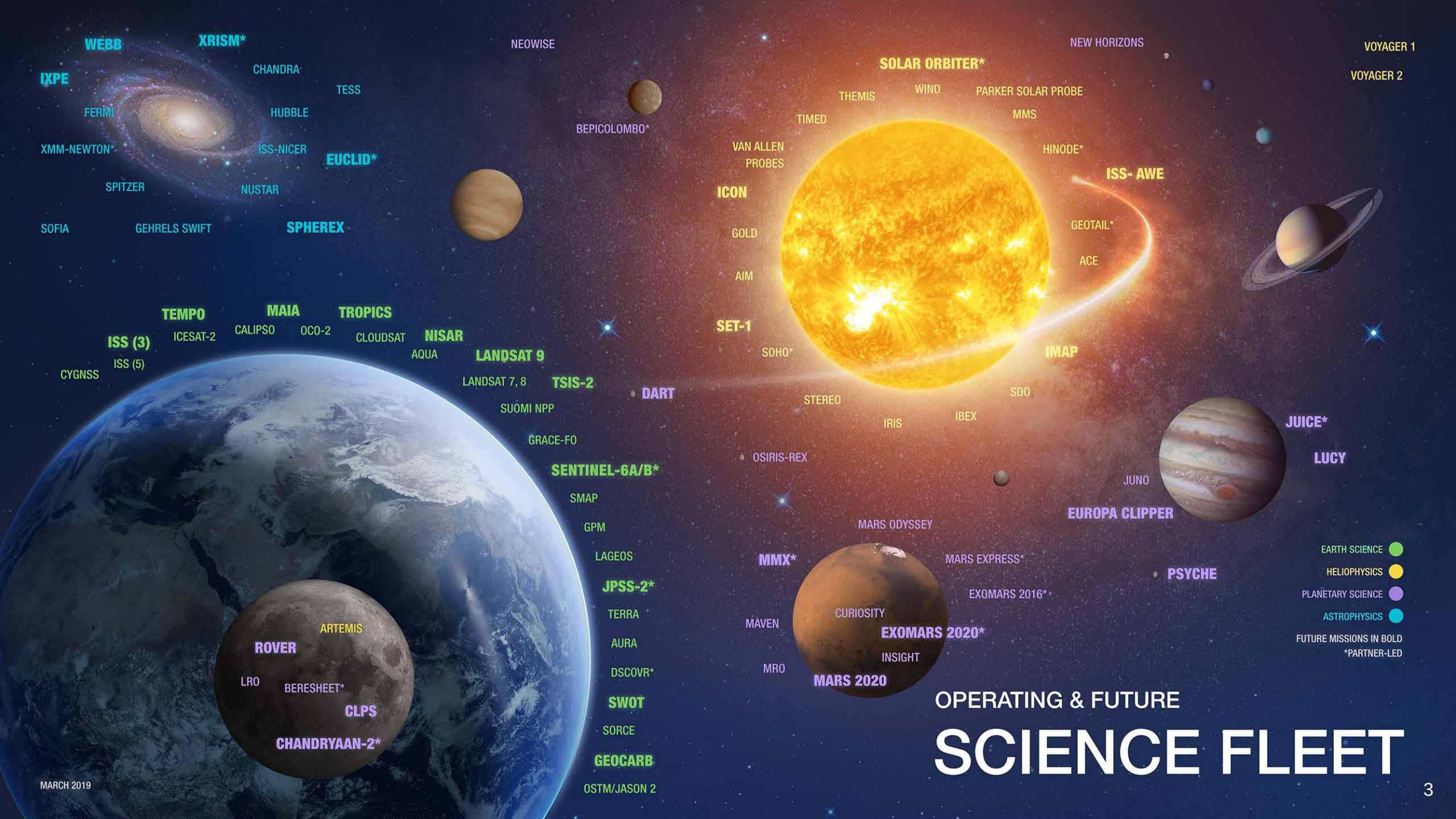
March 2019

KEY SCIENCE THEMES

Protect & Improve Life on Earth

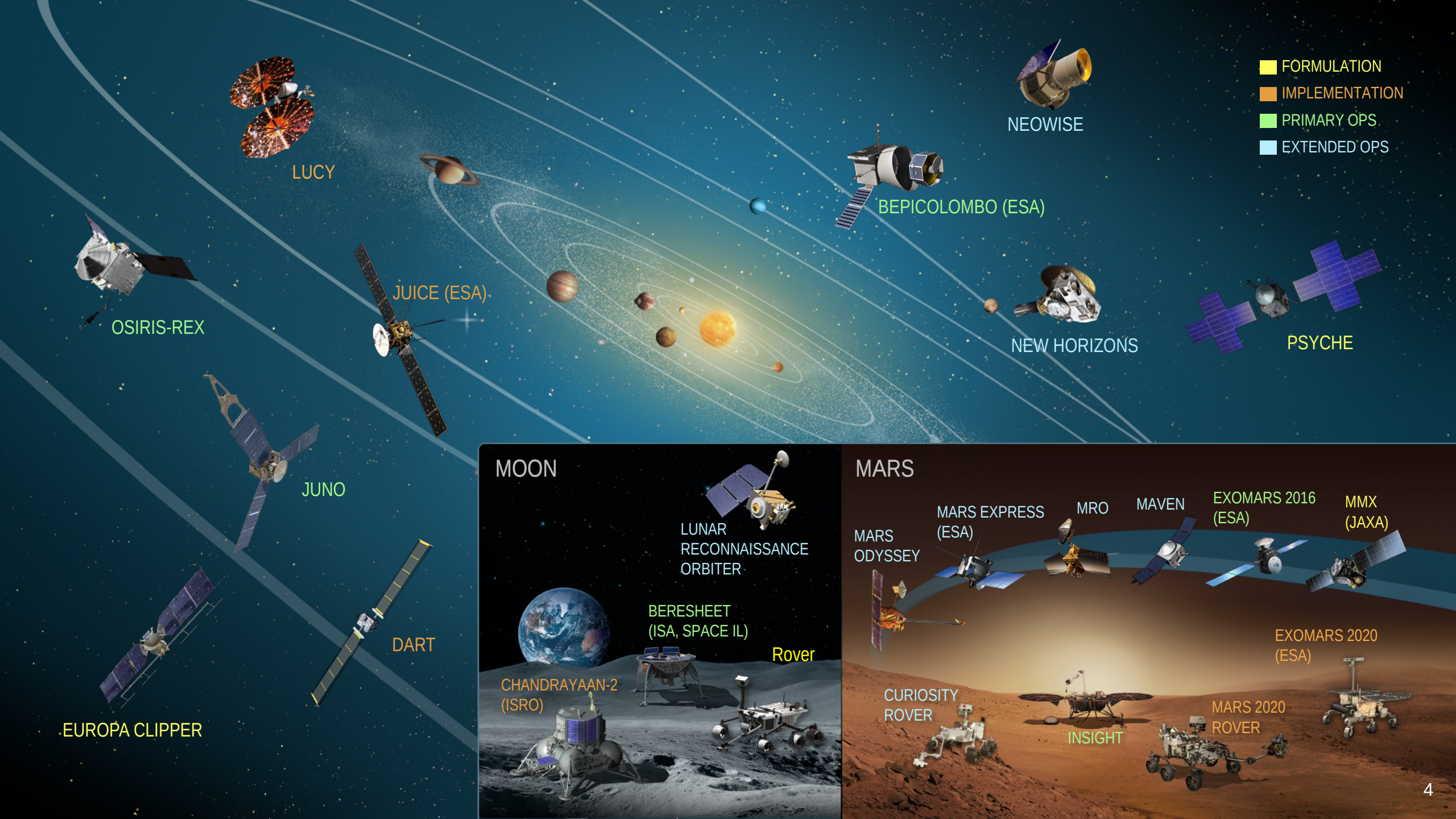
Search for Life Elsewhere

Discover Secrets of the Universe



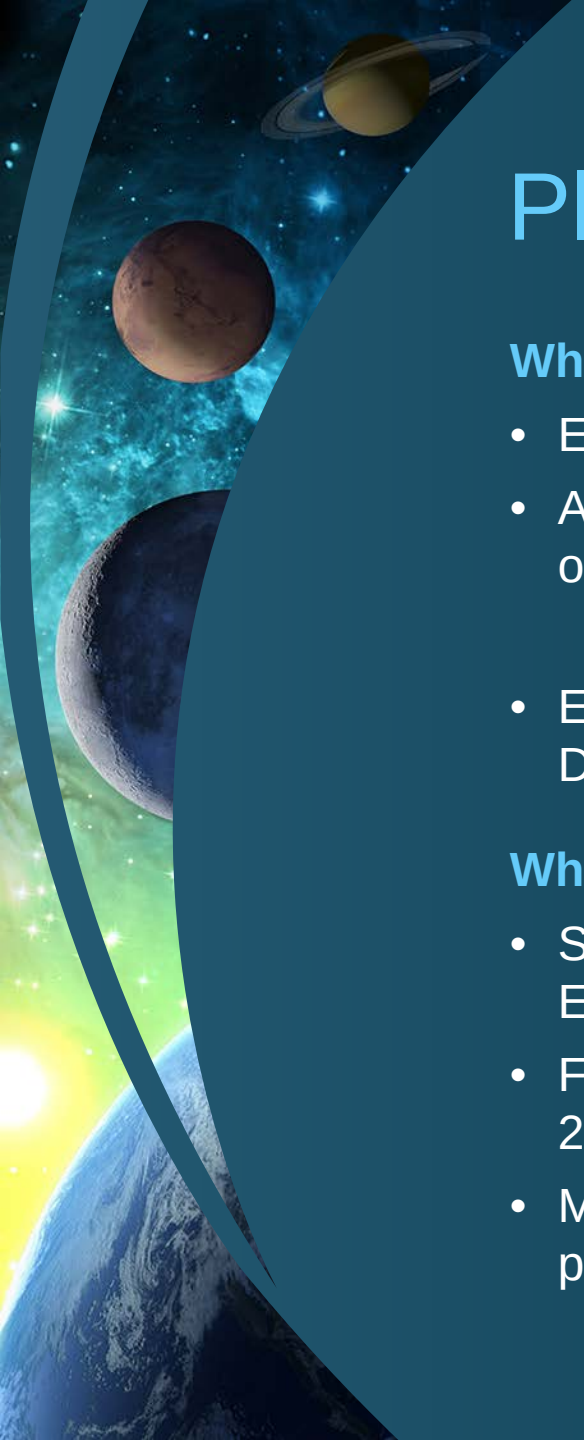
OPERATING & FUTURE

SCIENCE FLEET


FORMULATION
IMPLEMENTATION
PRIMARY OPS
EXTENDED OPS
LUCY
NEOWISE
BEPICOLOMBO (ESA)
OSIRIS-REX
JUICE (ESA)
NEW HORIZONS
PSYCHE
JUNO
DART
EUROPA CLIPPER
MOON
LUNAR RECONNAISSANCE ORBITER
BERESHEET (ISA, SPACE IL)
Rover
CHANDRAYAAN-2 (ISRO)
MARS
MARS ODYSSEY
MARS EXPRESS (ESA)
MRO
MAVEN
EXOMARS 2016 (ESA)
MMX (JAXA)
EXOMARS 2020 (ESA)
CURIOSITY ROVER
INSIGHT
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



Planetary Science FY20 Budget Features

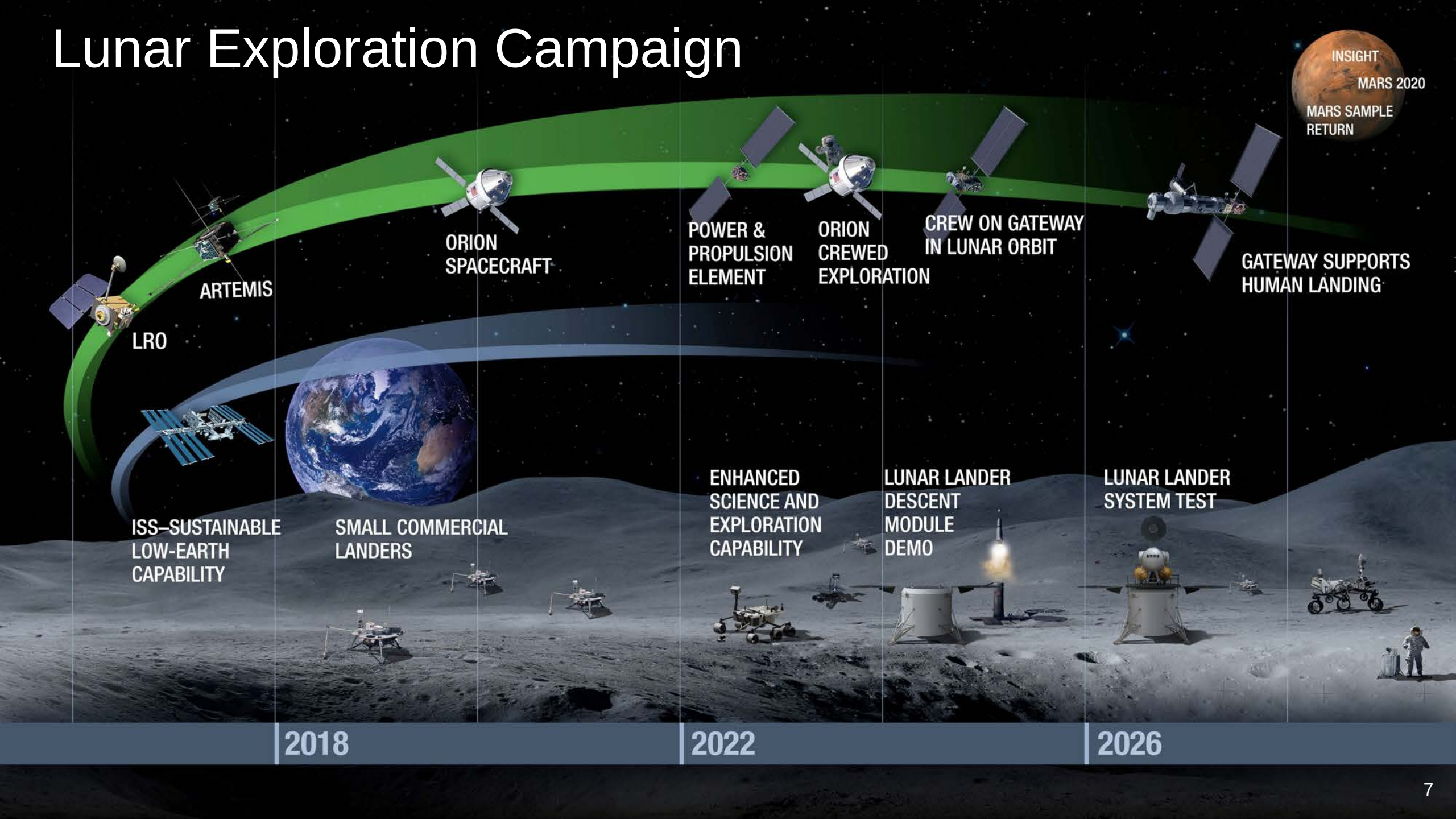
What's Changed

- Enables a Mars Sample Return launch as early as 2026
- Accelerates launch readiness date for Europa Clipper to 2023; proposes Clipper launch on a commercial vehicle, which saves over $700 million.
    - No funding included for Europa Lander beyond FY19
- Establishes 5 year cadence for New Frontiers while maintaining 2-3 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

Lunar Exploration Campaign



Lunar Discovery and Exploration Program (LDEP)

- A key component of the National Exploration Campaign
- CAPS reports on Planetary Science and Commercial aspects of LDEP provide guidance for implementation strategies
- Includes
  - Commercial Lunar Payload Services (CLPS)
    - Instruments to fly on CLPS landers
  - Instrument Development – Development and Advancement of Lunar Instrumentation (DALI)
  - LRO Mission Operations
  - Lunar SmallSats thorough Small Innovative Missions for Planetary Exploration (SIMPLEX) calls
  - Future mobility capabilities
  - Comm/data relay assets

Commercial Lunar Payload Services (CLPS)

- Contract awards announced November 29:

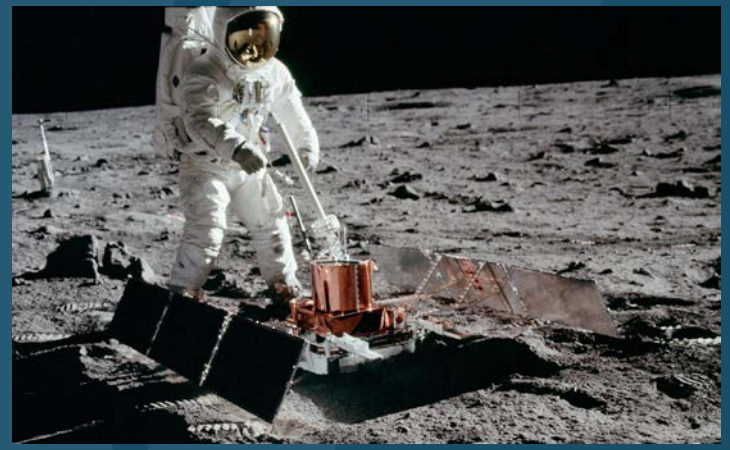
Astrobotic Technology, Inc	**Firefly Aeronautics, Inc.**	**Masten Space Systems, Inc.**
Deep Space Systems	**Intuitive Machines, LLC**	**Moon Express**
Draper	**Lockheed Martin Space**	**Orbit Beyond**

- Services will be acquired through Task Orders
- First Lunar Surface Transportation Task Order award planned for 2Q CY19
    - Draft TO released March 8
- Expected Task Order cadence of approximately 1-2 per year
- Future on-ramps for additional providers and as more capabilities are developed

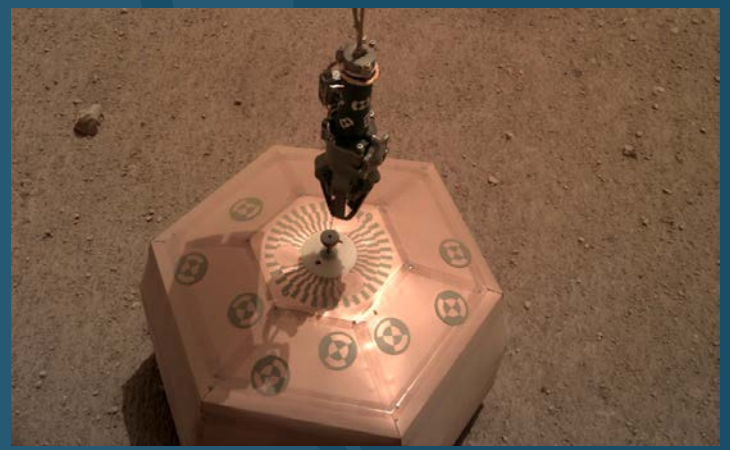
Lunar Payload Selections

- Thirteen science and technology demonstration payloads selected to fly to the Moon as early as end of 2019, depending on the availability of commercial landers
- Selected payloads, along with Lunar Surface Instrument and Technology Payloads, will begin to build pipeline of scientific investigations and technology development payloads using U.S. commercial landing delivery services
- Instruments include:
  - Linear Energy Transfer Spectrometer
  - Near-Infrared Volatile Spectrometer System
  - Advanced Neutron Measurements at the Lunar Surface
  - Ion-Trap Mass Spectrometer for Lunar Surface Volatiles
  - Quadrupole Mass Spectrometer
  - Low-frequency Radio Observations from the Near Side Lunar Surface
  - Stereo Cameras for Lunar Plume-Surface Studies
  - Surface and Exosphere Alterations by Landers (SEAL)
  - Navigation Doppler Lidar for Precise Velocity and Range Sensing
- Two technology demonstrations selected to fly:
  - Solar Cell Demonstration Platform for Enabling Long-Term Lunar Surface Power
  - Lunar Node 1 Navigation Demonstrator
- Future calls for payloads planned to be released each year for additional opportunities


APOLLO
50
NEXT GIANT LEAP



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

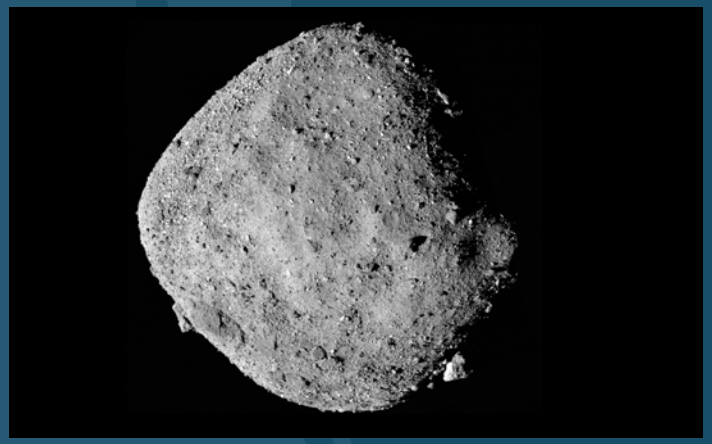


Dec. 19, 2018 – InSight seismometer on Martian surface – first time a spacecraft robotically placed a seismometer onto surface of another planet

OSIRIS-REx

Bennu Arrival
December 3, 2018

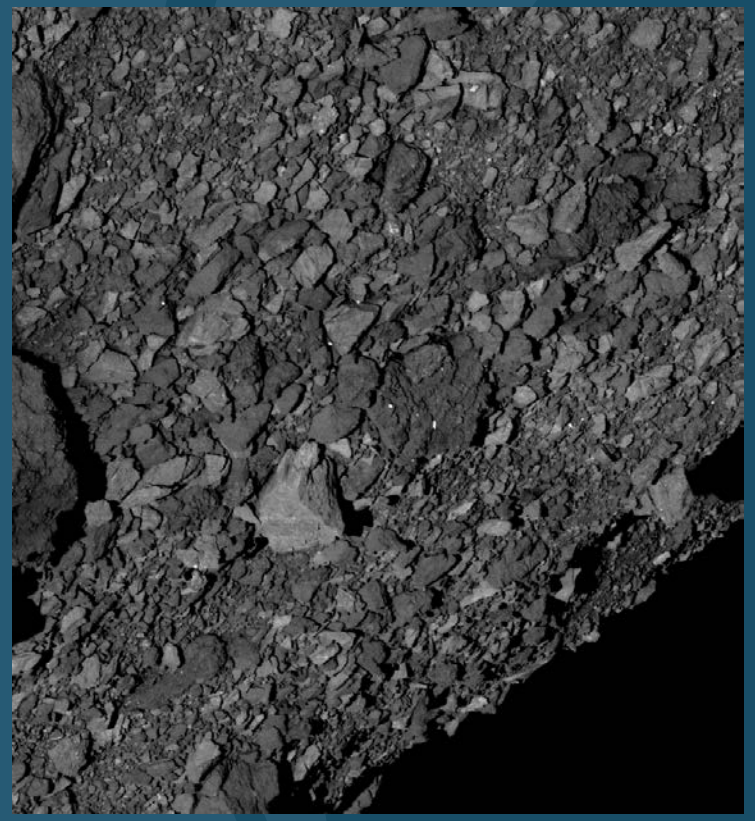
1972 – Scientist-astronaut Harrison Schmitt using a sampling scoop to retrieve lunar samples during Apollo 17



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

OSIRIS-REx

Bennu Arrival
December 3, 2018



Mar. 7, 2019 – OSIRIS-REx image shows a view across Bennu's southern hemisphere; demonstrates the number and distribution of boulders

eneration
sis

to analyze specially
nples from Apollo, in
ext era of exploration

nally preserved for

r scientists and
l teams

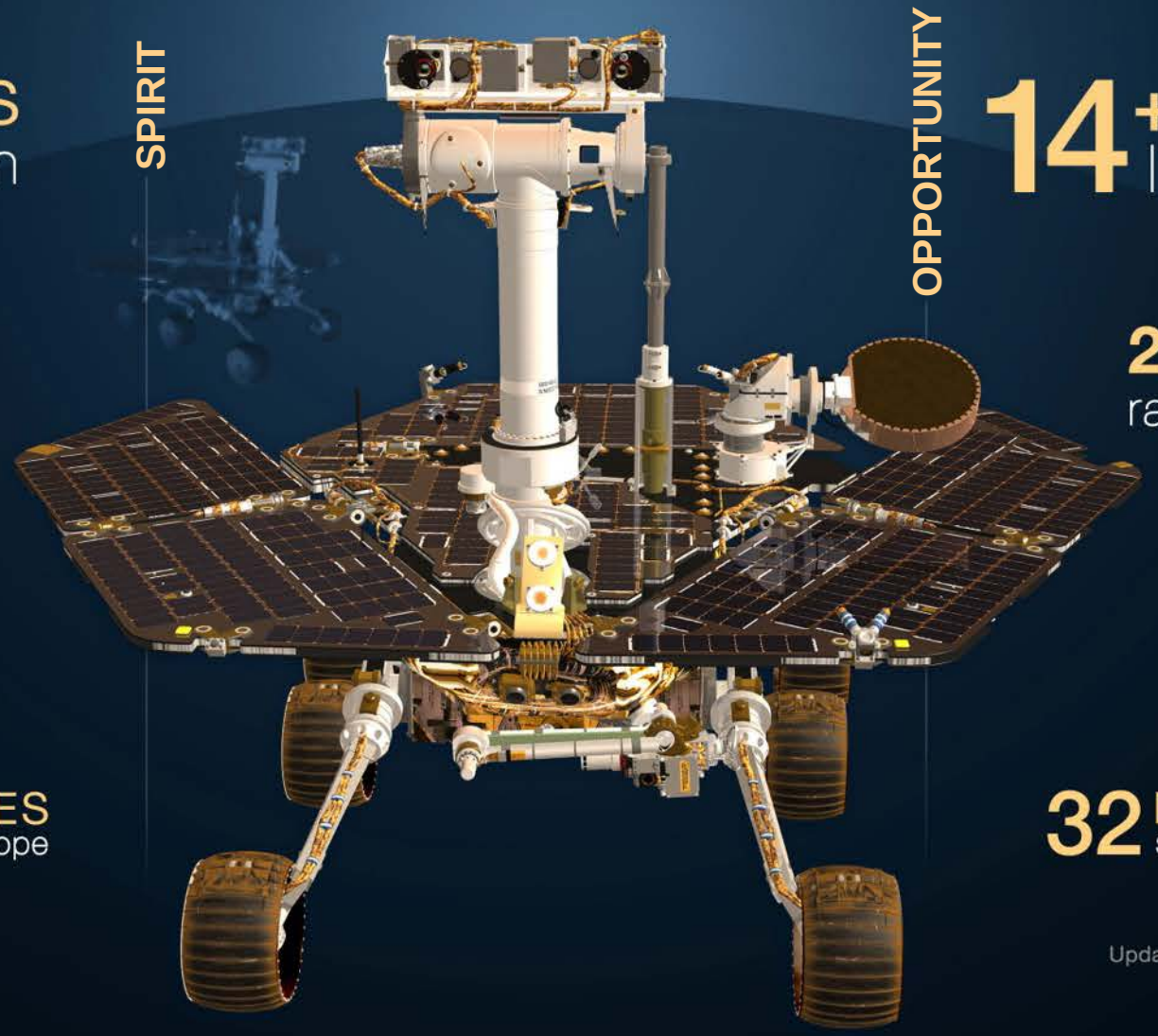
Lunar Discovery and
am

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

124,838 raw images

4.8 MILES traveled

30 DEGREES steepest slope

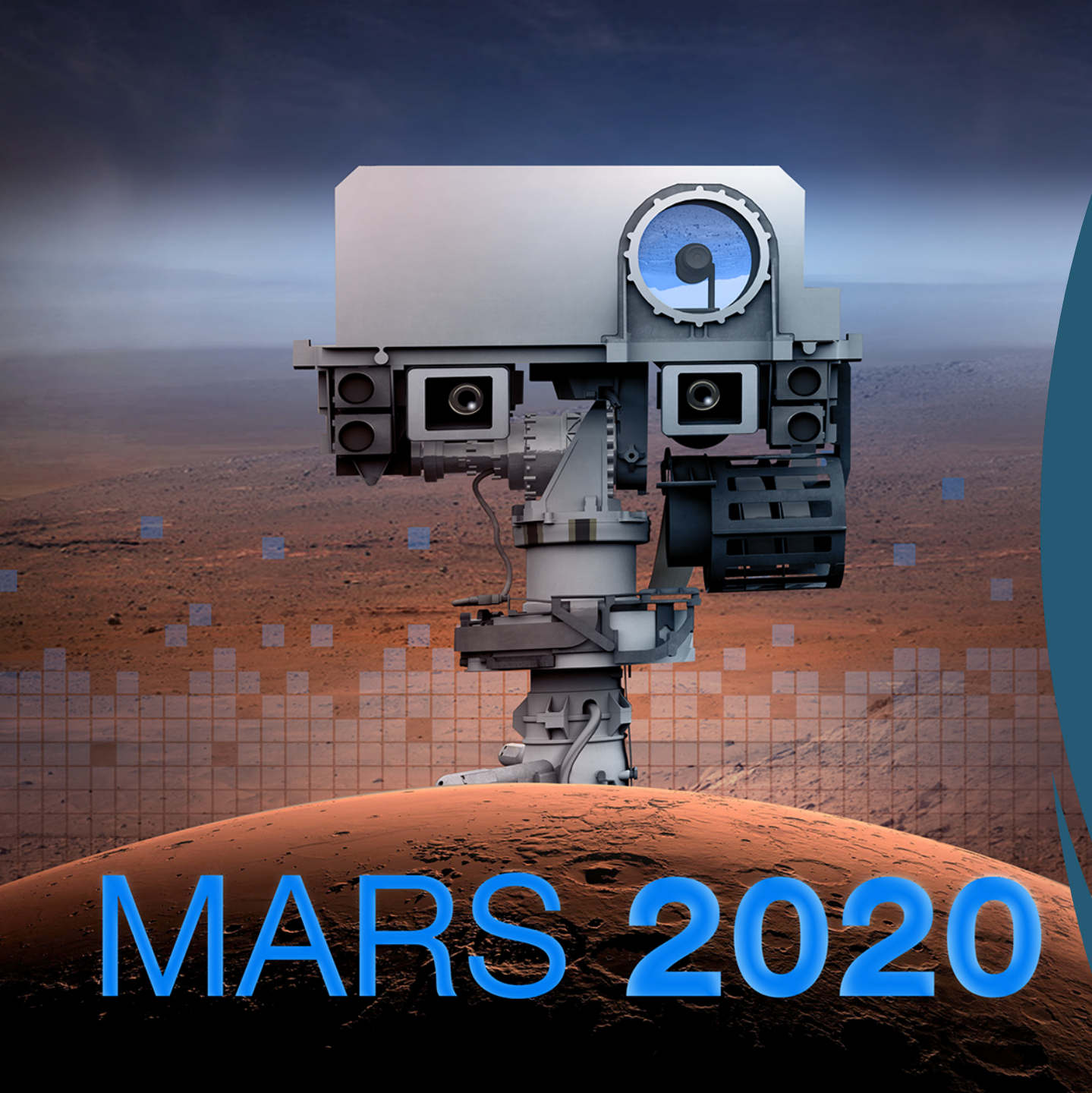
14+ YEARS lifespan

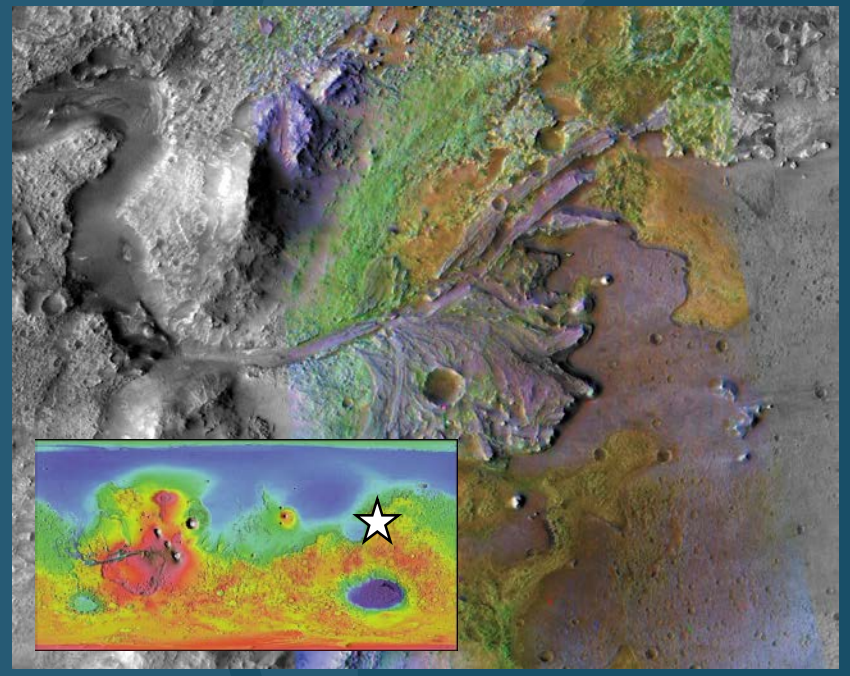
217,594 raw images

28 MILES traveled

32 DEGREES steepest slope

Updated February 4, 2019





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

Mars 2020 on Track for 2020 Launch

- **Spacecraft stack** for cruise environmental testing completed in March

- **Sample Caching System** will complete delivery in June
- **RIMFAX, MOXIE, MEDA** - delivered to ATLO
- **Mastcam-Z** to be delivered in two weeks
- **SuperCam** mast unit to be delivered by end of May

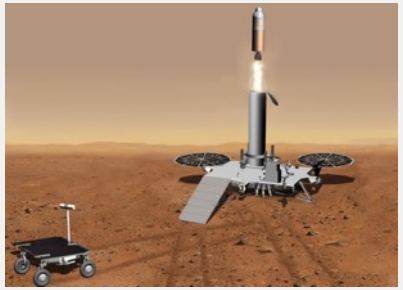
- **PIXL** – body assembly to be delivered late April; turret assembly June
- **SHERLOC** – concluded risk review: flight unit to be delivered end of June and flight laser power supply replaces EM by end of 2019

Mars Sample Return (MSR) Concept

FY20 Budget Request supports formulation of Mars Sample Return

Sample Caching Rover (Mars 2020)
- *Sample acquisition and caching*

2020



Sample Retrieval Lander*
- *Fetch Rover*
- *Orbiting Sample container*
- *Mars Ascent Vehicle*

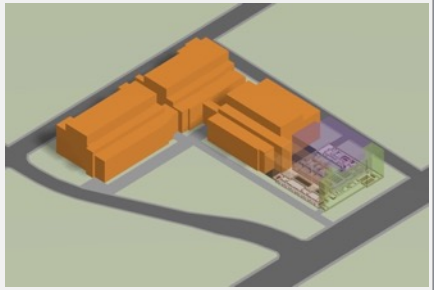
NET 2026

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

NET 2026

Flight Elements

Future Work



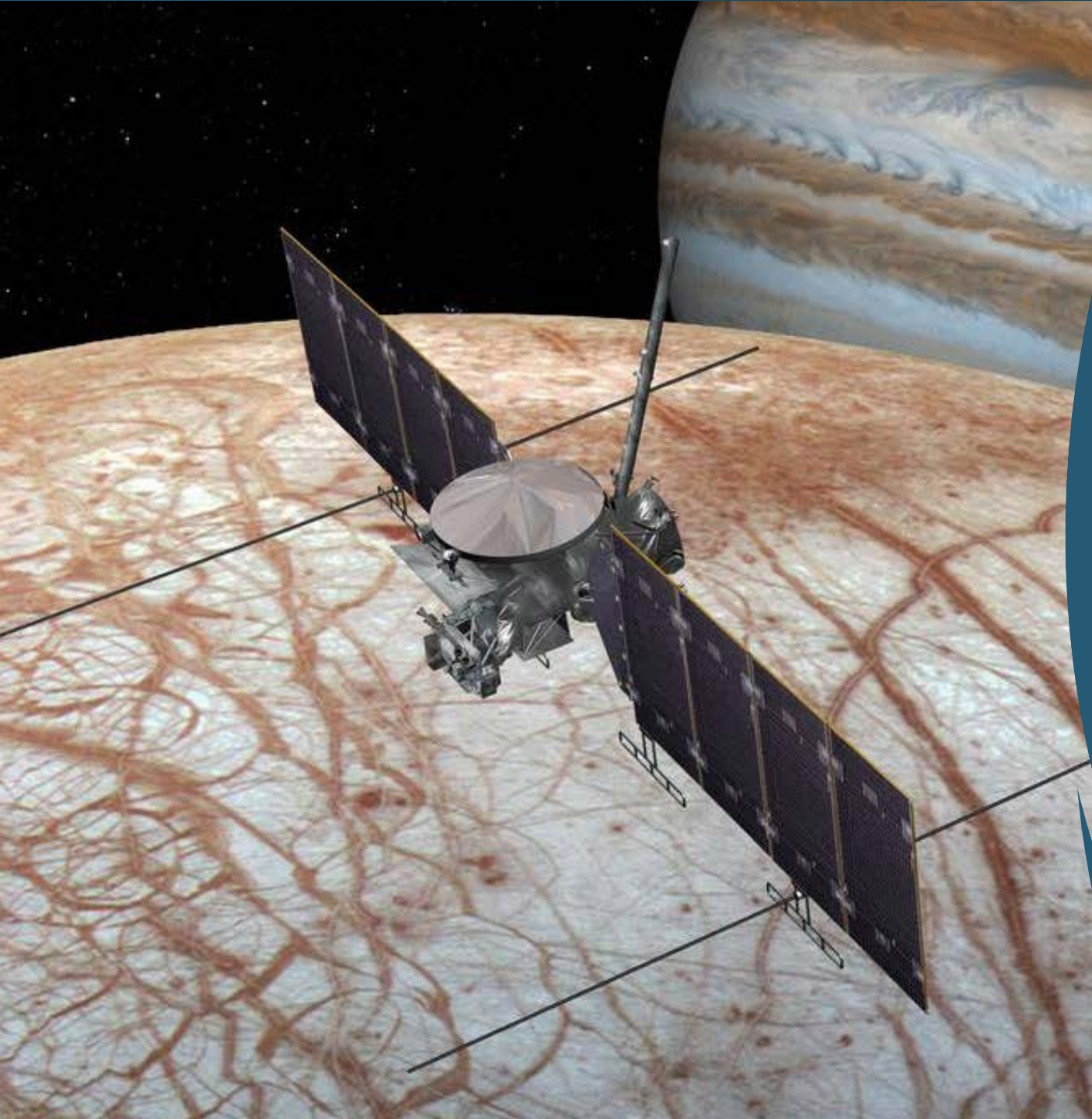
Mars Returned Sample Handling
- *Sample Receiving Facility*
- *Curation*
- *Sample science investigations*

2031

Ground Element

**NASA-led*

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



Europa Clipper

- A mission to investigate Europa, shared highest priority for a flagship mission in last Decadal Survey
- The Decadal Survey recommended mission's cost and science scope be reduced, which was successfully done
- Decadal Survey Midterm Review reaffirmed recommendations, and recommended NASA closely monitor cost to ensure it stays within estimated range
- The Europa Clipper Project is moving forward with UCLA to deliver the facility magnetometer, and is also investigating back-up options as needed

Decision, Rationale & Way Ahead

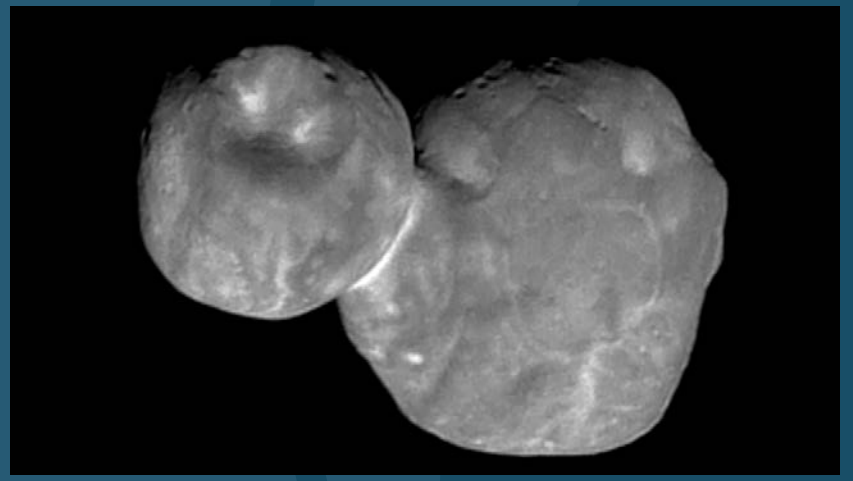
As a result of continued, significant cost growth and remaining high cost risk, the ICEMAG investigation on the Europa Clipper mission is terminated

Planetary Science is pursuing a simpler magnetometer investigation that retains significant value to Europa science and exploration

- A suite of simpler, less complex fluxgate-only sensors still provides moderate scientific advancement over Galileo
- Planetary Science will present a plan within next two weeks for facility instrument composed of four fluxgate magnetometers on existing boom
- All ICEMAG Co-Investigators will be invited to remain on Europa Clipper science team to support this facility instrument

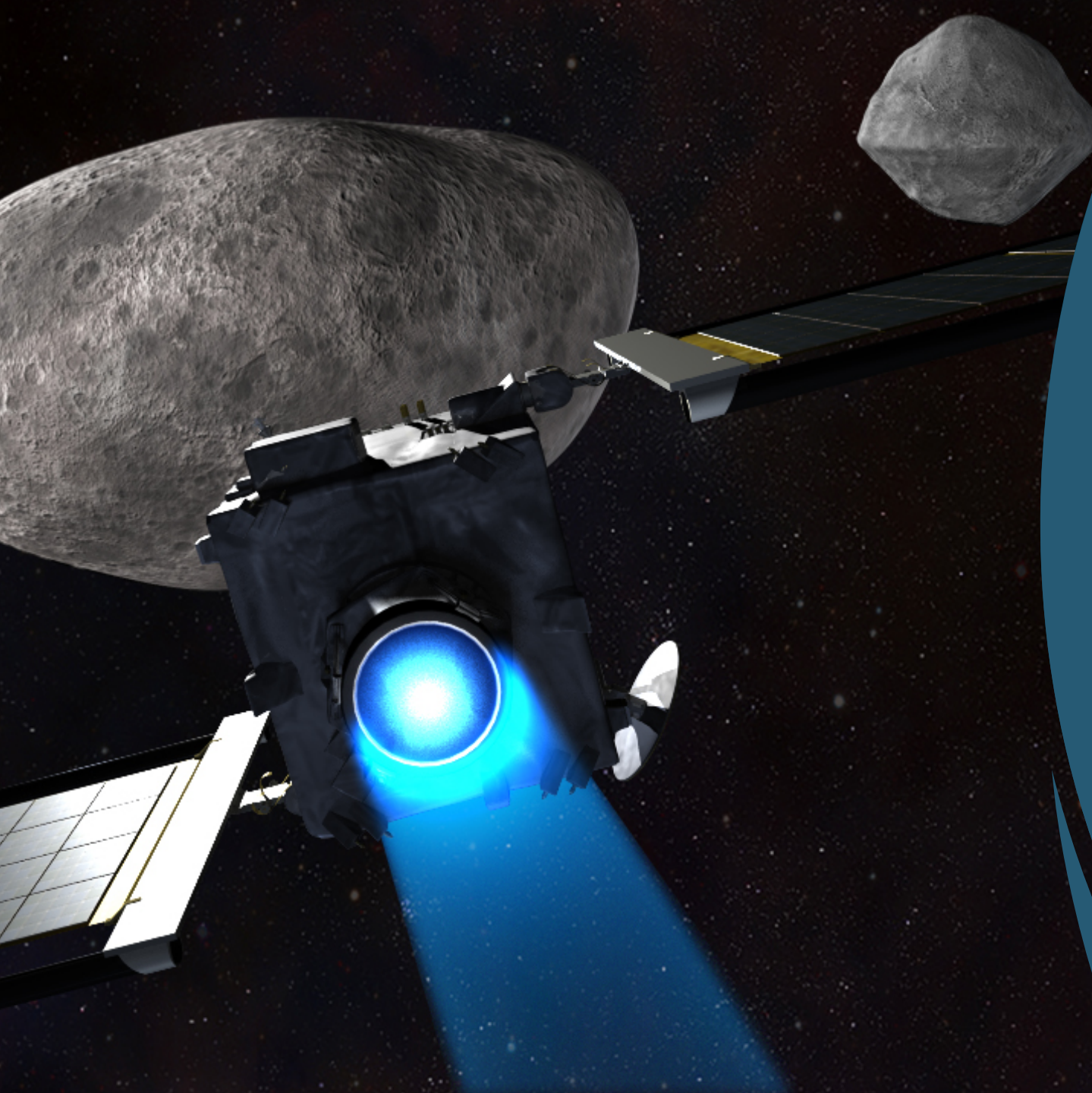
New Horizons

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]
IAU
Minor Planet Center
SEARCH, DETECT & TRACK
[GROUND-BASED & SPACE-BASED OBSERVATIONS, IAWN]
PLANETARY DEFENSE
MITIGATE
[DART, FEMA EXERCISES]
CHARACTERIZE
[NEOWISE, GOLDSTONE, ARECIBO, IRTF]
PLAN & COORDINATE
[SMPAG, PIERWG, DAMIEN IWG]



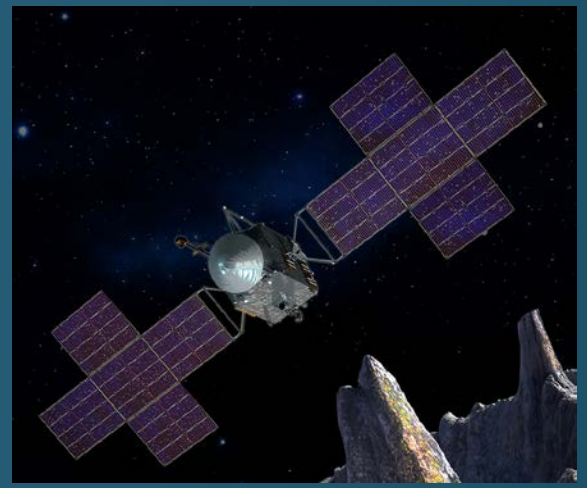
Double Asteroid Redirection Test (DART)

- 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) (PSD)

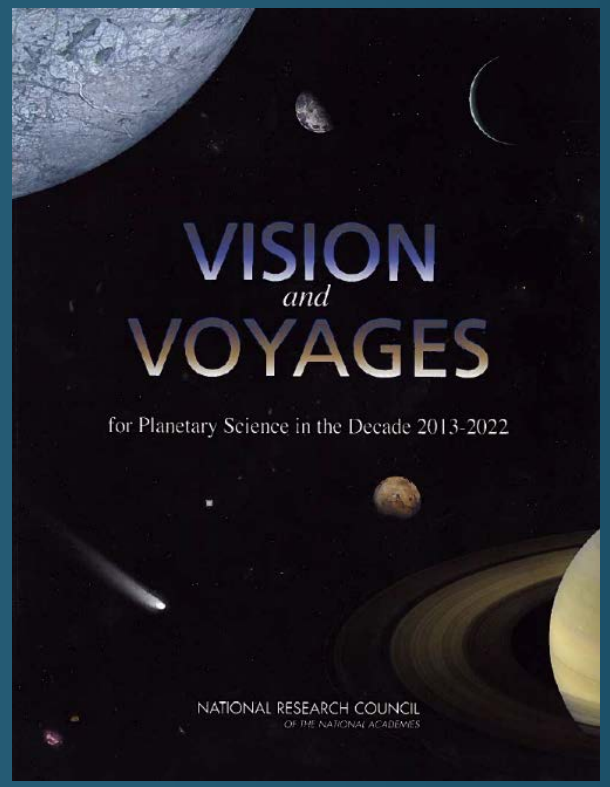
- Step-1 reviews were completed before shutdown
- Step-1 selection to be scheduled NET April 12, 2019

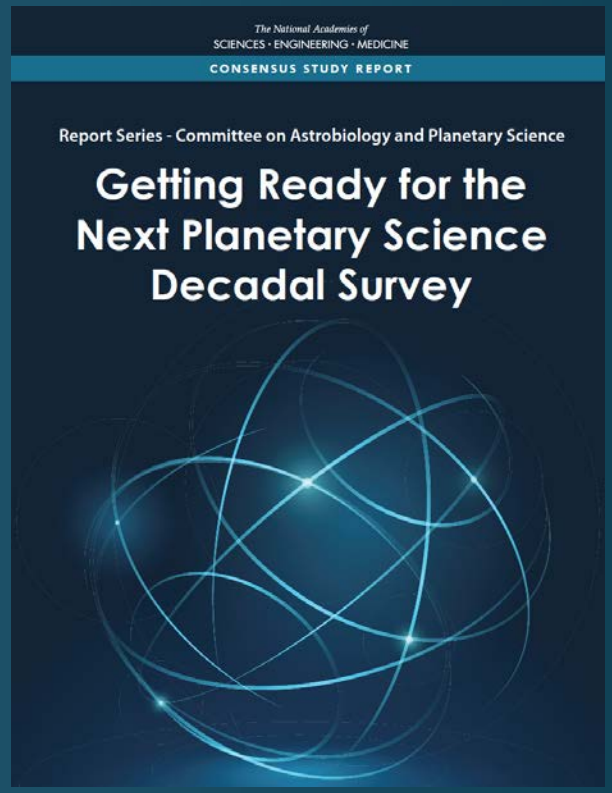
New Frontiers #4 Down-selection (PSD)

- 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 (PSD)

- 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





Preparing for the Next Decadal Survey

- Conduct mission concept studies for the next decadal Survey
- Solicitations released February 14, 2019
- Latest FAQs released March 18, 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

General R&A Updates

- Impacts to R&A due to 35 day Government shutdown
  - ROSES 2019 roll out delayed by ~1 month, impacting earliest program element due dates
  - Proposal due dates for 2018 Habitable Worlds & Solar Systems Workings delayed ~2 months, LDAP ~1 month
  - Review panels for five 2018 programs delayed (PICASSO, HW, SSW, LDAP, KPLO), puts pressure on 2019 reviews
  - SSERVI panel review delayed
- Expected increase for Lunar Discovery & Exploration Program (LDEP) did not translate to an increased R&A Budget
  - Language added to many ROSES 2018 calls to emphasize the Moon
  - Saw increase in the number of Lunar proposals across several programs (EW, SSW (NOIs))
  - LDEP funds to cover ANGSA and DALI selections but did not translate to core R&A programs

Planetary Science Division - ROSES 18

Program Name	Step-1 Due Date	Step-2 Due Date	Panels Held	Selections/ Proposals	Selection Dates
Exobiology (EXOB)	04/16/2018	05/24/2018	Yes	23/156	10/17
Exoplanets (XRP)	03/29/2018	05/30/2018	Yes	16/117	10/03
Emerging Worlds (EW)	04/12/2018	06/01/2018	Yes	26/110	10/18
Development & Advance of Lunar Instruments (DALI)	04/03/2018	06/05/2018	Yes	10/48	10/26
Solar System Obs. (SSO)	04/05/2018	06/07/2018	Yes	10/66	03/11
MatISSE	04/18/2018	06/20/2018	Yes	6/56	11/09
Laboratory Analysis of Returned Sample (LARS)	05/24/2018	07/26/2018	Yes	XX/26	TBD
Planetary Data Archiving, Restoration, Tools (PDART)	05/10/2018	07/12/2018	Yes	16/91	11/19
Cassini Data Analysis (CDAP) C. 10 Cassini Data Analysis (CDAP) C. 26	06/01/2018	08/14/2018	Yes	16/61 XX/7	03/18 03/31
New Frontiers Data Analysis Program (NFDAP)	06/12/2018	08/23/2018	Yes	10/25	03/08
Apollo Next Generation Sample Analysis (ANGSA)	06/22/2018	08/21/2018	Yes	9/26	3/11
Planetary Major Equipment/Facilities (PMEF)	07/17/2018	09/17/2018	Yes	XX/11	TBD
Mars Data Analysis (MDAP)	08/23/2018	10/25/2018	Yes	XX/104	TBD
Discovery Data Analysis (DDAP)	08/30/2018	11/01/2018	Yes	XX/22	TBD
Rosetta Data Analysis Program (RDAP)	08/30/2018	11/01/2018	Yes	XX/23	TBD
PICASSO	09/20/2018	11/20/2018	No	XX/91	TBD
Habitable Worlds (HW)	11/15/2018	03/29/2019	No		TBD
Solar System Workings (SSW)	11/15/2018	04/02/2019	No		TBD
Lunar Data Analysis (LDAP)	11/29/2018	03/29/2019	No		TBD
Korean Pathfinder Lunar Orbiter (KPLO)	04/11/2019	06/11/2019	No		TBD
Planetary Protection Research (PPR)	04/12/2019	05/10/2019	No		TBD

Planetary Science Division - ROSES 19

Program Name	Step-1 Due Date	Step-2 Due Date	Panels Held	Selections/ Proposals	Selection Dates
Exoplanets (XRP)*	03/29/2019	05/29/2019	TBD	TBD	TBD
Korean Pathfinder Lunar Orbiter (KPLO)	04/11/2019	06/11/2019	TBD	TBD	TBD
Planetary Protection Research (PPR)	04/12/2019	05/10/2019	TBD	TBD	TBD
Emerging Worlds (EW)	04/16/2019	06/12/2019	TBD	TBD	TBD
Development & Advance of Lunar Instruments (DALI)	04/16/2019	06/12/2019	TBD	TBD	TBD
Solar System Obs. (SSO)	04/16/2019	06/12/2019	TBD	TBD	TBD
MatISSE	N/A	N/A	TBD	TBD	TBD
Laboratory Analysis of Returned Sample (LARS)	04/24/2019	06/25/2019	TBD	TBD	TBD
Planetary Data Archiving, Restoration, Tools (PDART)	05/09/2019	07/11/2019	TBD	TBD	TBD
Exobiology (EXOB)	05/13/2019	06/12/2019	TBD	TBD	TBD
Cassini Data Analysis (CDAP)	05/16/2019	07/18/2019	TBD	TBD	TBD
New Frontiers Data Analysis Program (NFDAP)	05/30/2019	08/01/2019	TBD	TBD	TBD
Apollo Next Generation Sample Analysis (ANGSA)			TBD	TBD	TBD
Planetary Major Equipment/Facilities (PMEF)	08/20/2019	10/22/2019	TBD	TBD	TBD
Mars Data Analysis (MDAP)	08/22/2019	10/24/2019	TBD	TBD	TBD
Discovery Data Analysis (DDAP)	08/29/2019	11/01/2019	TBD	TBD	TBD
Rosetta Data Analysis Program (RDAP)			TBD	TBD	TBD
PICASSO	09/20/2019	11/20/2019	TBD	TBD	TBD
Habitable Worlds (HW)	11/15/2019	01/17/2020	TBD	TBD	TBD
Solar System Workings (SSW)	11/15/2019	01/30/2020	TBD	TBD	TBD
Lunar Data Analysis (LDAP)	11/26/2019	02/27/2020	TBD	TBD	TBD

* Amended into ROSES 2018 as a second round

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 Sciences 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

Future Investigators in NASA Earth and Space Science and Technology (FINESST)

- Major change to NESSF to make more like a grant program than a fellowship program
- Award amount increased to $45K. ($35K stipend + $10K for travel to conferences and seminars, health insurance policy, books, tuition and fees, etc.)
- New award amount more in line with other graduate research fellowships, NASA will be able to compete for the best students
- Change went into effect for ROSES17, and impacts existing renewal NESSF awards
- Overall budgets did not change


EXPLORE
with us