

ESCAPADE

Escape and Plasma Acceleration and Dynamics Explorers



NASA's ESCAPADE mission will study the Sun's influence on Mars' past and present, which could help protect future human explorers from potentially dangerous space weather when they set foot on the Red Planet.

To do this, ESCAPADE uses two identical spacecraft to investigate how the solar wind interacts with Mars' magnetic environment (or magnetosphere) and how this interaction drives the planet's atmospheric escape. Its observations will reveal the planet's real-time response to space weather and how the Martian magnetosphere changes over time.

Mars' Hybrid Magnetosphere

Mars has a hybrid magnetosphere that consists of an induced magnetic field (resulting from the solar wind's interaction with the charged particles in Mars' upper atmosphere) and crustal magnetic fields (caused by areas of strongly magnetized crust).

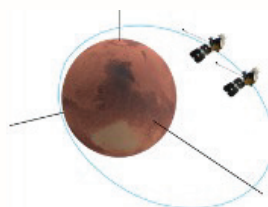
This hybrid magnetosphere provides minimal protection from the solar wind. Along with the thin Martian atmosphere, the relatively weak magnetosphere allows higher doses of damaging radiation to reach the surface of Mars than on Earth.

Over billions of years, the solar wind slowly stripped away most of Mars' early atmosphere, causing the planet to cool and to lose the liquid water that once flowed across its surface.

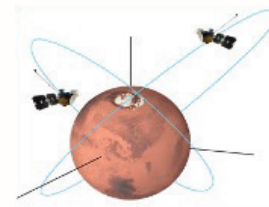
Two Science Campaigns

ESCAPADE is conducting two science campaigns at Mars.

- Campaign A uses a string-of-pearls formation, where the two spacecraft follow each other in the same orbit around Mars, studying how the planet's environment changes with time and location.
- Campaign B places the spacecraft in different orbits, with one traveling farther from Mars to observe the incoming solar wind and the other staying closer to the planet to study how Mars responds to the solar wind in real time.



Campaign A: string of pearls



Campaign B: separate orbits

Blazing a New Path to Mars

To save fuel, previous Mars missions have had to launch when Earth and Mars are aligned in their orbits. However, ESCAPADE is pioneering a new strategy that allows Mars-bound spacecraft to launch almost anytime.

Instead of launching directly to Mars, ESCAPADE will loop around the Earth-Sun Lagrange point 2 (L2), in an "Earth-proximity" or "loiter" orbit that allows the spacecraft to wait until November 2026, when the two planets are aligned, to head to Mars.

This unique orbit will make ESCAPADE the first mission to fly through Earth's distant magnetotail (the part of Earth's magnetosphere that stretches away from the Sun). The two spacecraft then return to Earth for a gravity assist that slingshots them to Mars.

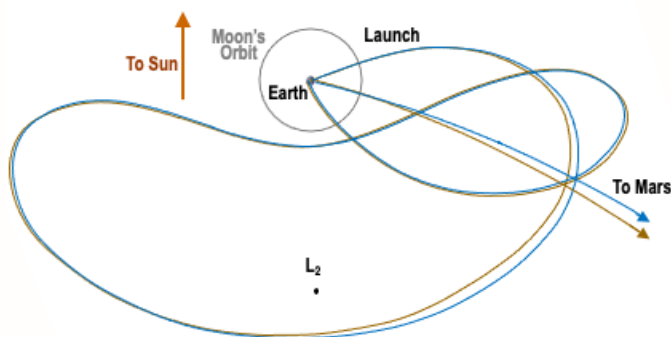
Unraveling the
cause-and-effect of
space weather on
Mars' environment



Mission Firsts

ESCAPADE is the first:

- coordinated multi-spacecraft orbital science mission to the Red Planet.
- mission to measure both the solar wind and Mars' upper atmosphere simultaneously.
- Mars mission to launch from Earth when the two planets are not in alignment.
- mission to follow an "Earth proximity" orbit that loops around the Earth-Sun Lagrange point 2 (L₂) before heading to Mars.
- mission to fly through the most distant part of Earth's magnetotail.
- scientific mission to Mars with a low-cost commercial focus.



Launch

Date: Fall 2025

Provider: Blue Origin

Vehicle: New Glenn

Site: Cape Canaveral Space Force Station Launch Complex 36 in Florida

Mission

Duration: 11 months

(Campaign A: 6 months; Campaign B: 5 months)

Location: Mars orbit

Cruise to Mars: 10 months (after Earth "loiter" phase)

Objective: Unravel the solar wind's interaction with Mars' unique magnetic environment

Spacecraft

- Two twin satellites
- Dimensions:
 - o Stowed: 3.9 ft. x 5.4 ft. x 3.6 ft. (1.20 m x 1.65 m x 1.09 m)
 - o Deployed: 16 ft. x 5.4 ft. x 3.6 ft. (4.88 m x 1.65 m x 1.09 m)
- Weight:
 - o Dry (without fuel): 461 lbs. (209 kg)
 - o Wet (with fuel): 1,179 lbs. (535 kg)



Science Instruments

- Ion and Electron Electrostatic Analyzers
- Magnetometer
- Langmuir Probe
- Visible and Infrared Cameras

Partners

The ESCAPADE mission is led by the Space Sciences Laboratory at the University of California, Berkeley, with key partners:

- Rocket Lab (spacecraft)
- Advanced Space LLC (mission design)
- Blue Origin (launch)
- NASA's Goddard Space Flight Center (magnetometers)
- Embry-Riddle Aeronautical University (Langmuir probes)

The ESCAPADE mission is funded by NASA's Heliophysics Division and managed by the Explorers Office at NASA's Goddard Space Flight Center.

For more information, please visit:
nasa.gov/escapade

