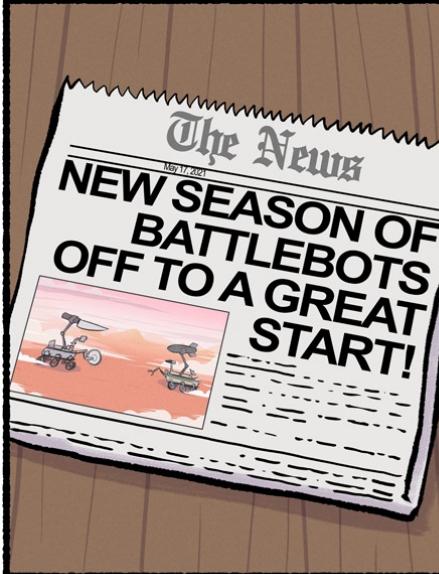
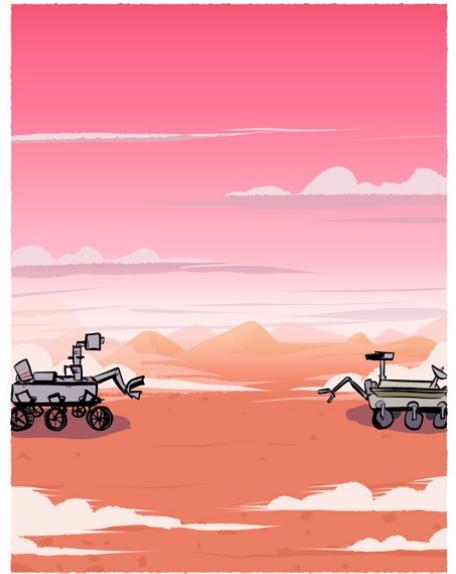
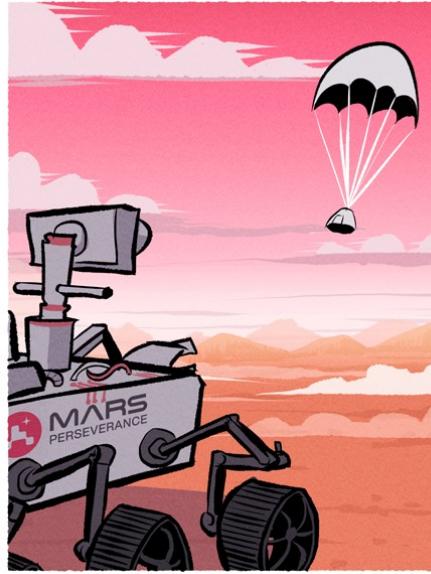


Solar System Happenings

Planets and asteroids

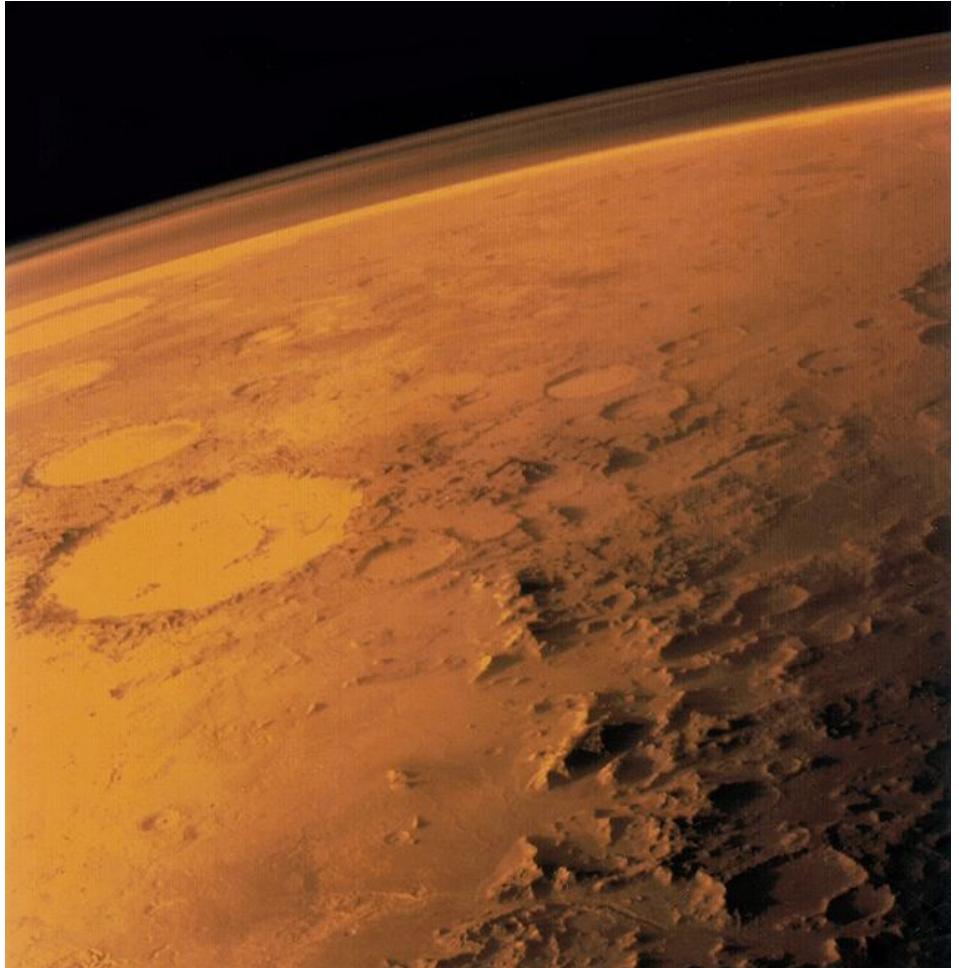
June 10, 2021 – Learners at Wind Crest – What's New in Astronomy?



Mars

- Three new spacecraft arrived at Mars in February 2021
- The US Perseverance rover
- An orbiter, ‘Hope’ from the UAE
- A Chinese orbiter and lander/rover called Zhurong
- All arrived successfully. Many other spacecraft have not, for a variety of reasons.

- Mars has a thin atmosphere
- About 0.1% of earth pressure
- Mostly CO₂
- Surface is dry and cold
- No global magnetic field (core likely solid unlike earth).
- Atmosphere is at the mercy of the solar wind, which is blowing it away.



Viking, 1976

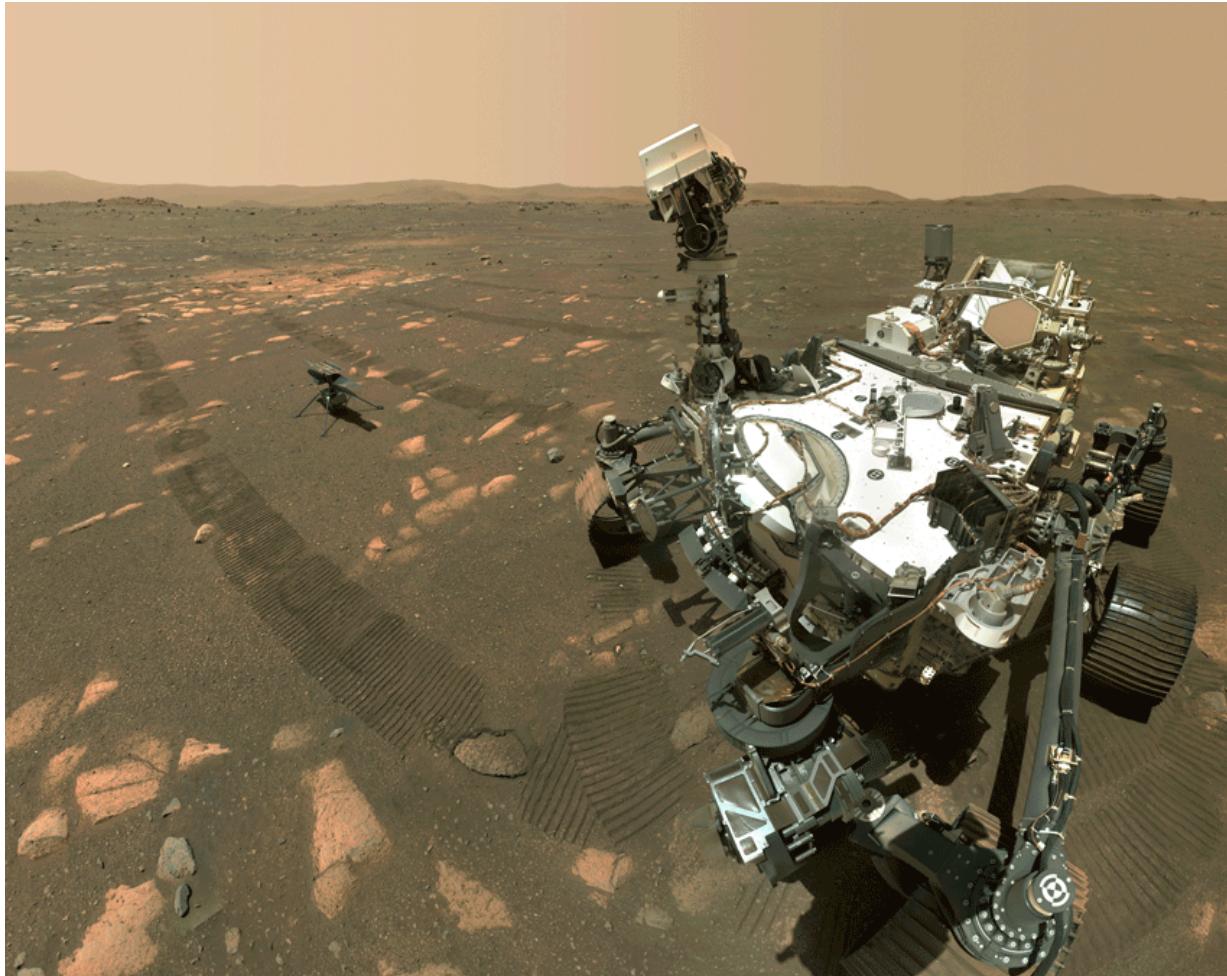
- Twin orbiters and landers soft- landed on Mars in 1976.
- Martin Marietta had a major part in the mission
- This is an early surface photo from Viking 2
- credit: [https://apod.nasa.gov/
apod/ap210521.html](https://apod.nasa.gov/apod/ap210521.html)



Basic facts about Mars

- There's a planet in our solar system inhabited entirely by robots... Mars.
- It's more earth-like in many ways than other planets: rocky; 10% of earth mass; 0.4 earth gravity; 0.1% of earth atmospheric pressure, mostly CO₂; cold (-226 to +95 F with an average of a balmy -82 F)
- It's likely that in its first billion years there was much more atmosphere, liquid water on the surface, at a time when life was getting started on earth.
- If life started there, microbes might have found a way to survive in the soil or under the polar caps (liquid water has been detected under the south polar cap).

- Every two years or so there's an opportunity to send spacecraft to Mars.
- Recent missions include the small rovers Opportunity and Spirit, which lasted for years on solar power. Spirit got stuck in the sand, and Opportunity was lost during a global dust storm.
- Curiosity has been prospecting in Gale Crater since 2012. It's car sized and powered by a radioisotope thermoelectric generator (RTG) which converts heat from the decay of Pu-238 into electric power. It has a variety of geological instruments and cameras.
- Insight, a fixed lander, is doing seismology on Mars.
- Perseverance landed in Feb 2021 in Jezero crater.



- Self-portrait of Perseverance and the helicopter Ingenuity
- Geological instruments to search for signs of ancient life
- Engineering demos: helicopter and manufacturing oxygen
- Will collect samples for possible return by another mission



T w o W o r l d s



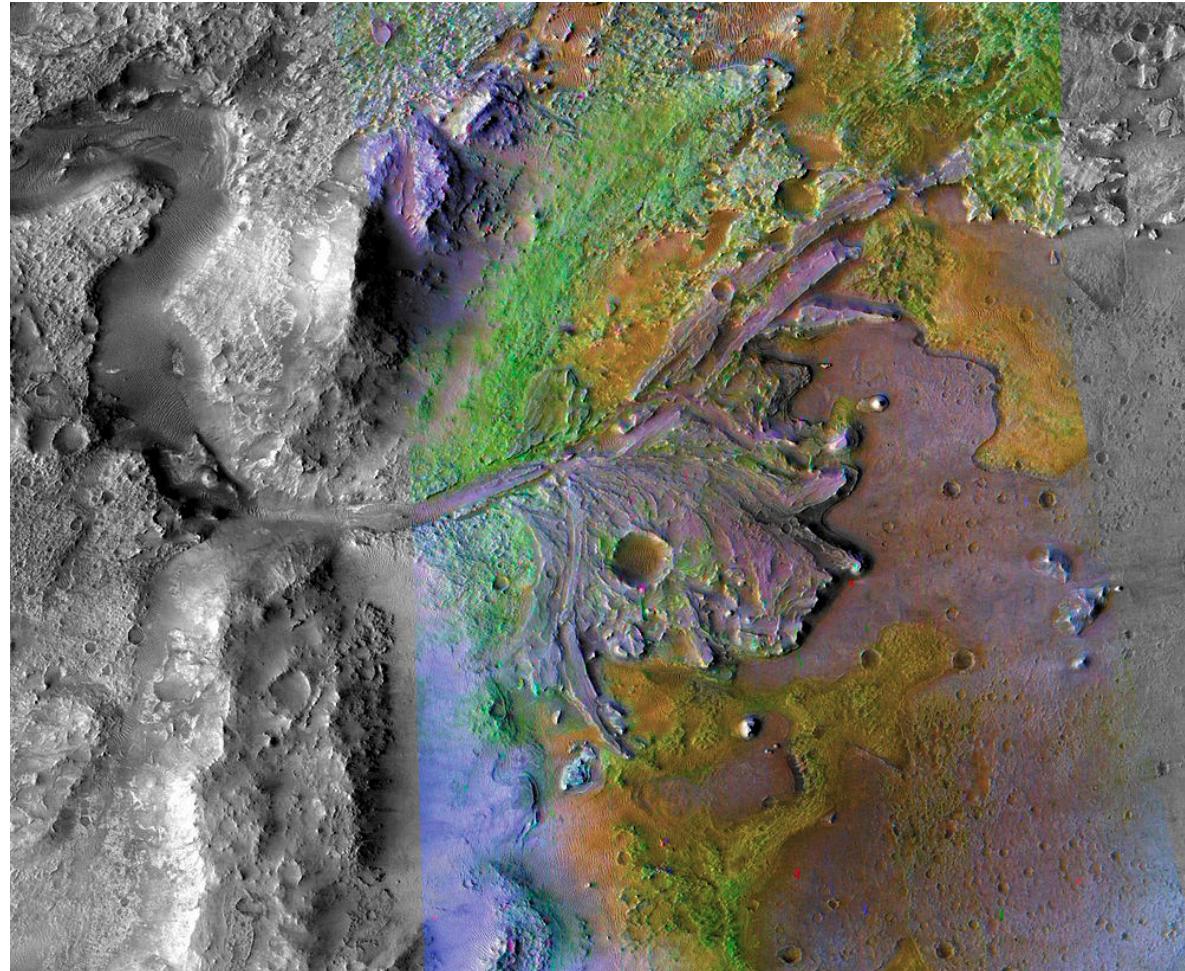
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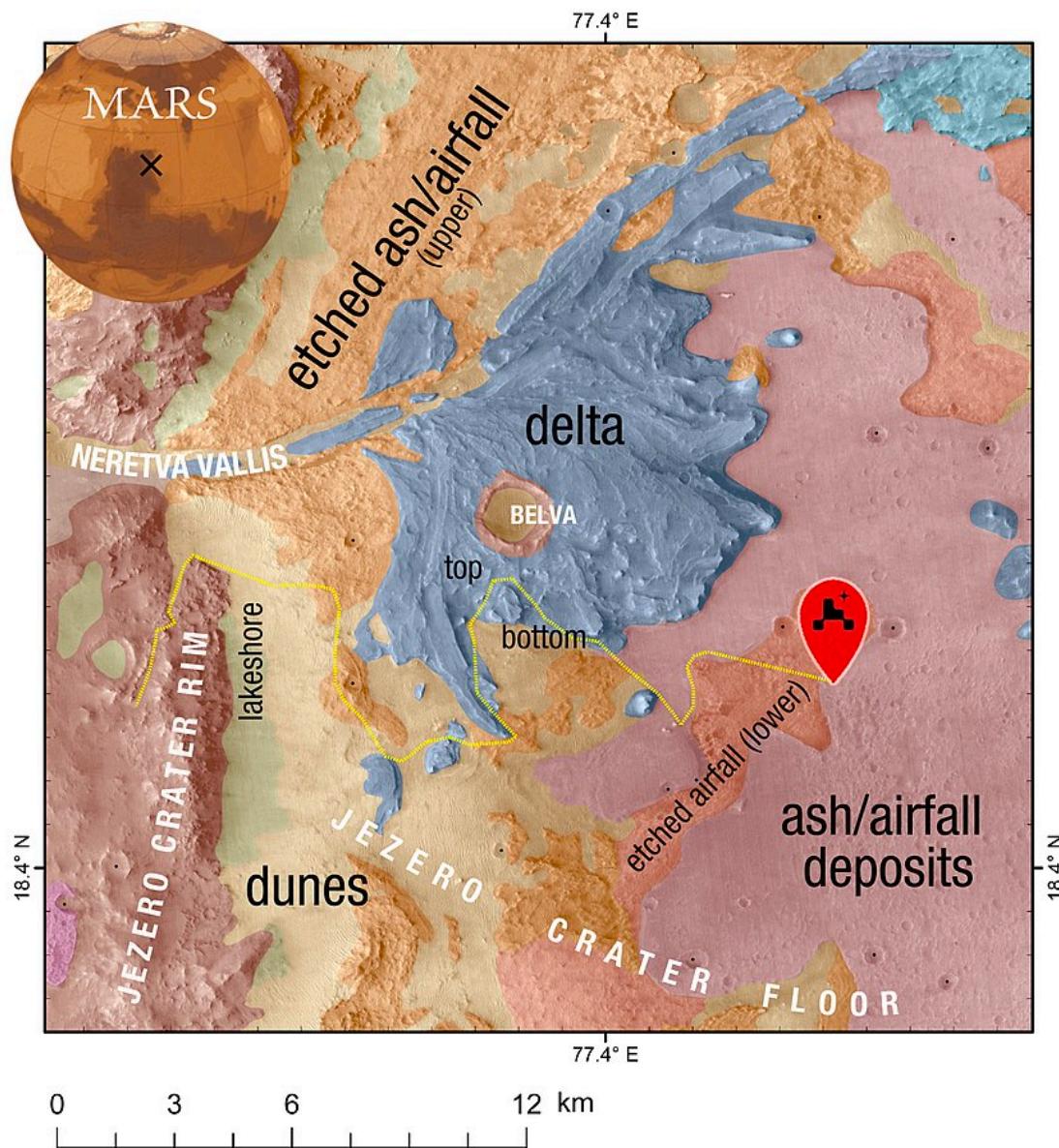
Place : Earth > France > Marseille
Date : 18th May, 2012
Camera : EOS 400D, 18-200mm
Damia Bouic

S u n

Place : Mars > Elysium Planitia > Gale Crater
Date : 15th April, 2015
Camera : Mastcam 34
NASA/JPL-Caltech/MSSS/Damia Bouic

- Landing zone: Jezero Crater
- Probably had a lake in it 3.5 to 3.9 billion years ago.
- Note the river valley coming from the left, through the crater wall, and the sediment fan. The landing site is about 5 km from the edge of the fan.



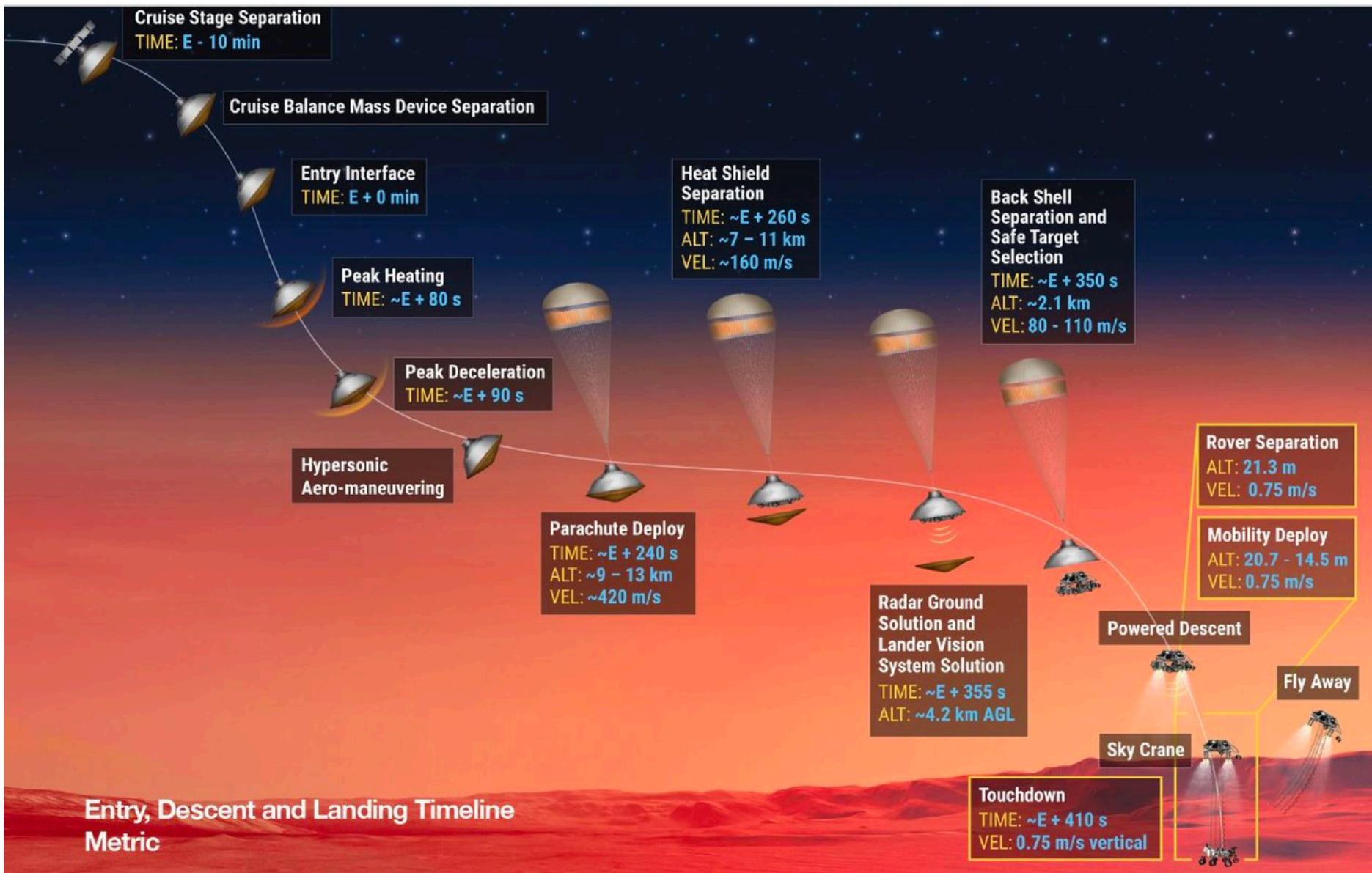


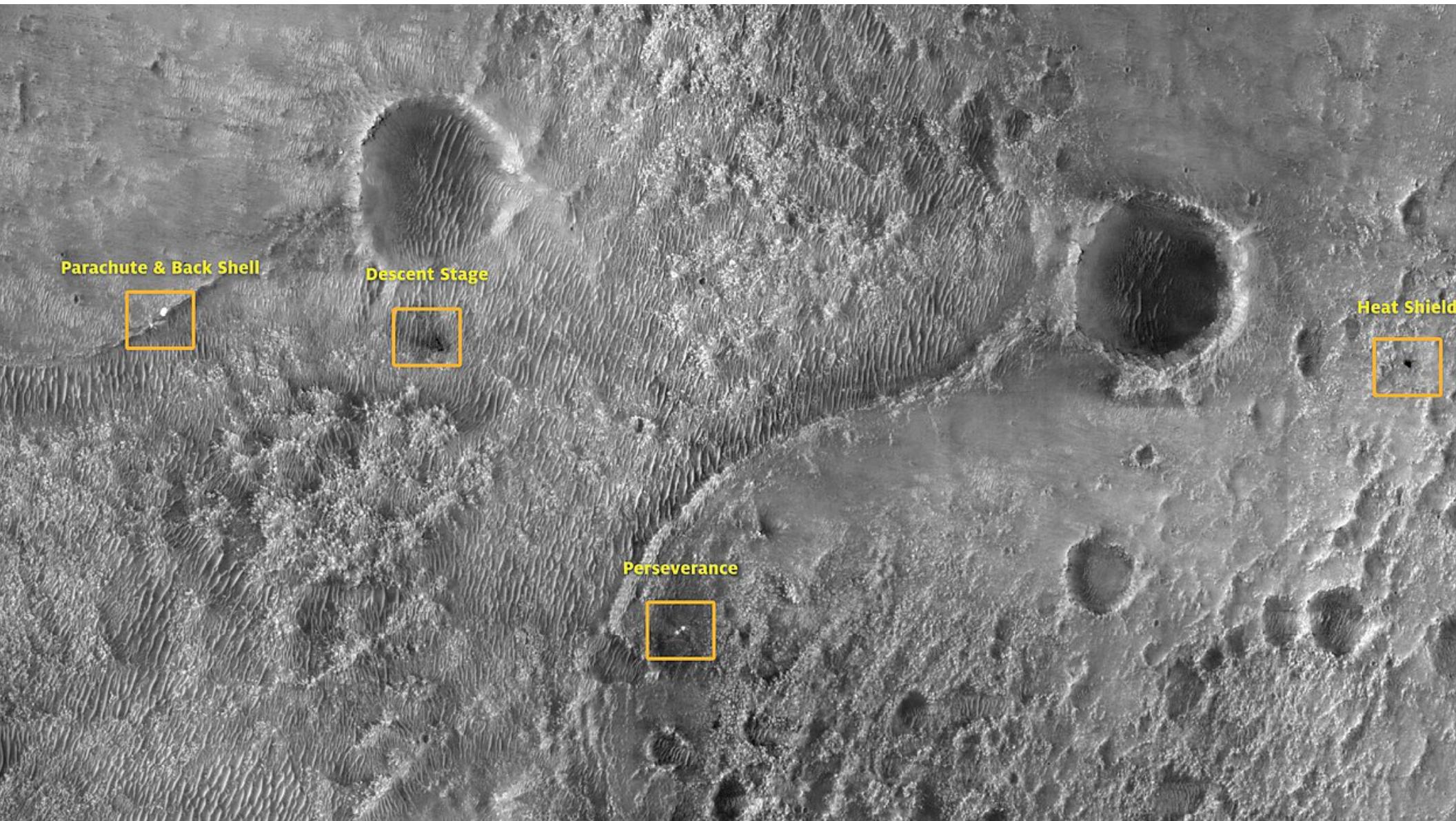
LEGEND

- Dunes (Aeolian Transverse Ridges)
- Neretva lacustrine deltaic fan deposit 3.8-3.4 Ga
- Volcanic ash or aeolian airfall deposit Predates deltas. Volcanic flow?
- Etched volcanic ash or aeolian airfall deposit (lower)
- Etched volcanic ash or aeolian airfall deposit (upper) with yardangs
- Mass wasting deposits
- Impact crater rim
- Perserverance potential traverse
- Perserverance landing site

Landing on Mars is hard.

- There's enough atmosphere to burn up your spacecraft, so you need a heat shield.
- But not enough atmosphere to slow it down to subsonic speeds.
- So you need a supersonic parachute (!!?!). But there's not enough air for a soft touchdown even with a parachute.
- So you also need a rocket for the soft landing.
- Sky crane to lower the rover onto its wheels, and then the descent module flies away and crashes elsewhere.
- “Seven minutes of terror” — All autonomous as Mars is 11 light-min away.

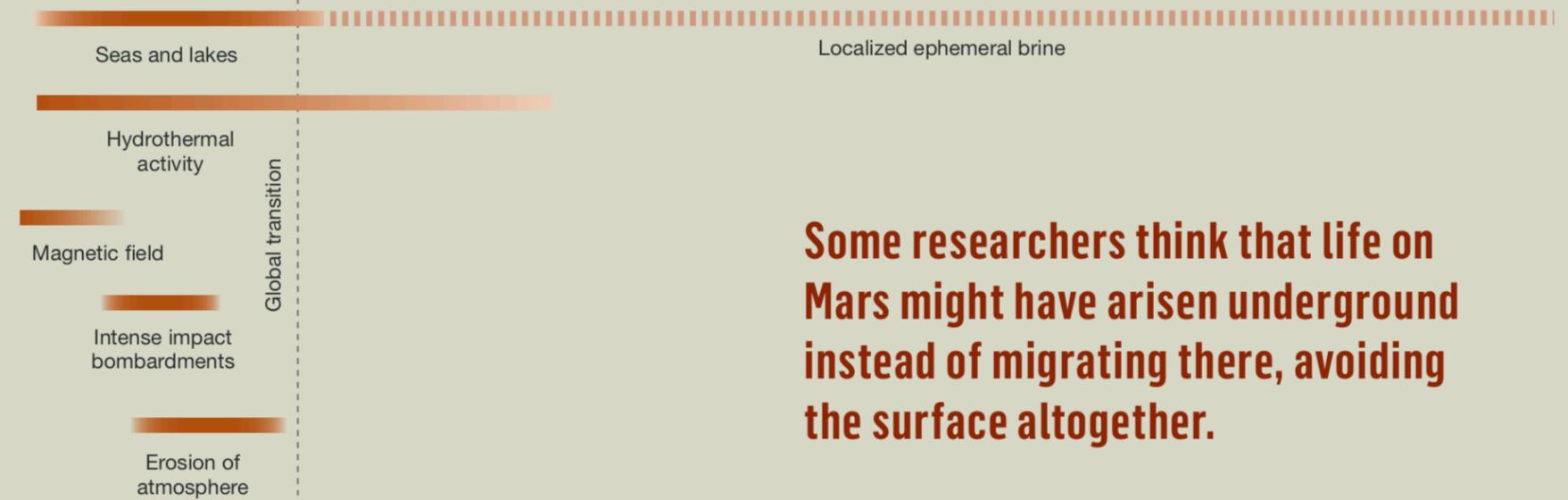




Earth



Mars



Some researchers think that life on Mars might have arisen underground instead of migrating there, avoiding the surface altogether.

▼ **GEOLOGICAL TIMELINE** When life arose on Earth, Mars also had seas and lakes. By the time photosynthetic life had taken over and transformed Earth's atmosphere, however, Mars's surface was a wasteland.

- Conditions on Mars for the first billion years or so were much like on Earth.
- Liquid core means global magnetic field; probably solidified about 3.5 bn years ago.
- Atmosphere was abraded away by the solar wind after the magnetic field collapsed.
- Surface water either froze or evaporated.
- But the rocks remember.
- Places like Jezero Crater seem good candidates to find evidence of past conditions that might have harbored life.

Next time:

- A few interesting things about Venus: New spacecraft missions selected, strange things in the atmosphere.
- Jupiter & moons: The Juno mission.
- Asteroids, and what happens when they hit planets.
- The Sun, and other stars.