# 2. Escapade Mission - Science & Technology

NASA's latest ESCAPADE is sending twin low-cost orbiters to examine Mars' atmosphere. NASA's twin ESCAPADE (Escape and Plasma Acceleration and Dynamics Explorers) spacecraft were launched aboard Blue Origin's New Glenn rocket to study how solar wind shapes Mars' magnetic and atmospheric environment.

## About the ESCAPADE Mission

ESCAPADE is a dual-spacecraft heliophysics mission designed to analyze Mars' magnetosphere and atmospheric loss processes.

**Lead Institution -** University of California, Berkeley.

**Spacecraft Builder -** Rocket Lab.

**Target -** Mars' magnetic and atmospheric environment.

**Primary Goal -** To determine how the solar wind interacts with Mars' weak magnetic environment.

### Objectives

The mission aims to achieve the following specific scientific objectives -

1. Measure how solar storms accelerate atmospheric escape and influence Martian space weather.
2. Analyze variations in magnetospheric conditions over short timescales.
3. Achieve coordinated observations using dual-orbit observations.

## Payloads (Scientific Instruments)

The mission utilizes three key instruments to achieve its objectives -

| Pay-load | Full Name | Measurement/Function |
|---|---|---|
| **EMAG** | Electromagnetometer | Measures magnetic field strength and direction. |
| **EDP** | Electric Field and Plasma Density Instrument | Records electric fields and plasma densities. |
| **EESA** | Ion and Electron Spectrometer | Studies energy and distribution of charged particles. |

## Trajectory and Mission Design

The mission utilizes a flexible trajectory design allowing for year-round departure opportunities.

**Initial Travel -** The spacecraft will first travel to Lagrange Point-2 (L2).

**Loiter Phase -** They will wait at L2 for a favorable Earth–Mars alignment before performing a slingshot maneuver toward Mars in 2026.

**Mars Arrival -** They are scheduled to enter Mars orbit in 2027.

**Operational Phases -** The mission will operate in two phases once at Mars -

1. A "string-of-pearls" formation.
2. Dual-altitude orbits.

## Significance

The ESCAPADE mission has both scientific and strategic implications -

**Scientific Insight -** It will reveal how Mars became a cold, desert planet by tracing the process of atmospheric erosion.

**Human Exploration Support -** It will support planning for future human missions by characterizing radiation and plasma hazards around Mars.

**Technological Demonstration -** It demonstrates flexible **"**loiter-orbit" interplanetary launches, which enables year-round departure opportunities.

**About Lagrange Points (L-Points) -** Lagrange Points are specific positions in space where the gravitational forces of two large bodies (like the Sun and Earth) balance the orbital motion of a smaller object, enabling stable or semi-stable parking.

## Locations and Examples of Key L-Points

| L-Point | Location Description | Example Mission/Significance |
|---|---|---|

| | | |
|---|---|---|
| **L1** | Lies between Earth and Sun. | Ideal for uninterrupted solar observation. India's solar observatory Aditya-L1 is stationed here. |
| **L2** | Positioned beyond Earth, opposite the Sun. | Ideal for deep-space observation. The James Webb Space Telescope is located at the Sun-Earth L2. ESCAPADE will use this point for loitering. |
| **L3** | Located behind the Sun, opposite Earth's orbit. | (No major contemporary examples provided in text). |
| **L4** | Forms an equilateral triangle leading Earth in its orbit. | (No major contemporary examples provided in text). |
| **L5** | Forms an equilateral triangle trailing Earth in its orbit. | (No major contemporary examples provided in text). |

Source - https - //www.pbs.org/newshour/science/nasas-latest-escapade-is-sending-twin-low-cost-orbiters-to-examine-mars-atmosphere