Perseverance Mars Rover to acquire first sample

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A light-colored "paver stone" like the ones seen in this mosaic will be the likely target for first sampling by the Perseverance rover. The image was taken on July 8, 2021 in the "Cratered Floor Fractured Rough" geologic unit at Jezero Crater. Credit: NASA/JPL-Caltech/ASU/MSSS

NASA is making final preparations for its Perseverance Mars rover to collect its first-ever sample of Martian rock, which future planned missions will transport to Earth. The six-wheeled geologist is searching for a scientifically interesting target in a part of Jezero Crater called the "Cratered Floor Fractured Rough."

This important mission milestone is expected to begin within the next two weeks. Perseverance landed in Jezero Crater on Feb. 18, and NASA kicked off the rover mission's science phase June 1, exploring a 1.5-square-mile (4-square-kilometer) patch of crater floor that may contain Jezero's deepest and most ancient layers of exposed bedrock.

"When Neil Armstrong took the first sample from the Sea of Tranquility 52 years ago, he began a process that would rewrite what humanity knew about the Moon," said Thomas Zurbuchen, associate administrator for science at NASA Headquarters. "I have every expectation that Perseverance's first sample from Jezero Crater, and those that come after, will do the same for Mars. We are on the threshold of a new era of planetary science and discovery."

It took Armstrong 3 minutes and 35 seconds to collect that first Moon sample. Perseverance will require about 11 days to complete its first sampling, as it must receive its instructions from hundreds of millions of miles away while relying on the most complex and capable, as well as the cleanest, mechanism ever to be sent into space—the Sampling and Caching System.

Precision instruments working together

The sampling sequence begins with the rover placing everything necessary for sampling within reach of its 7-foot-long (2-meter-long) robotic arm. It will then perform an imagery survey, so NASA's science team can determine the exact location for taking the first sample and a separate target site in the same area for "proximity science."

"The idea is to get valuable data on the rock we are about to sample by finding its geologic twin and performing detailed in-situ analysis," said science campaign co-lead Vivian Sun, from NASA's Jet Propulsion Laboratory in Southern California. "On the geologic double, first we use

an abrading bit to scrape off the top layers of rock and dust to expose fresh, unweathered surfaces, blow it clean with our Gas Dust Removal Tool, and then get up close and personal with our turret-mounted proximity science instruments SHERLOC, PIXL, and WATSON."

SHERLOC (Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals), PIXL (Planetary Instrument for X-ray Lithochemistry), and the WATSON (Wide Angle Topographic Sensor for Operations and eNgineering) camera will provide mineral and chemical analysis of the abraded target.

Perseverance's SuperCam and Mastcam-Z instruments, both located on the rover's mast, will also participate. While SuperCam fires its laser at the abraded surface, spectroscopically measuring the resulting plume and collecting other data, Mastcam-Z will capture high-resolution imagery.

Working together, these five instruments will enable unprecedented analysis of geological materials at the worksite.

"After our pre-coring science is complete, we will limit rover tasks for a sol, or a Martian day," said Sun. "This will allow the rover to fully charge its battery for the events of the following day."

Sampling day kicks off with the sample-handling arm within the Adaptive Caching Assembly retrieving a sample tube, heating it, and then inserting it into a coring bit. A device called the bit carousel transports the tube and bit to a rotary-percussive drill on Perseverance's robotic arm, which will then drill the untouched geologic "twin" of the rock studied the previous sol, filling the tube with a core sample roughly the size of a piece of chalk.

Perseverance's arm will then move the bit-and-tube combination back into bit carousel, which will transfer it back into the Adaptive Caching

Assembly, where the sample will be measured for volume, photographed, hermetically sealed, and stored. The next time the sample tube contents are seen, they will be in a clean room facility on Earth, for analysis using scientific instruments much too large to send to Mars.

"Not every sample Perseverance is collecting will be done in the quest for ancient life, and we don't expect this first sample to provide definitive proof one way or the other," said Perseverance project scientist Ken Farley, of Caltech. "While the rocks located in this geologic unit are not great time capsules for organics, we believe they have been around since the formation of Jezero Crater and incredibly valuable to fill gaps in our geologic understanding of this region—things we'll desperately need to know if we find life once existed on Mars."

More information: To learn more about Perseverance, visit: nasa.gov/perseverance and mars.nasa.gov/mars2020/

Provided by NASA

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