

SAMPLING MARS

THE AUDACIOUS PLAN TO COLLECT RED-PLANET ROCKS.

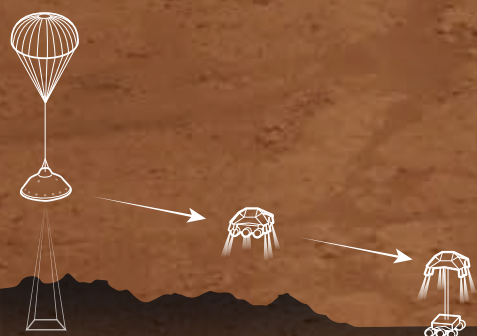
BY ALEXANDRA WITZE
DESIGN BY JASIEK KRZYSZTOFIAK

In 2020, NASA plans to send a rover to Mars to collect and store tubes of rock and dirt. If it succeeds, it will be the first step in bringing carefully documented Martian samples back to Earth for study. Engineers are now designing the robotic system to gather the samples — and they have to make it excruciatingly clean, so as not to contaminate any possible traces of Martian life.

LANDING

NEW LANDING TECHNIQUE

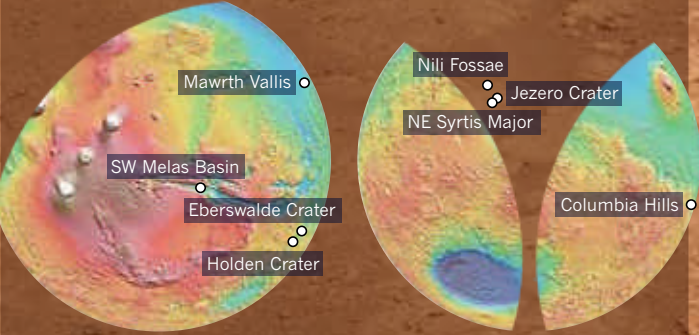
When it reaches Mars, the mission will use an updated version of the entry, descent and landing sequence used by the Curiosity probe in 2012. The new method, known as 'terrain relative navigation', allows the spacecraft to land closer to its area of interest because it can divert from dangerous situations in the last moments before landing, if necessary.



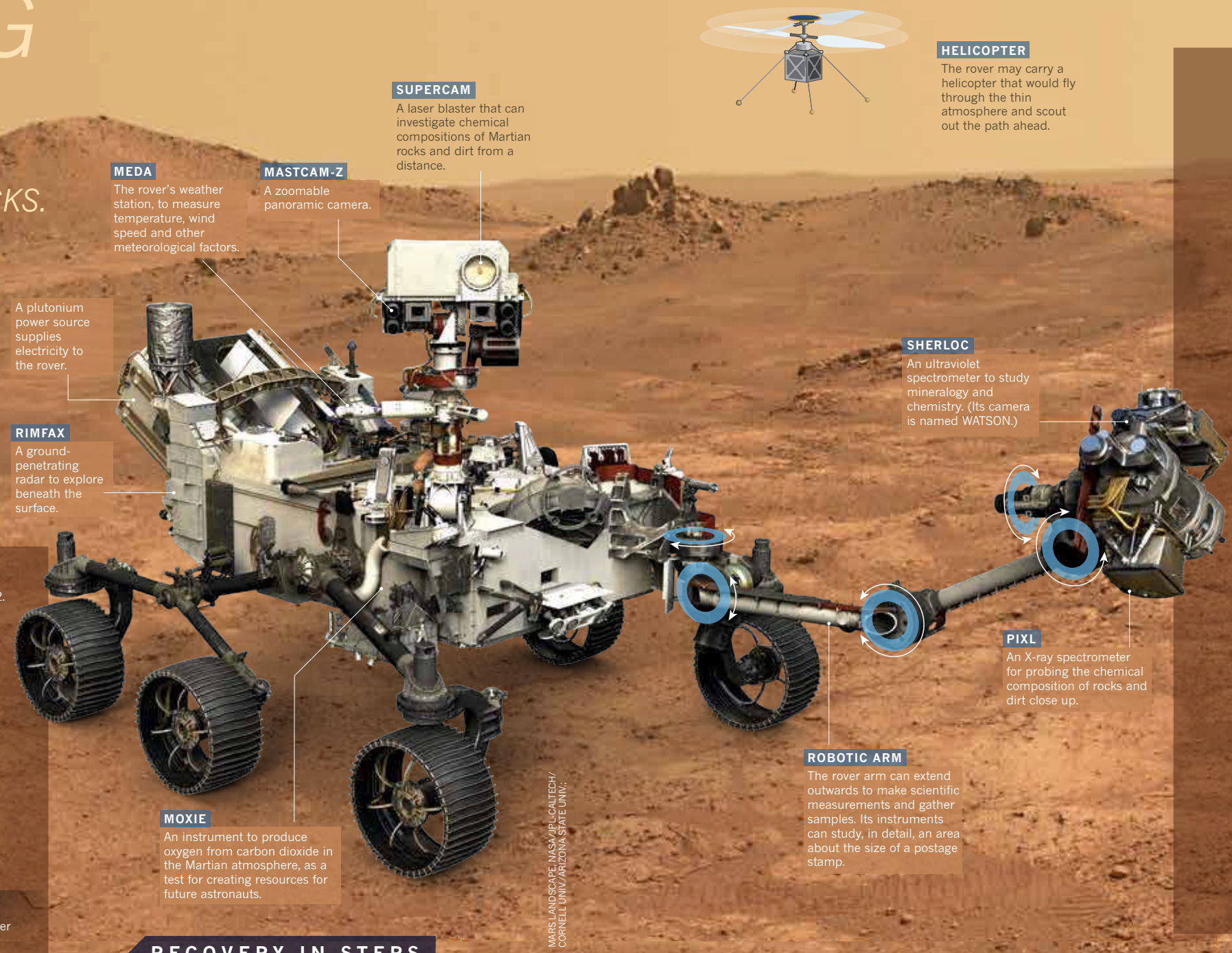
- 1 Photograph landing area and compare to map.
- 2 Divert to avoid cliffs and other problems.
- 3 Hover above surface and lower rover.

POTENTIAL LANDING SITES

Eight landing sites are being considered for the 2020 rover. Where it goes will dramatically shape the future of Mars science.



Mawrth Vallis
SW Melas Basin
Eberswalde Crater
Holden Crater
Nili Fossae
Jezero Crater
NE Syrtis Major
Columbia Hills



HELICOPTER
The rover may carry a helicopter that would fly through the thin atmosphere and scout out the path ahead.

SUPERCAM
A laser blaster that can investigate chemical compositions of Martian rocks and dirt from a distance.

MASTCAM-Z
A zoomable panoramic camera.

MEDA
The rover's weather station, to measure temperature, wind speed and other meteorological factors.

RIMFAX
A ground-penetrating radar to explore beneath the surface.

SHERLOC
An ultraviolet spectrometer to study mineralogy and chemistry. (Its camera is named WATSON.)

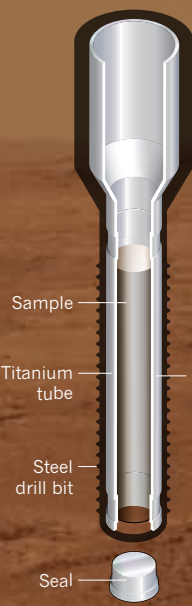
PIXL
An X-ray spectrometer for probing the chemical composition of rocks and dirt close up.

ROBOTIC ARM
The rover arm can extend outwards to make scientific measurements and gather samples. Its instruments can study, in detail, an area about the size of a postage stamp.

MOXIE
An instrument to produce oxygen from carbon dioxide in the Martian atmosphere, as a test for creating resources for future astronauts.

MARS LANDSCAPE: NASA/JPL-CALTECH/CORNELL UNIV./ARIZONA STATE UNIV.

SAMPLING AND CACHING



Sample
Titanium tube
Steel drill bit
Seal

Sample tubes can hold about 10 cubic centimetres of material.


43 sample tubes carried aboard the rover

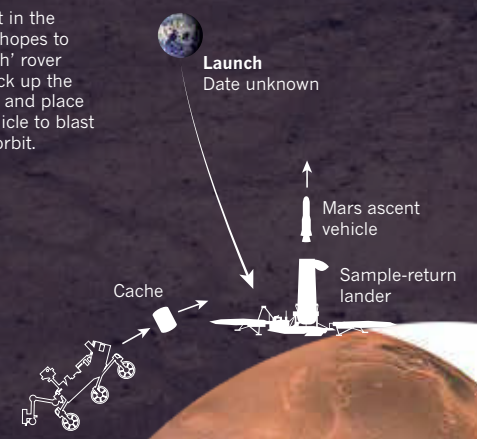
37 filled with rock/dirt sample, or atmospheric contamination as a 'witness tube'

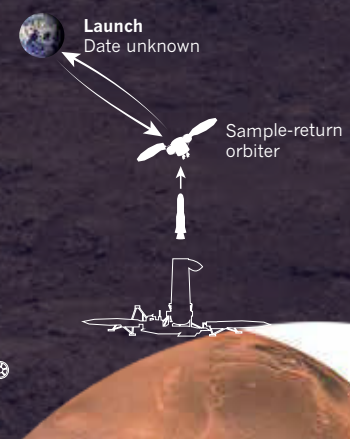
Witness tubes

6 spares

RECOVERY IN STEPS

- 1** The 2020 rover is only the first stage in bringing Martian rocks to Earth. After collecting samples and storing them in sealed tubes, the vehicle will set them on the planet's surface, in one or more cache spots.


Earth
Launch
July–August 2020
Arrive
February 2021
Caching rover
Mars
- 2** At some point in the future, NASA hopes to launch a 'fetch' rover that would pick up the sample tubes and place them in a vehicle to blast into Martian orbit.


Launch
Date unknown
Cache
Mars ascent vehicle
Sample-return lander
- 3** Once in orbit, the vehicle would rendezvous with another craft that would carry the samples to Earth. This could be an extension of the fetch mission or a separate third one.


Launch
Date unknown
Sample-return orbiter

LAND ROVER: NASA/JPL; STEPS: NASA/JPL-CALTECH