



National Aeronautics and
Space Administration



EXPLORE SOLAR SYSTEM & BEYOND

Lori S. Glaze, Ph.D.
NASA Planetary Science Division Director

CAPS
March 24, 2021



Budget

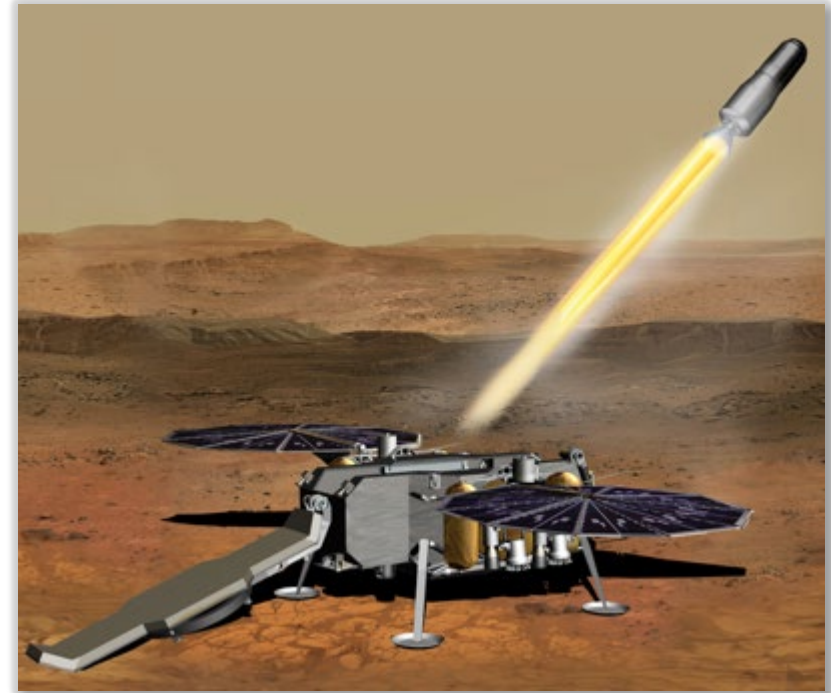


FY21 Appropriations Highlights

- FY 2021 Consolidated Appropriations Act signed into law December 27, 2020
- Continued strong support for Science with a \$7.3B budget
 - \$994M above the FY21 President's Budget request
 - \$162M above the FY20 enacted level

Planetary Science

- \$40M above the FY21 request
- Funding to support decadal priorities such a Mars Sample Return mission, Europa Clipper
- Additional funds for Planetary Defense, supporting DART and Near-Earth Object Surveillance Mission
- Additional funding for New Frontiers/Dragonfly
- Strong support for Lunar Discovery and Exploration, as well as Commercial Lunar Payload Services
- Europa Clipper given permission to use CLV in the event SLS is not available or incompatible



(\$M)	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21 Omnibus Bill
PSD	1,342.3	1,446.7	1,628.0	1,827.5	2,217.9	2,746.7	2,712.6	2,700.0



Mission Updates



NEW HORIZONS

JANUS

OSIRIS-REx

BEPICOLOMBO (ESA)

Q-PACE

NEOWISE

PSYCHE

JUICE (ESA)

JUNO

DRAGONFLY

EUROPA CLIPPER

LUCY

DART

MOON

LUNAR
TRAILBLAZER

LUNA H-MAP

LUNAR
RECONAISSANCE
ORBITER

VIPER

CLPS (X5)

MARS

MARS
ODYSSEY

MARS EXPRESS
(ESA)

MRO

MAVEN

TRACE GAS ORBITER
(ESA)

MMX (JAXA)

INSIGHT

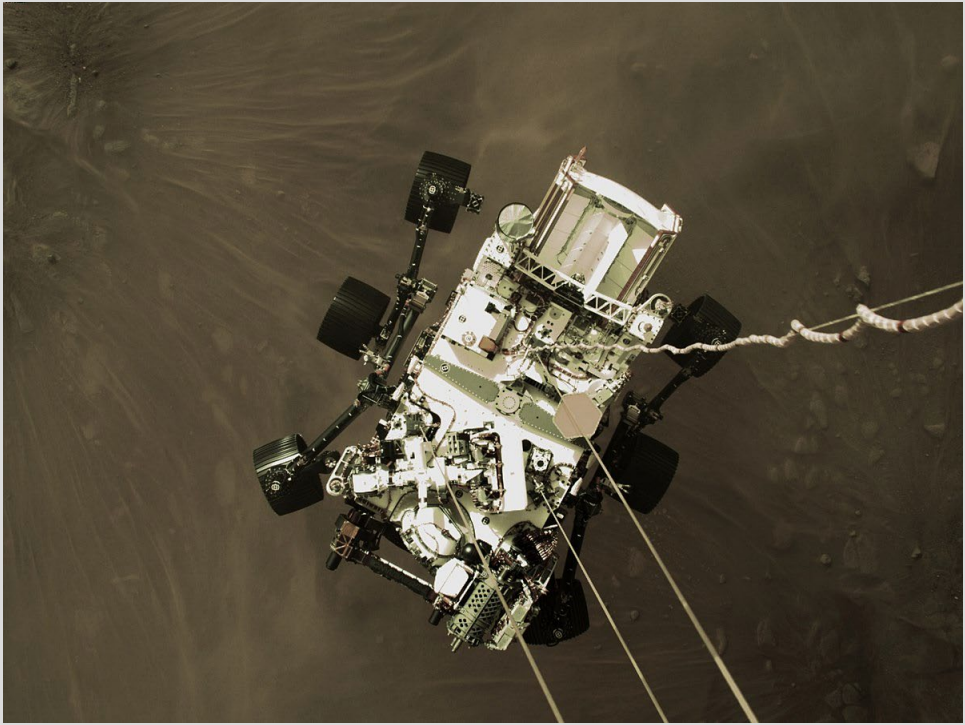
PERSEVERANCE

ROSALIND
FRANKLIN
(ESA)

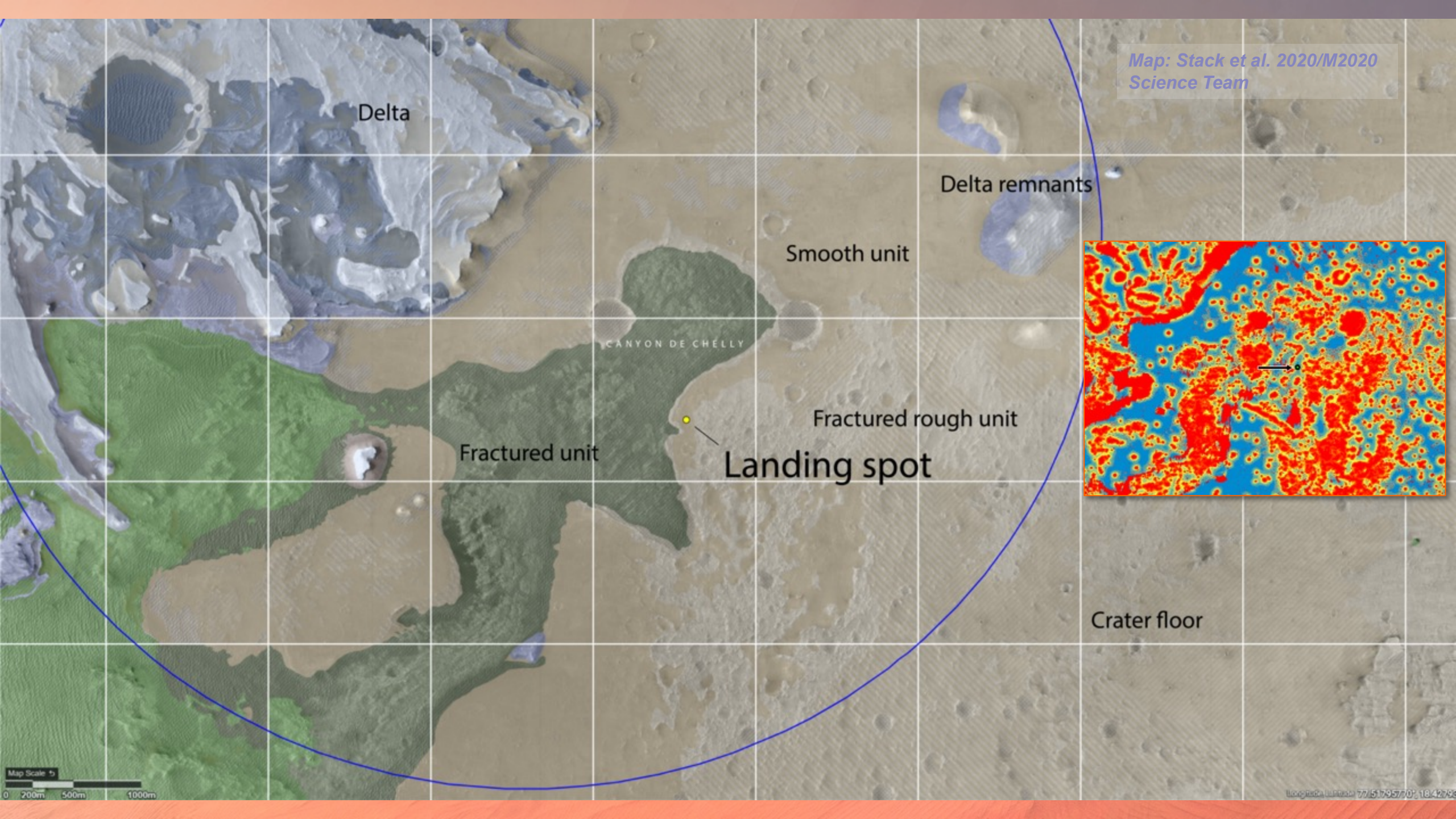
CURIOSITY

- FORMULATION
- IMPLEMENTATION
- PRIMARY OPS
- EXTENDED OPS

PLANETARY FLEET



Map: Stack et al. 2020/M2020
Science Team



Map Scale 0 200m 500m 1000m

Longitude, UTM East 77.51795770° 18.42795770°

Social and Traditional Media Coverage



Landing Broadcast:

- 4.2 million (at peak) live viewers watching the event broadcast of the Perseverance landing
- YouTube video of coverage: 21 million views (as of March 25) and top viewed video of all time on the NASA YouTube channel

Landing video viewership:

- Landing YouTube video maintained #2 trending spot on YouTube
- 14 million video views (as of March 15)

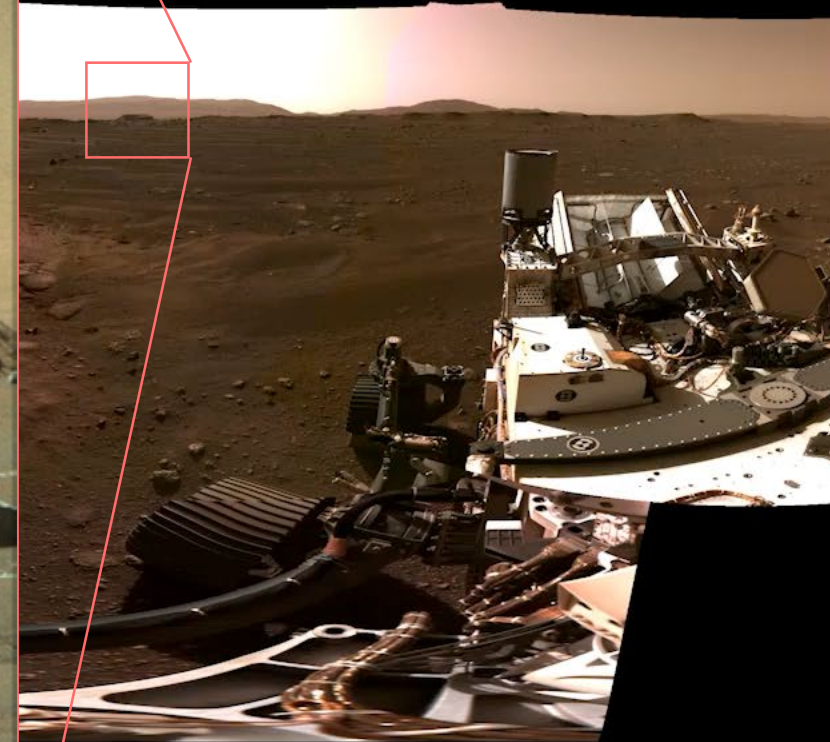
Web Traffic: 26.9 million page views across all NASA sites on landing date (triple traffic from launch)

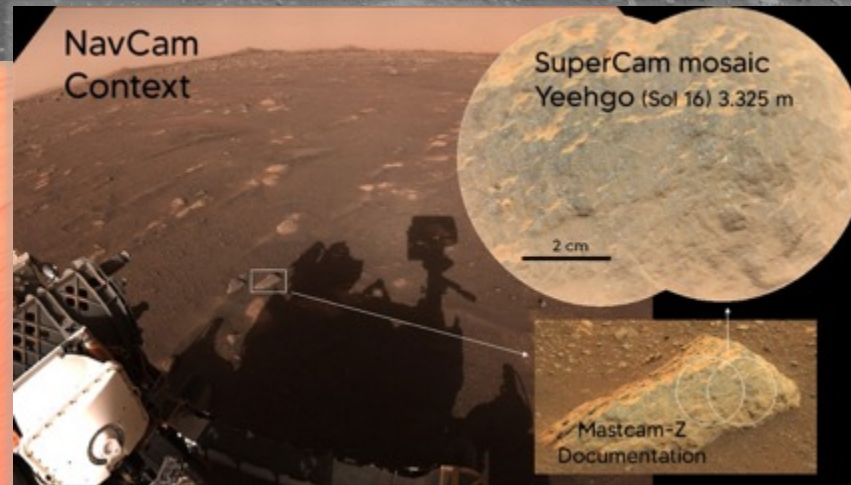
Hashtag Performance: >248k total social media mentions involving #CountdownToMars/Mars2020/Perseverance (Feb 18 to 19 across platforms)

Notable Mentions: From POTUS, VPOTUS, FLOTUS, Barack Obama, Ringo Starr

Traditional media:

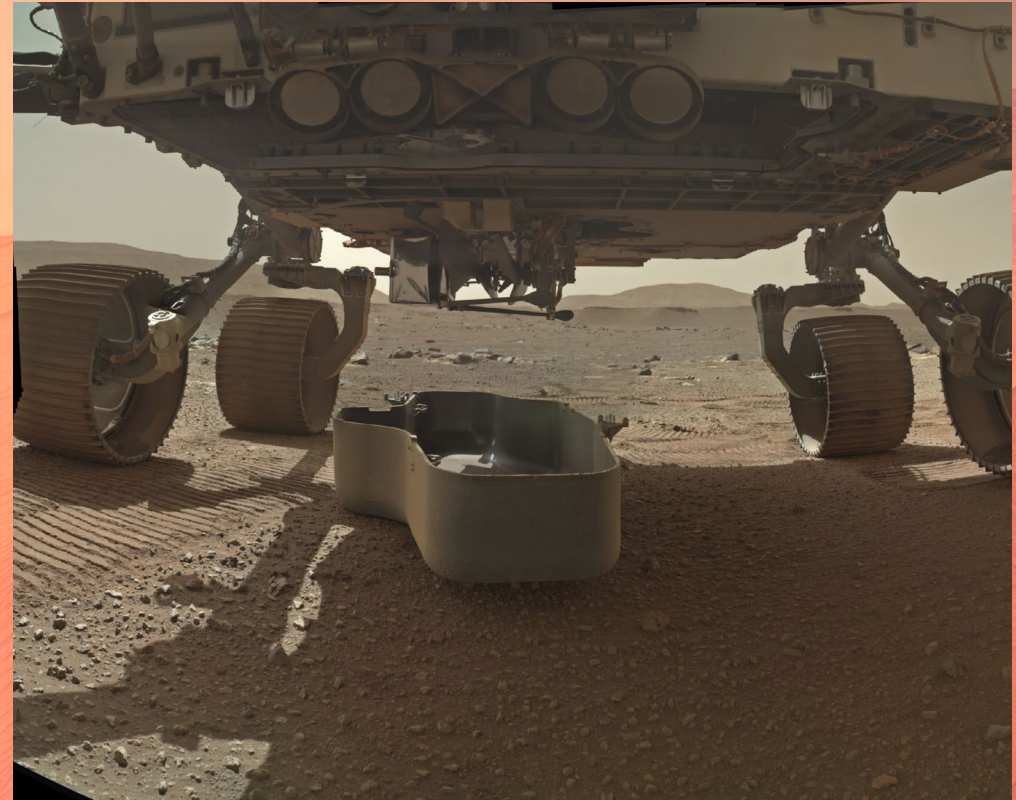
- >8.7k media mentions between Feb 18 and 19 (e.g., The New York Times, CNN, NPR)
- Front pages of 157 newspapers
- About 200 interviews with NASA experts; 25 in Spanish; 28 as radio/podcast format (most ever for both)

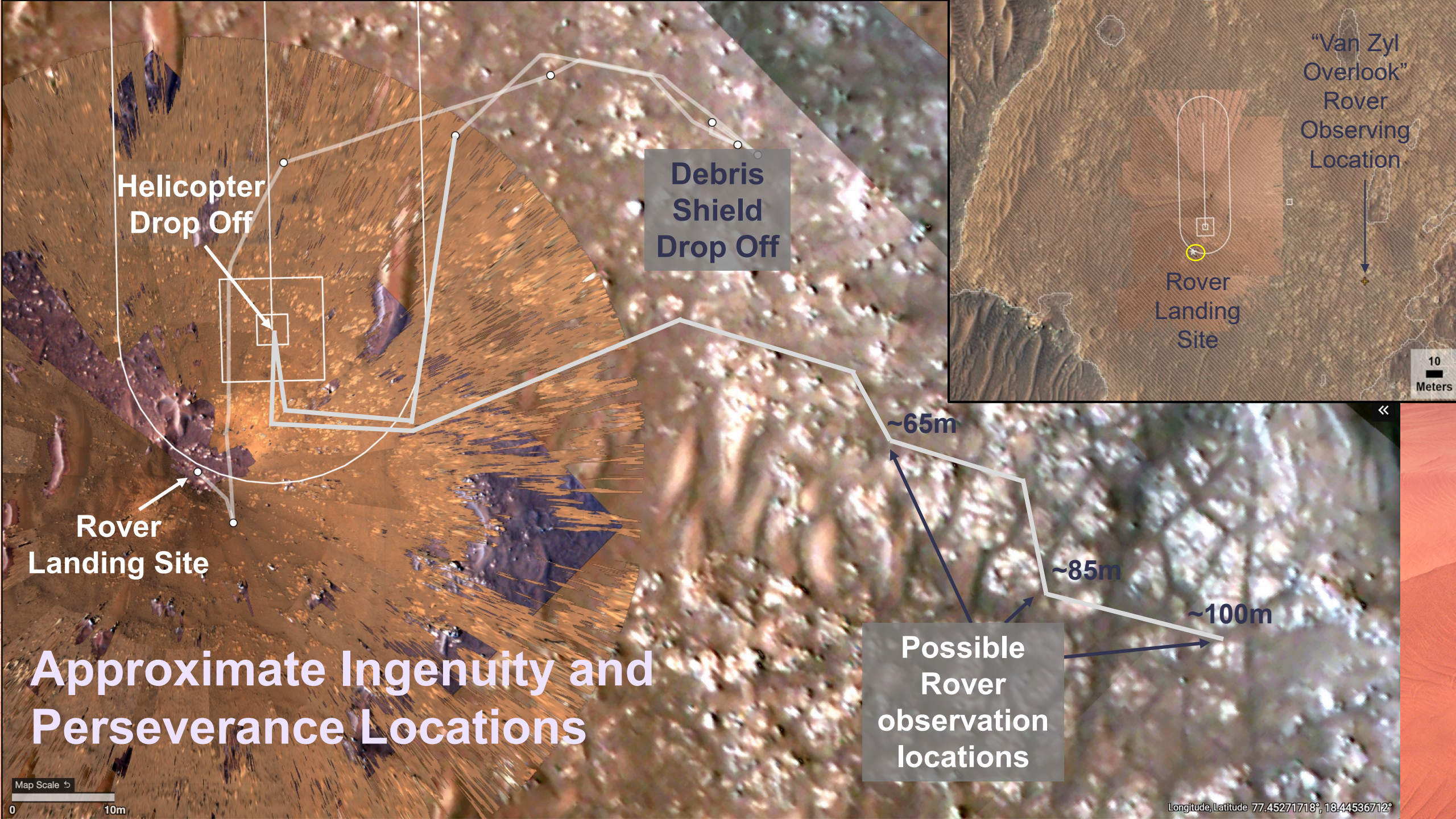




Ingenuity

- Will be a 30-Mars-day experimental flight test window once helicopter is deployed to the surface
- Will be first flight of an aircraft on another world
- If Ingenuity succeeds in taking off and hovering during the first flight, it will have achieved >90% of the project's goals
- If Ingenuity lands successfully and remains operable, up to four more flights could be attempted





Approximate Ingenuity and Perseverance Locations

Map Scale 0 10m

Longitude, Latitude 77.45271718°, 18.44536712°



Mars Sample Return

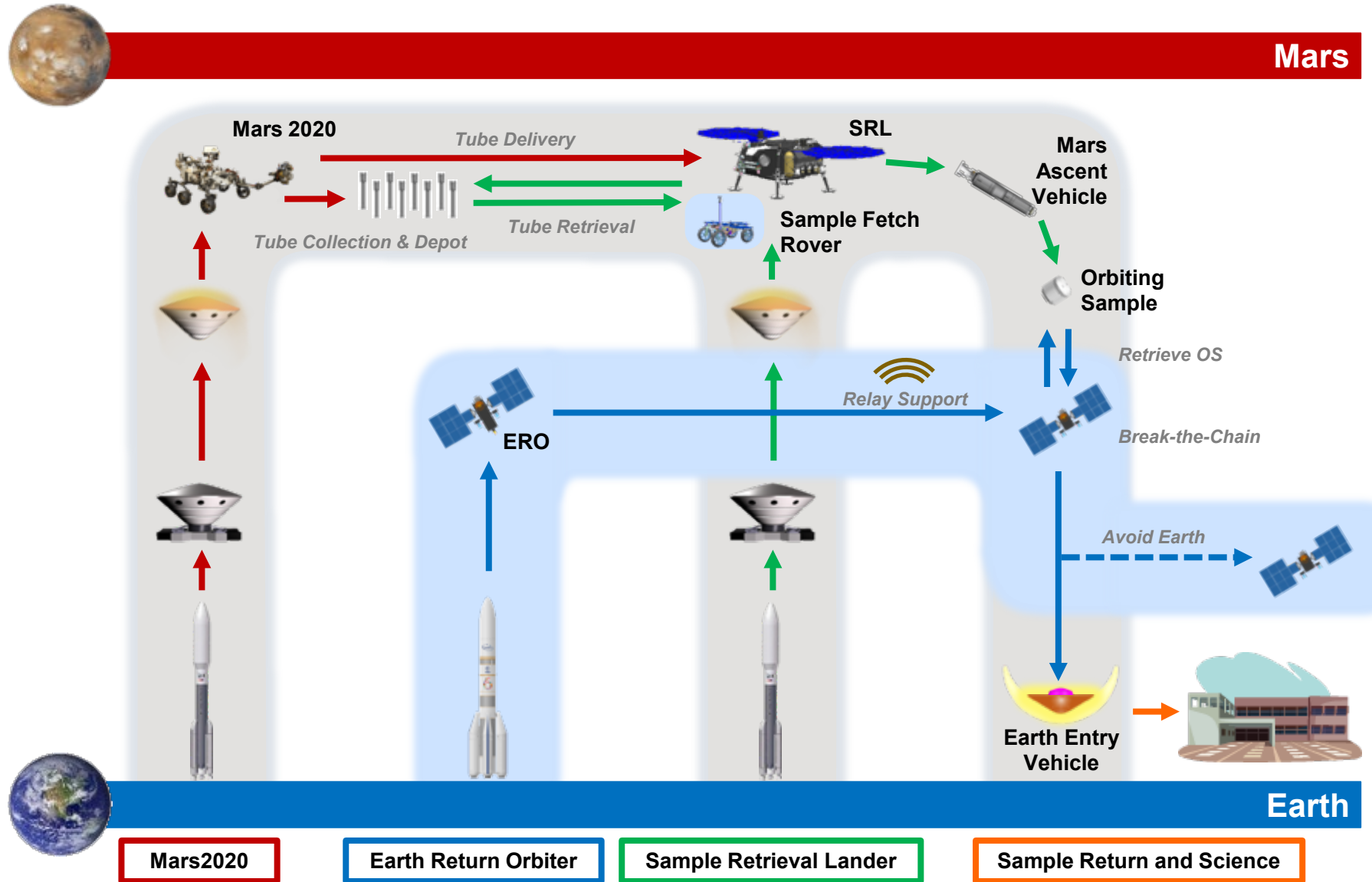


Current Status



- Mars Sample Return (MSR) approved to proceed to Phase A in December
- Because of size, complexity, and technological and engineering advances required, several processes were initiated Pre-Phase A:
 - Two independent cost/schedule estimates
 - Independent Review Board (IRB) program examination
 - Standing Review Board established to conduct MCR as an Agency review
- Relationship between MSR and Mars Exploration Program (MEP) is being finalized in a Memorandum of Agreement
 - PSD Lead Mars Scientist (Michael Meyer) will serve as both MEP Lead Scientist and MSR Program Scientist
 - Joint Steering Group (JSG), co-chaired by MEP (Eric Ianson) and MSR (Jeff Gramling) Program Directors, will be used to resolve any issues; will be convened on an as-needed basis
 - MEP Director will serve as a member of the MSR NASA/ESA Joint Steering Board and will present MEP recommendation at MSR decisional meetings
 - MSR and MEP Program Offices are both at JPL

Mars Sample Return Architectural Overview



MSR Campaign

1



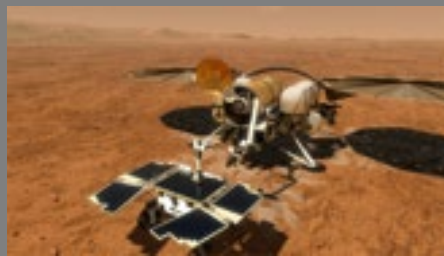
Sample Caching Rover (Mars 2020) Operations

- Sample acquisition/caching
- Sample (subset) delivery

Initiates the Campaign

Mars Sample Return Program

2



Sample Retrieval Lander

- Fetch Rover
- Orbiting Sample (OS) Container
- Mars Ascent Vehicle

New Element

3



Earth Return Orbiter

- Capture/Containment System
- Earth Return Vehicle

New Element

4



Mars Returned Sample Handling

- Sample Receiving Facility
- Curation
- Sample science investigations

New Element

Ground Element

To be reviewed at a future date



Mars Returned Sample Science

- Perseverance is capable of selecting and caching 43 samples
 - 15 NASA/ESA Returned Sample Scientists have been competitively selected for the Perseverance Science Team
- Caching Strategy Workshop held January 2021
 - Recommended modifications to the Operations MOU between Perseverance and SRL
- NASA/ESA Mars Sample Return Science Planning Group – Phase 2 (MSPG2)
 - Meeting weekly to:
 - Develop a Science Management Plan
 - Address science technical issues
 - Propose a working list of high-level requirements for the Sample Return Facility
 - Develop a timeline of key decision points
 - Report expected Spring 2021
- A JPL and JSC team visited 18 BioSafety Level-4 and contamination-controlled facilities to scope the containment challenges of conducting science with returned Mars samples
 - Report available: <http://hdl.handle.net/2014/50446>
- COSPAR Sample Safety Assessment Protocol Working Group (SSAP), with NASA and ESA members, is developing a recommendation for determining when extraterrestrial samples are safe for distribution outside of containment – progress reported at COSPAR Assembly 2021



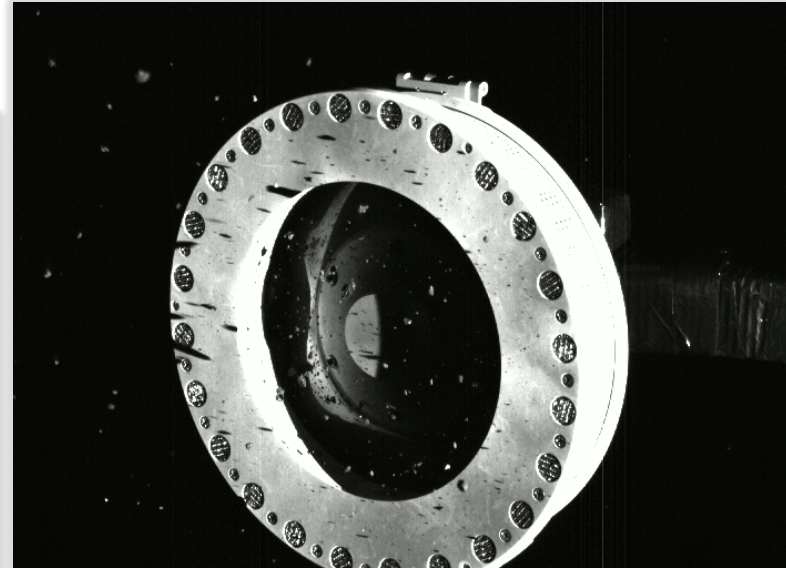
Coming Up In 2021



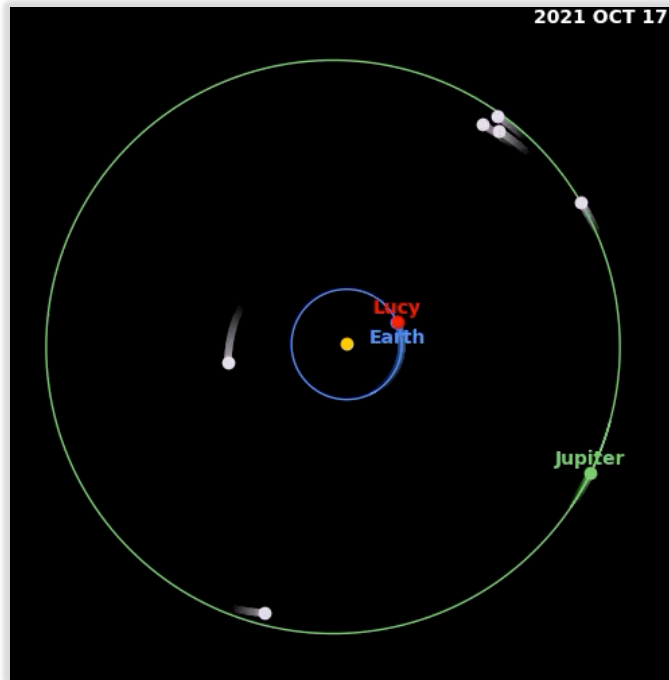
OSIRIS-REx



Touch-and-Go ('TAG')
at Nightingale Crater
Oct 20



- Final flyby of Bennu:
April 7, 2021
- Will image sample collection site, *Nightingale*, to look for surface transformations (mimicking a 2019 observation sequence)
- Will image Bennu for a full 4.3-hr rotation to obtain high-resolution images of the northern and southern hemisphere and its equatorial region
- Headed back to Earth:
May 10, 2021
- Arrives Earth:
September 2023



Lucy

- First mission to the Trojan asteroids:
 - 12 years, 7 flybys, one spacecraft
- ATLO progressing well
 - Pre-Environmental Review completed – modal survey testing has begun in Reverberant Acoustic Lab
 - All spacecraft components, including solar arrays and high-gain antenna, and blanket now installed
 - Launch and Asteroid Encounter Systems Verification Tests performed successfully
- Due to ship to Cape Canaveral late July
- Launch window opens October 2021; first Trojan flyby August 2027

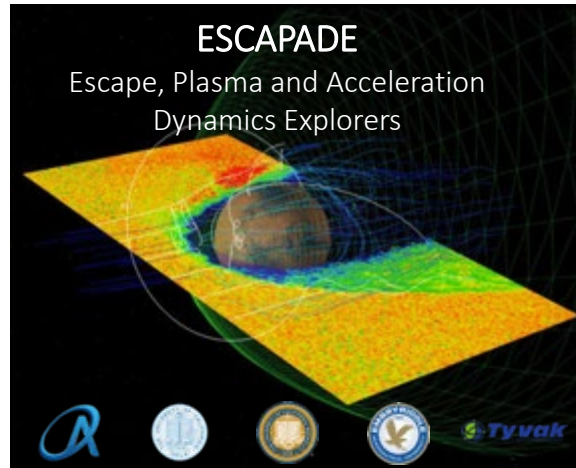
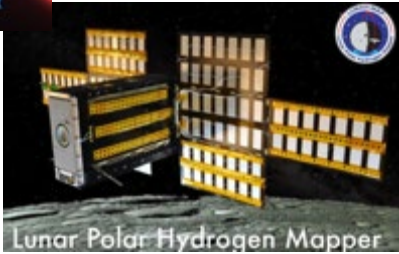
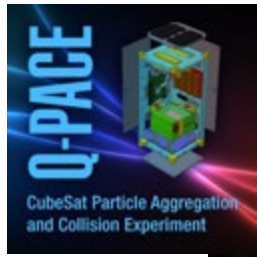


Double Asteroid Redirection Test



- Risk assessment was performed on DART project schedule to determine viability of primary and secondary launch periods
 - Technical challenges associated with DRACO imager and solar arrays
 - SMD has directed DART project to pursue secondary launch window (November 24, 2021 to February 15, 2022)
 - Project is working with SpaceX and NASA's Launch Services Program to identify earliest possible launch opportunity within this window
 - DART will arrive at Didymos binary asteroid system within a few days of the originally scheduled impact date (September 30, 2022)
- Integration and Test activities are ongoing
- LICIACube manufacturing, integration, and test has started; on track for delivery May 2021





SIMPLEx

SIMPLEx-1

Q-PACE:

- Launched on Virgin Orbit's LauncherOne January 17
- As of March 23, the spacecraft's beacon has not been detected despite multiple attempts

LunaH-Map:

- Will launch on Artemis-1, NLT November 2021
- Delivery required March 2021

SIMPLEx-2

Janus (Psyche rideshare):

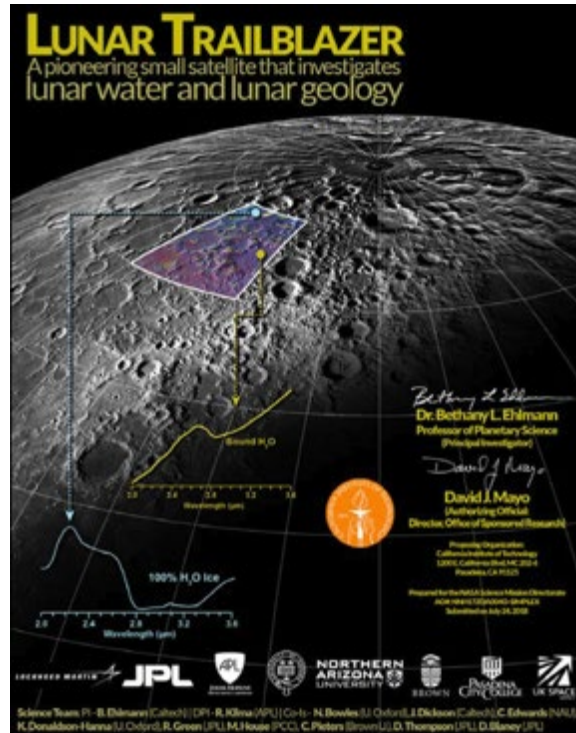
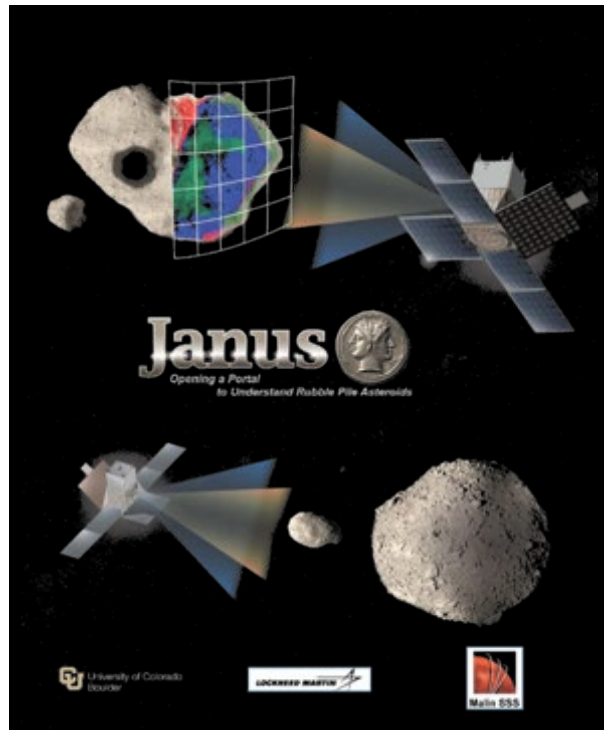
- Passed KDP-C in September; CDR held February

Lunar Trailblazer (IMAP rideshare):

- Passed KDP-C in November; CDR will be in June

EscaPADE (TBD rideshare):

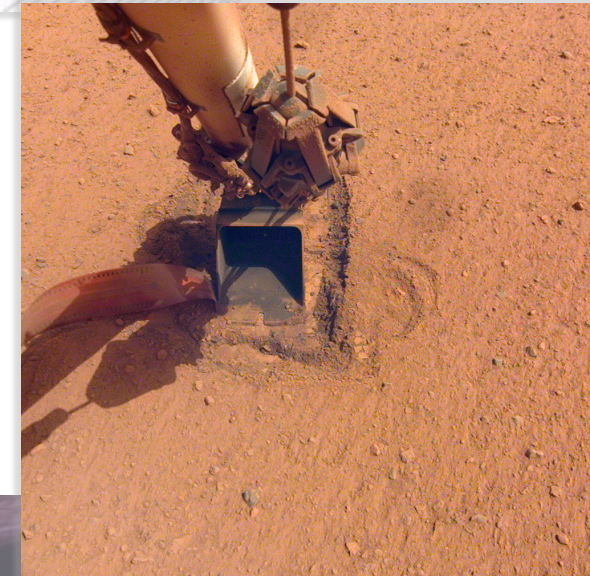
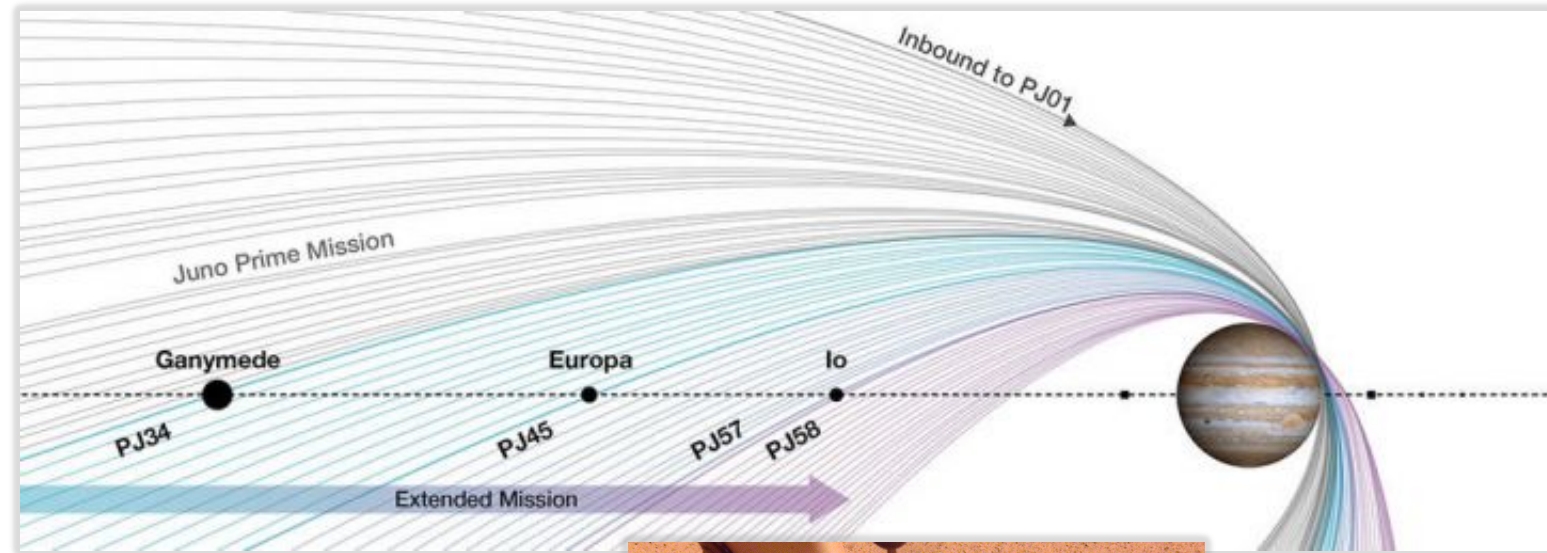
- KDP-C will be summer 2021



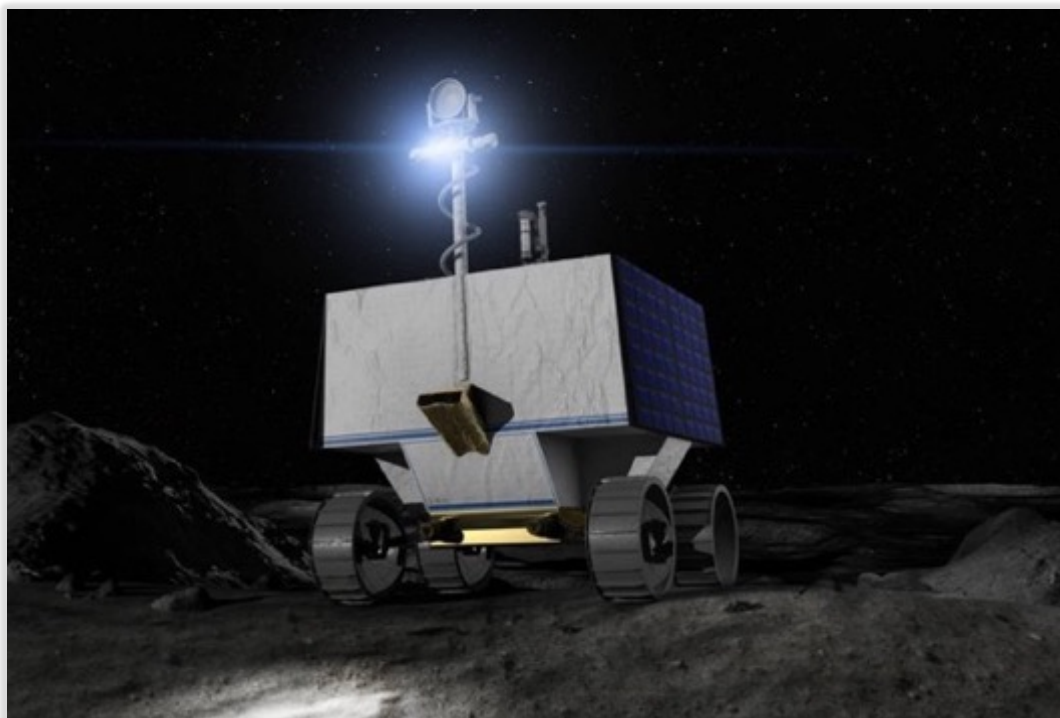
Juno and InSight



- Extended missions for both missions approved!
- **Juno:** approved through September 2025
 - Continued investigation of Jupiter
 - Flybys of Ganymede, Europa, Io
 - Investigation of Jupiter's rings
 - Planning to run a Participating Scientist Program in ROSES-2021
- **InSight:** extended for two years (through December 2022)
 - Focus on producing long-duration, high-quality seismic dataset
 - Continued operation of weather station and burial of seismic tether using Instrument Deployment Arm
 - 'Mole' recovery efforts have now ended
 - Energy challenges caused by dust covering the solar arrays

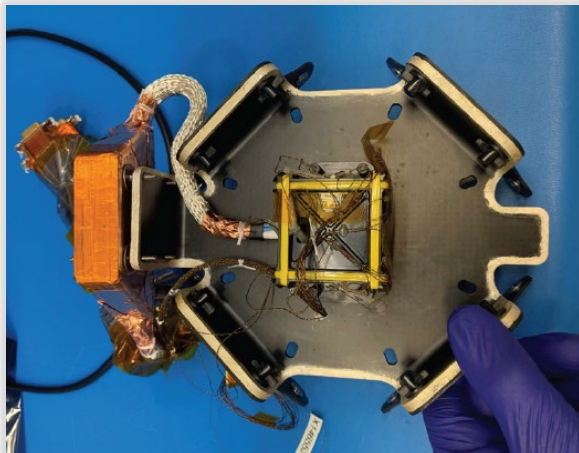
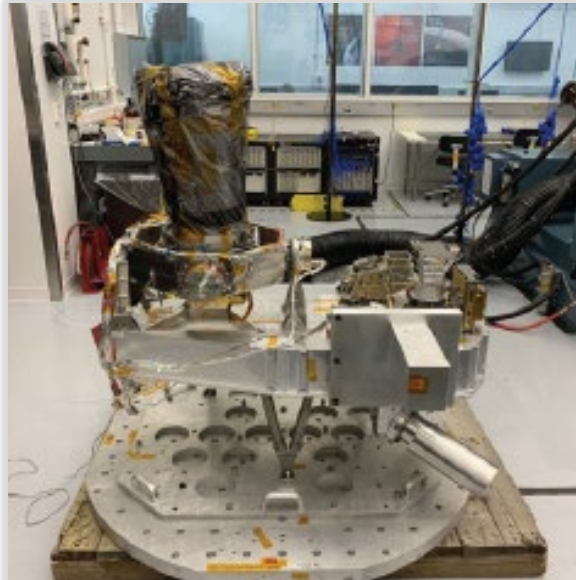
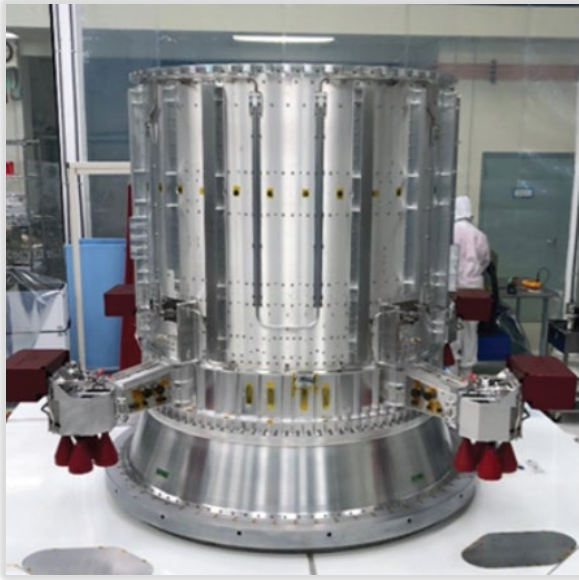


VIPER



- Golf-cart-sized rover – first ever resource mapping on another body
- Will be delivered by Astrobotic (CLPS) late 2023 for a 100-day mission
- Will explore the South Pole of the Moon in search of water ice and other potential resources
- Instruments: neutron, near-IR, and mass spectrometers; and a 1-m drill
- KDP-C held February 23, 2021

Europa Clipper



Project Schedule: Project & Flight System CDR was December 2020; in midst of reporting results to HQ

Launch: Team is working to launch readiness in 2024; in process of acquiring CLV via competitive selection – RFP has been released

Instrument Cost Control: EIS and MASPEX are proceeding well under their cost caps

Instrument & Flight System Hardware: Instruments are delivered this year!

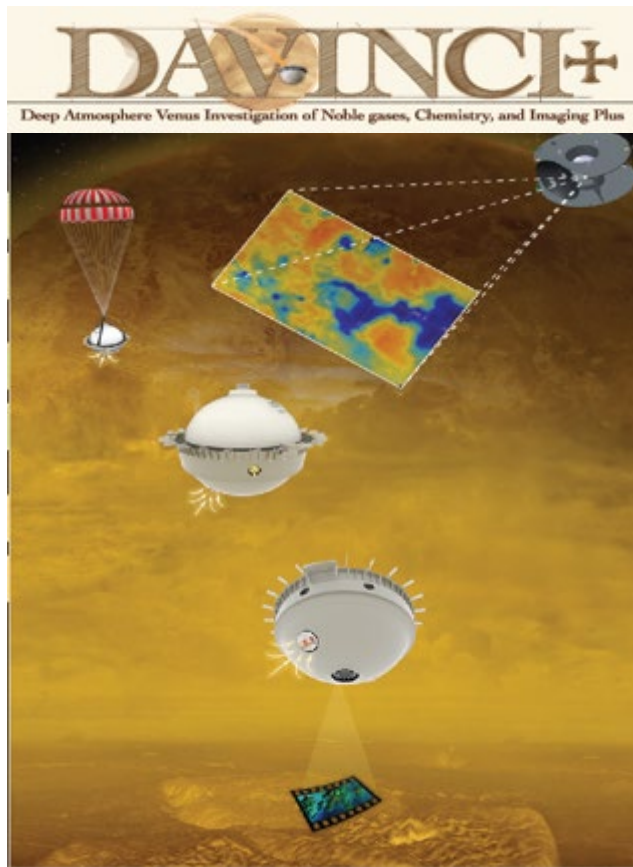
Concerns: COVID impacts are stretching resources, thermal pump, internal electrostatic discharge (IESD), EM interference/cleanliness, contamination control

Clockwise, starting top left: REM installation to lower cylinder of Propulsion Module; NADIR deck shock testing of NAC and WAC; FM oxidizer tank; EM flux gate sensor



Looking Forward





Discovery and New Frontiers

Discovery

- Discovery 2019 remains on schedule, despite COVID-19
- Aiming for Step-2 selections June 2021

New Frontiers

- Dragonfly progressing toward confirmation
- NF5 to be released Fall 2022 (current schedule)
- Community engagement began last fall and is ongoing
 - Community announcement with planning parameters released November 5
 - Community Town Hall will be held late March





Astrobiology



Astrobiology Updates

PSD Research & Analysis Programs

- **Exobiology:** 23/156 proposals selected in ROSES-20
- **Habitable Worlds:**
 - ROSES-20: 71 Step-2 proposals received
 - ROSES-21: Not solicited
- **PSTAR:** now on a biennial solicitation (solicited in ROSES-2021)
- **Interdisciplinary Consortia for Astrobiology Research (ICAR):**
 - 8 Teams selected; awards made in February 2021 (average size \$5M)
 - Will be solicited on a three-year cadence

Conferences:

- **Habitable Worlds Conference** held February 2021, cohosted by NExSS, AAS, and NExSci
- **Astrobiology Graduate Conference (AbGradCon):** Scheduled for September 14–17 in Tokyo





Community





Community Initiatives – NASEM Studies

- Decadal Survey panel meetings are ongoing
 - Additional mission concept studies list received, and started
 - Targeting release March 2022
- NASEM study on [Increasing Diversity and Inclusion in the Leadership of Competed Space Missions](#):
 - Jointly performed under Space Studies Board and Board on Science Education
 - Committee co-chaired by Fran Bagenal (LASP) and Wanda Ward (UIUC)
- NASA has requested a study from the NASEM Committee on Planetary Protection on the criteria for determining locations on Mars that are suitable for robotic missions of lower biological cleanliness than the current Category IV requirements – study will likely be complete by Fall 2021

Community Opportunities

- As part of a PSD pilot study Psyche, Europa Clipper, and Dragonfly provided the opportunity for early-career scientists to observe their science team meetings
 - Lessons learned being considered before continuing the program
- Next PI Launchpad: **June 14–25, 2021**
 - Virtual over two weeks: 1 week of asynchronous content, 1 week interactive (2 to 3 hours per day)
 - Application information posted to NSPIRES January 28; deadline for applications: March 22; notifications by May 3
- Content from 2019 workshop is online:
<https://science.nasa.gov/researchers/pi-launchpad>
- Senior review of the Planetary Data System discipline nodes will begin with a call for proposals from the existing nodes in March 2021; will be influenced by the Planetary Data Ecosystem Independent Review Board findings and recommendations



R&A Updates

- COVID-19 Augmentations and Funded Extensions
 - Several requests were not eligible, mainly because of large uncoded numbers
 - Eligible, high-priority requests have been approved
 - Additional requests (received by deadline) are being evaluated
- Habitable Worlds (ROSES-20) Dual-Anonymous Peer Review (DAPR) proposals have been submitted and review process has started:
 - Several proposals returned without review because of egregious DAPR rule violations
 - Many other non-compliances observed; PIs will be 'warned' this year
- ROSES-2021 was released February 12
 - All PSD data analysis programs (CDAP, DDAP, LDAP, MDAP, NFDAP) and cross-divisional Exoplanet's Research Program (XRP) will use DAPR
 - No Due Date (NoDD)/Rolling Submissions in place for seven PSD programs:
 - Solar Systems Workings, Emerging Worlds, Exobiology, PICASSO, Laboratory Analysis of Returned Samples, Solar System Observations, PDART
 - No proposal can be submitted to any NoDD program if it was previously submitted within the past 12 months
 - More information: <https://science.nasa.gov/researchers/NoDD>

EXPLORE

with us

