



Mars Sample Return

Mars Sample Return

Returning Mars Samples to Earth

NASA and the European Space Agency (ESA) are developing plans to bring the first samples of Mars material back to Earth for detailed study.

NASA's Mars Perseverance rover is the first leg of this international interplanetary relay team. Its job is to collect and cache samples on Mars. A Sample Retrieval Lander would land near or in Jezero Crater, bringing a small rocket on which the scientifically selected samples collected by Perseverance would be loaded. Two Ingenuity-like helicopters would provide a secondary capability to retrieve samples on the surface of Mars. Once the sample cache is launched off the Red Planet, another spacecraft would capture it in Mars orbit, securely contain it, and then bring it back to Earth safely in 2033.

These first collected and returned samples could answer a key question: *did life ever exist on Mars?* Only by bringing the samples back can we truly answer the question by using the most sophisticated, state-of-the-art labs, and enable future generations to study them for decades using techniques yet to be invented.

Firsts

- First launch from another planet
- First in-orbit rendezvous at Mars
- First round-trip mission to another planet
- First return of samples from another planet



Illustration of a ~6-inch (~15-cm) sample tube carried on board the Perseverance rover. Credit: NASA/JPL-Caltech

Location: Jezero Crater

An impact crater north of the Martian equator and at the western edge of the flat plain region Isidis Planitia, Jezero Crater is the site of an ancient river delta and lake that scientists believe may hold ancient organic molecules and other potential signs of microbial life from billions of years ago. The site was determined to be good for sampling, and Perseverance landed there to collect these samples. The crater is about 28 miles (45 kilometers) in diameter.

Key Spacecraft

- **Perseverance Mars Rover**
This rover is already on Mars and caching samples in tubes for potential pickup and return to Earth by a future mission. Perseverance is the primary mode of transport to bring samples to the Sample Retrieval Lander.
- **Sample Retrieval Lander**
The NASA-led Sample Retrieval Lander would carry a Mars rocket and land near the Perseverance rover's location in Jezero Crater. Perseverance would rendezvous with this lander to transfer samples.
- **Sample Recovery Helicopters**
A pair of next-generation Mars helicopters would serve as a secondary capability to retrieve cached samples on Mars.
- **Mars Ascent Vehicle**
The first rocket ever to launch off the surface of another planet would transport a container of sample tubes into Mars orbit.
- **Capture, Containment, and Return System**
Aboard the ESA-provided Earth Return Orbiter, this system would capture the orbiting sample container, seal it up securely while sterilizing any Mars material that may remain in the seam of the primary container, and transfer it to a clean zone for its trip back to Earth.
- **Earth Return Orbiter**
Meeting the sample container in orbit, the Earth Return Orbiter would leave Mars orbit with the samples inside and head back toward Earth. Close to Earth, it would release the entry capsule containing the samples, for its landing on our home planet.

- **Earth Entry System**
With its robust heat shield, this cone-shaped entry vehicle would carry the Mars samples back through Earth's atmosphere for a safe touchdown on land.

Follow Along

mars.nasa.gov/msr

Facebook & Twitter: @nasamars

Quick Facts

Program:
Mars Sample Return

Main Job:
Return samples collected by the Mars Perseverance rover to Earth for study

Launch:
Planned launches in 2027 (orbiter) and 2028 (lander)

Landing Location:
Jezero Crater, where Perseverance is currently collecting samples

Return of Samples:
The samples would arrive on Earth in 2033

This strategic NASA and ESA partnership would be the first mission to return samples from another planet and the first launch from the surface of another planet. The samples collected by Perseverance during its exploration of an ancient river delta are thought to present the best opportunity to reveal the early evolution of Mars, including the potential for life.



Illustration of the Perseverance rover and Mars Sample Return spacecraft - including lander, rocket, helicopter, and orbiter - working on Mars.

Credit: NASA/ESA/JPL-Caltech