

Monthly Space News

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First images from James Webb Space Telescope released



Credits: NASA

Webb

Hubble

NASA's Artemis/Moon to Mars program updates

- CLPS (Commercial Lunar Payload Services)
 - New mission, old missions delayed, and a bankruptcy
 - Launches scheduled to start in Dec., 2022
- Artemis I launch scheduled for Aug. 29



NASA CLPS program updates

- CLPS = Commercial Lunar Payload Services, part of Artemis program
 - NASA buys lunar delivery services rather than spacecraft
 - Analogous to ISS Commercial Cargo, Commercial Crew
 - Contracts don't include the payloads, but do include rocket, lander, payload integration
 - Intended for small scale, higher risk tolerance than normal
- Contractors: Astrobotic, Intuitive Machines, Masten Space, Firefly, ...

Astrobotic
Peregrine lander



Intuitive Machines
Nova-C lander



OrbitBeyond
Z-01 lander



CLPS: Draper contract 7/21/2022

- Draper team awarded \$73 M to deliver scientific instruments to far side of the Moon in 2025
 - Schrödinger Basin, 200 mile diameter impact crater near the lunar south pole
 - Also deploying 2 communications relay satellites
 - The 8th CLPS delivery task award to the lunar surface



- Draper team includes General Atomics, ispace, Karman Space & Defense
- Launch provider TBA

SERIES-2 lunar lander. Credit: Draper

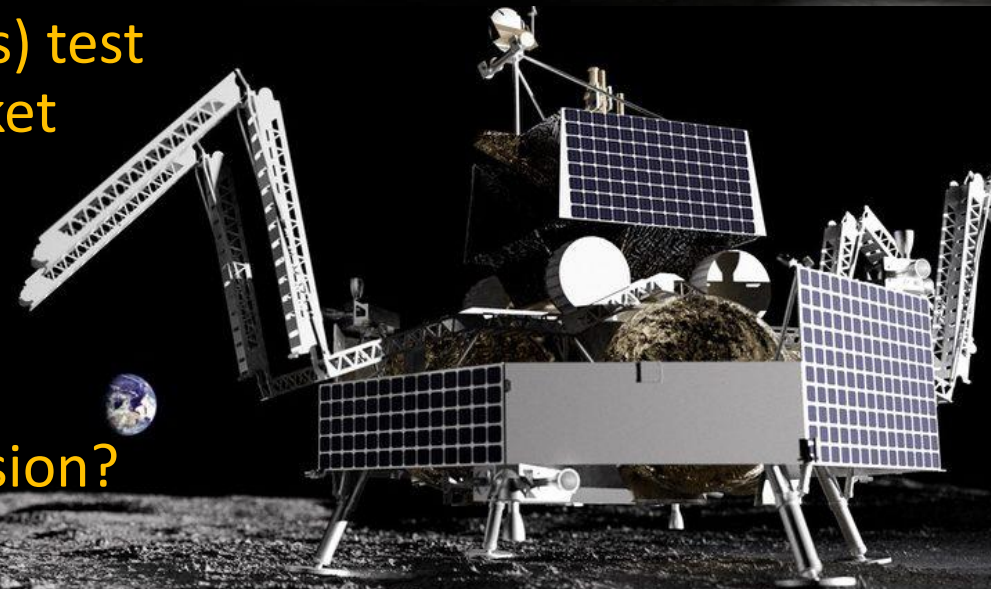
CLPS: NASA's VIPER lunar rover delayed a year

- Volatiles Investigating Polar Exploration Rover (VIPER)
 - Ice prospecting rover: 100 days near lunar South pole
 - Golf cart size (1.4 x 1.4 x 2 meters)
 - 1 meter drill, on-board analysis with spectrometers
 - Managed by NASA Ames, designed at Johnson Space Ctr.
 - Cost estimated at \$433.5 M
- Falcon Heavy rocket/ Astrobotic's Griffin lunar lander
 - Smaller Peregrine lander (with common subsystems) test might be this year, on new ULA Vulcan Centaur rocket
- Delayed from Nov 2023 to Nov 2024
 - NASA wants more testing of Griffin lunar lander
 - Landing contract increased to \$320.4 M
 - Most expensive CLPS – is it becoming a normal mission?

Griffin with VIPER. Credit: Astrobotic



VIPER. Image credit: NASA Ames



CLPS: Previous delays

- Intuitive Machines Nova-C lander: original date fall 2021, now Dec. 2022
 - SpaceX delayed Falcon-9 launch due to unspecified “unique mission requirements”
- Astrobotic Peregrine lunar lander: original date late 2021, now Dec. 2022
 - First payload for ULA Vulcan Centaur, with engine delay and payload delay
- OrbitBeyond Z-01 lander: original date Sept 2020, but company dropped out
- Masten Space Systems XL-1 lander: original Dec. 2022, then Nov. 2023
 - (But Masten declared bankruptcy in July ...)

Astrobotic
Peregrine lander



Intuitive Machines
Nova-C lander



OrbitBeyond
Z-01 lander



Masten
XL-1 lander



CLPS: Masten Space Systems bankruptcy filing 7/28/22

- Filed for Chapter 11, but might try to sell off assets, (not Chapter 7, which is always liquidation)
- Original contract \$76 M to deliver payloads to Haworth Crater
- \$4.6 M SpaceX flight reservation will probably go to Intuitive Machines
- Masten had or proposed some interesting technology
 - Creating its own landing pad, injecting ceramics in rocket exhaust
 - Other landers used in NASA tests
 - Mining water with rocket engines



Masten Space Systems Xelene (XL-1) lander artist's conception. Credit: Masten Space Systems

Artemis I launch is scheduled for Aug. 29

SLS + Orion
at launch

Launch Abort System

Orion, after disposal of its
propulsion stage

2 Solid Rocket
Boosters (SRBs)

4 RS-25D engines
(Space Shuttle)

- 42 day mission around moon (no crew)
 - Orion splashdown: Oct. 10
 - Backup launch windows: Sept. 2, Sept. 5
 - First test of SLS, and Orion integration
- SLS will be the most powerful rocket (8.8m lbs thrust) until Starship
 - Starship (17m), Shuttle (7.8m), Apollo (7.5m), Falcon Heavy (5m)
- 10 cubesats deploy into lunar orbits

Orion capsule

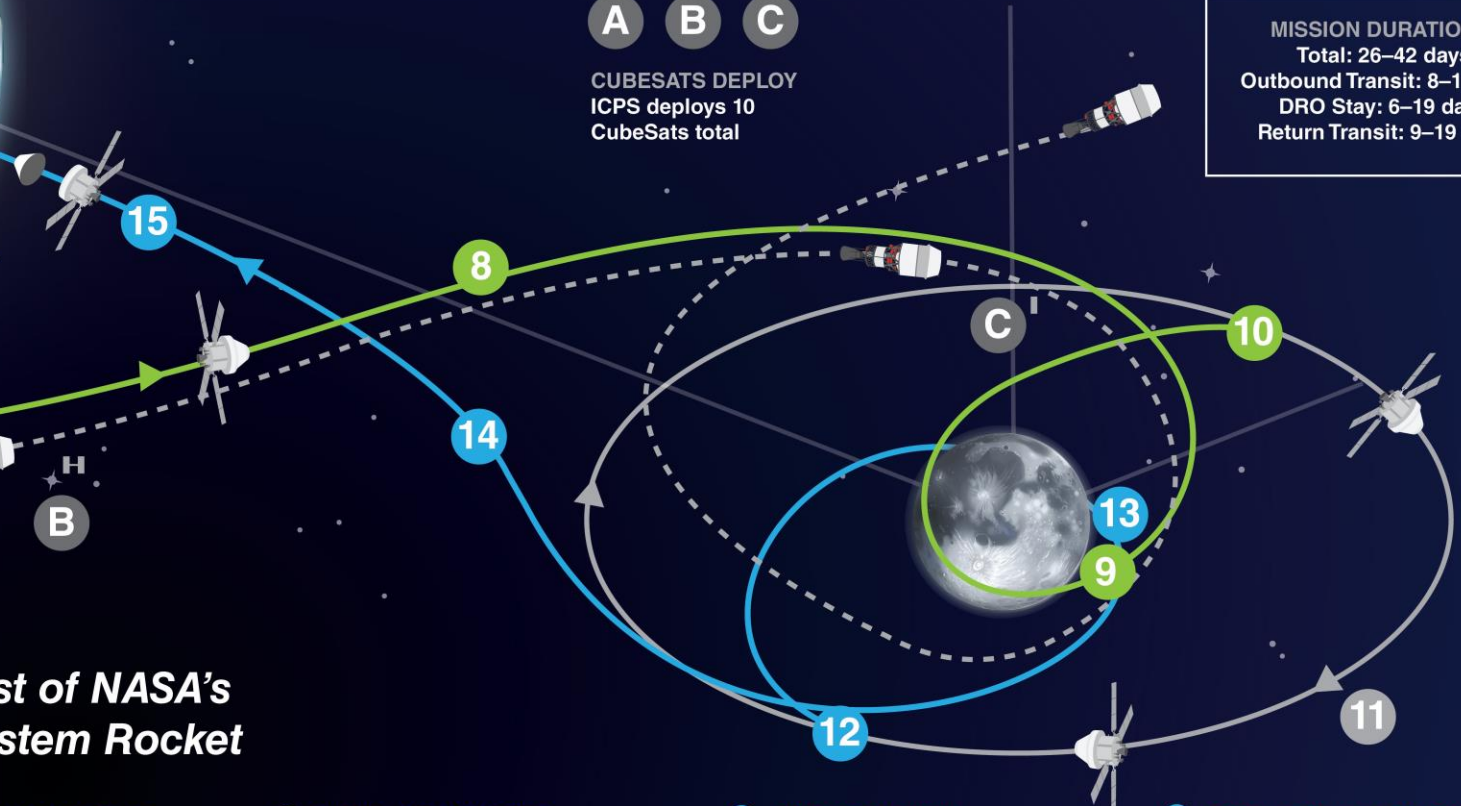
ESA Service Module

Artemis I mission



A B C
 CUBESATS DEPLOY
 ICPS deploys 10
 CubeSats total

MISSION DURATIONS:
 Total: 26–42 days
 Outbound Transit: 8–14 days
 DRO Stay: 6–19 days
 Return Transit: 9–19 days



ARTEMIS I

The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System Rocket

- 1 LAUNCH**
SLS and Orion lift off from pad 39B at Kennedy Space Center.
- 2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM**
- 3 CORE STAGE MAIN ENGINE CUT OFF**
With separation.
- 4 PERIGEE RAISE MANEUVER**
- 5 EARTH ORBIT**
Systems check with solar panel adjustments.
- 6 TRANS LUNAR INJECTION (TLI) BURN**
Maneuver lasts for approximately 20 minutes.
- 7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) SEPARATION AND DISPOSAL**
ICPS commits Orion to moon at TLI.
- 8 OUTBOUND TRAJECTORY CORRECTION (OTC) BURNS**
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).
- 9 OUTBOUND POWERED FLYBY (OPF)**
60 nmi from the Moon; targets DRO insertion.
- 10 LUNAR ORBIT INSERTION**
Enter Distant Retrograde Orbit.
- 11 DISTANT RETROGRADE ORBIT**
Perform half or one and a half revolutions in the orbit period 38,000 nmi from the surface of the Moon.
- 12 DRO DEPARTURE**
Leave DRO and start return to Earth.
- 13 RETURN POWERED FLYBY (RPF)**
RPF burn prep and return coast to Earth initiated.
- 14 RETURN TRANSIT**
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere.
- 15 CREW MODULE SEPARATION FROM SERVICE MODULE**
- 16 ENTRY INTERFACE (EI)**
Enter Earth's atmosphere.
- 17 SPLASHDOWN**
Pacific Ocean landing within view of the U.S. Navy recovery ship.

Russia and the International Space Station (ISS)...again...

- NASA/Roscosmos ISS seat bartering agreement completed 7/14/22, with missions starting in September
- Dmitry Rogozin dismissed as head of Roscosmos (Russian space agency), replaced by Yuri Borisov 7/15/2022
- Russia to withdraw from ISS “*after 2024*” (vague)... again ...
 - Quoted in a TASS (Russian news agency) report as Borisov/Putin discussion
 - Russia would work on its own station ROSS
 - NASA has received no formal notification
- Later comments: withdrawal ...
 - will be after ROSS is in orbit
 - depends on ISS condition
 - could take several years
- In summary, no real change!



ISS, Nov., 2021. Credit: NASA

New plan for NASA/ESA Mars Sample Return mission

Mission retrieves samples cached by Perseverance rover

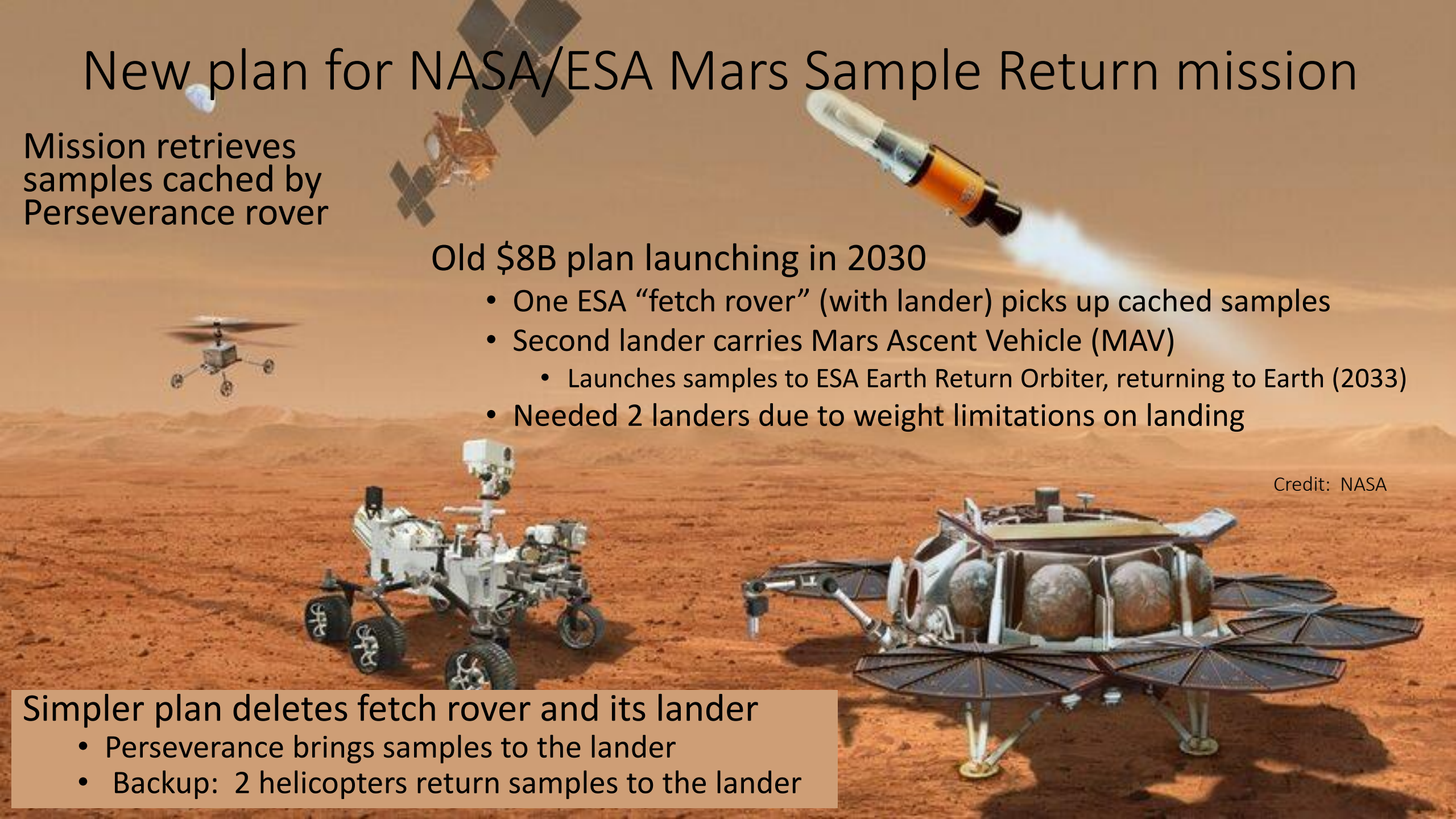
Old \$8B plan launching in 2030

- One ESA “fetch rover” (with lander) picks up cached samples
- Second lander carries Mars Ascent Vehicle (MAV)
 - Launches samples to ESA Earth Return Orbiter, returning to Earth (2033)
- Needed 2 landers due to weight limitations on landing

Credit: NASA

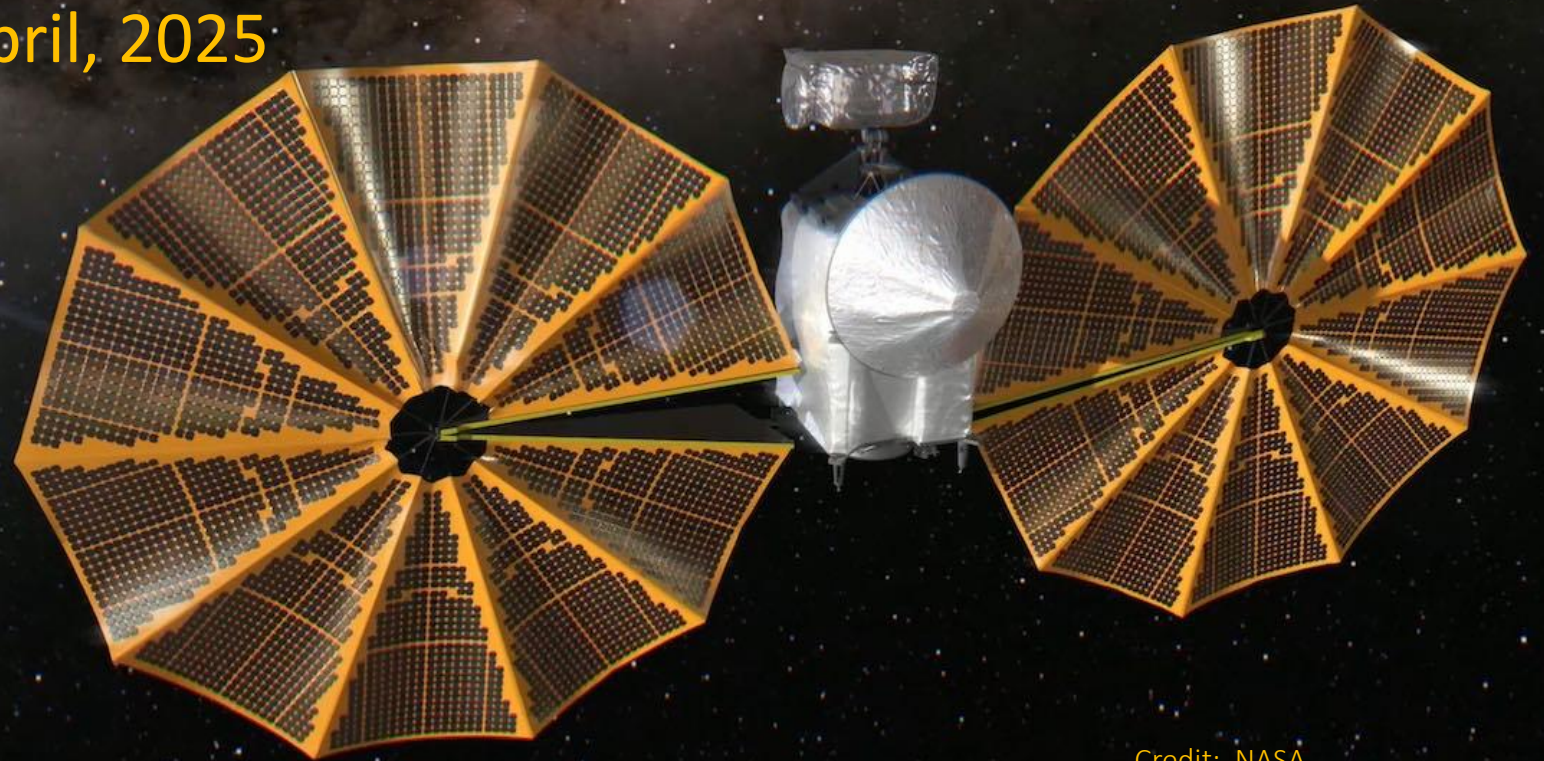
Simpler plan deletes fetch rover and its lander

- Perseverance brings samples to the lander
- Backup: 2 helicopters return samples to the lander



Lucy asteroid probe declared good enough to go

- Launched October 2021 to visit asteroids, mostly ones Jupiter trapped
- One solar array only deployed 347/360 degrees
- After 7 tensioning tries, got to 353 to 357 degrees, with good tension
- First of 3 Earth flyby/gravity assists coming in October
- First asteroid encounter: April, 2025



Miscellany

- Blue Origin launched 6th New Shepard 10 minute suborbital crewed flight (6 people)
- ISS tested waste disposal from Bishop Airlock
 - 172 lb. bag of waste burned up in atmosphere (max 600)
 - Packing material, dirty clothing, hygiene products, used office supplies
 - Previously, stored trash for months in Cygnus (disposable) cargo vehicle to burn up on re-entry
 - 4 astronauts generate 2,500 kg trash/year (two trash cans per week)
- Astra cancels Rocket 3, to build larger rocket
 - Rocket 3, with 50 kg payload, failed 5/7 launches
 - Vision: higher risk for lower cost (less testing/redundancy)
 - Rocket 4 payload will be 600 kg, testing in 2023
 - (Size of Electron or Falcon 1 – limited market?)
 - Separate electric thruster business will provide revenue



Credit: Blue Origin



Credit: Nanoracks



Credit: Astra/NASA

How many launches since the last meeting (July 9)?*














*Includes failed launches if they lift off the launch pad
Only includes launches attempting orbit or beyond*

South Korean KPLO Lunar Mission
8/4/22 Credit: SpaceX

* With belated entry for 1 Russian launch missed in last month's count















Launches since last meeting (July 9)* page 1

-  July 7* – Soyuz – navigation and timing network satellite
-  July 10 – Falcon 9 – 46 Starlink (internet service) satellites, first to new shell at 97.6°
-  July 12 – Long March 3B – communications relay satellite
-  July 13 – Electron – US/Australian spy satellite (National Reconnaissance Office)
-  July 13 – Vega C – Italian research satellite + 6 cubesats. First launch of Vega C
-  July 14 – Falcon 9 – Cargo to International Space Station (ISS)
-  July 15 – Long March 2C – 2 commercial Earth observation radar satellites
-  July 17 – Falcon 9 – 53 Starlink (internet service) satellites
-  July 22 – Falcon 9 – 46 Starlink (internet service) satellites
-  July 24 – Long March 5B – New science module for Chinese space station
-  July 24 – Falcon 9 – 53 Starlink (internet service) satellites
-  July 27 – Lijian-1 – 6 small satellites: first launch of CAS Space Lijian-1 solid rocket
-  July 29 – Long March 2D – 3 military reconnaissance satellite

* With belated entry for 1 Russian launch missed in last month's count

Launches since last meeting (July 9) page 2

-  Aug 1 – Soyuz – Possibly an “inspector satellite” (same orbit as a new U.S. spy satellite)
-  Aug 3 – Long March 4B – carbon and ecosystem monitoring satellite, 2 smaller ones
-  Aug 4 – Electron – classified mission for US NRO (National Reconnaissance Office)
-  Aug 4 – Atlas 5 – U.S. Space Force missile warning satellite
-  Aug 4 – Long March 2F – speculated to be 2nd flight of a reusable space plane like X-37
-  Aug 4 – Falcon 9 – South Korea’s first lunar orbiter (entering lunar orbit in December)
-  Aug 6 – SSLV – 2 small satellites – India’s new Small Satellite Launch Vehicle (FAIL)
-  Aug 9 – Ceres-1 (Galactic Energy, China) – 3 small remote sensing satellites
-  Aug 9 – Falcon 9 – 52 Starlink (internet service) satellites
-  Aug 9 – Soyuz – Iranian imaging satellite (some claimed initial use over Ukraine)
-  Aug 10 – Long March 6 – 16 Earth observation satellites
-  Aug 12 – Falcon 9 – 46 Starlink (internet service) satellites. Total launched = 3,055

Discussion & questions?



Image: NASA