

NASA's Europa Clipper snaps infrared image of Mars, thanks to ASU instrument

By Kim Baptista, ASU News
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The Mars flyby wasn't just a scenic detour.

As [Europa Clipper](#) closed in for its closest approach at just 550 miles above the Red Planet on March 1, it took advantage of the opportunity 24 hours earlier — from about 1 million miles away — to test and calibrate one of its vital instruments: the [Europa Thermal Emission Imaging System](#), or E-THEMIS.

E-THEMIS is designed to detect temperature variations on Europa's icy surface. These measurements will help scientists pinpoint active areas, understand the moon's geology and determine where a global subsurface ocean might lie closest to the surface — an important key to evaluating Europa's potential to support life.

"We want to measure the temperature of those features," said Arizona State University's [Phil Christensen](#), a Regents Professor in the [School of Earth and Space Exploration](#) and principal investigator of [E-THEMIS](#).

"If Europa is a really active place, those fractures, where the ocean comes close to the surface, will be warmer than the surrounding ice. Or if water erupted onto the surface hundreds to thousands of years ago, then those surfaces could still be relatively warm.

Testing, testing

Mars provided a perfect test case.

During the flyby, E-THEMIS collected more than 1,000 infrared images over 18 minutes — one every second — which were then downlinked to Earth beginning on May 5.

The images, which are enhanced from the grayscale pictures with familiar shading or color cues (bright or reds for warmth; dark or blues for cold), will be cross-checked with decades of existing

Mars observations to confirm E-THEMIS is performing with precision.

E-THEMIS follows in the footsteps of its predecessor, [THEMIS](#), aboard [NASA's Mars Odyssey](#), also developed by ASU and in operation since 2001. To bolster the test, Odyssey's THEMIS collected its own Mars imagery during Europa Clipper's flyby, providing a rare opportunity to compare real-time measurements from both instruments: a rigorous validation of E-THEMIS' calibration.

Beyond infrared imaging, the flyby also allowed Europa Clipper to test other critical systems. Its radar antennas, far too large to be tested in full on Earth, operated together for the first time in space. Preliminary data shows everything is functioning as expected.

The team also verified the spacecraft's ability to conduct radio science — a technique it will use at Europa to send signals through Mars' gravitational field back to Earth.

ASU's key role

(Video: <https://vimeo.com/1083149297?share=copy>)

ASU scientists and students are playing a vital role in NASA's Europa Clipper mission and will help to decode the secrets of one of the solar system's most intriguing moons.

[Everett Shock](#), a professor at ASU's School of Earth and Space Exploration and the [School of Molecular Sciences](#), along with [Mikhail Zolotov](#), a research professor also in the School of Earth and Space Exploration, are co-investigators on [MASPEX](#) — the MAss SPectrometer for Planetary EXploration/Europa — which is tasked with analyzing Europa's thin atmosphere. The professors will then leverage their expertise to decode the moon's chemistry, searching for potential signs of habitability.

Zolotov is also a co-investigator behind [SUDA](#) (SURface Dust Mass Analyzer), which will work in tandem with MASPEX to sample Europa's wispy atmosphere, sniffing out plume emissions and capturing tiny grains of ice and minerals hurled into space from the moon's surface.

"In order to assess the habitability of Europa, we will need to gather information about the composition of surface materials and understand their relations with putative water oceans," explains Zolotov, who is also a co-investigator on the Radar for Europa Assessment and Sounding: Ocean to Near-surface (REASON).

Shock adds that the work won't stop once the data is collected.

"We anticipate lots of data, but understanding what it means for Europa's potential to support life will take more — including lab experiments, advanced calculations and theoretical modeling," he says. "That's where our strengths in geochemistry, biochemistry and planetary science at ASU really come into play."

The mission

Launched on October 14, 2024, from Kennedy Space Center aboard a SpaceX Falcon Heavy, Europa Clipper is on a 1.8-billion-mile journey to Jupiter. Its next gravity assist will come from Earth in 2026, helping it arrive in the Jupiter system by 2030.

Once there, the mission will begin a series of 49 flybys of Europa, mapping its surface and subsurface in detail. ASU's E-THEMIS will be central to that effort, examining Europa's temperature to provide insight as scientists seek to better understand the astrobiological potential for habitable worlds beyond our planet.

More about Europa Clipper

Europa Clipper's three main science objectives are to determine the thickness of the moon's icy shell and its interactions with the ocean below, to investigate its composition and to characterize its geology. The mission's detailed exploration of Europa will help scientists better understand the astrobiological potential for habitable worlds beyond our planet.

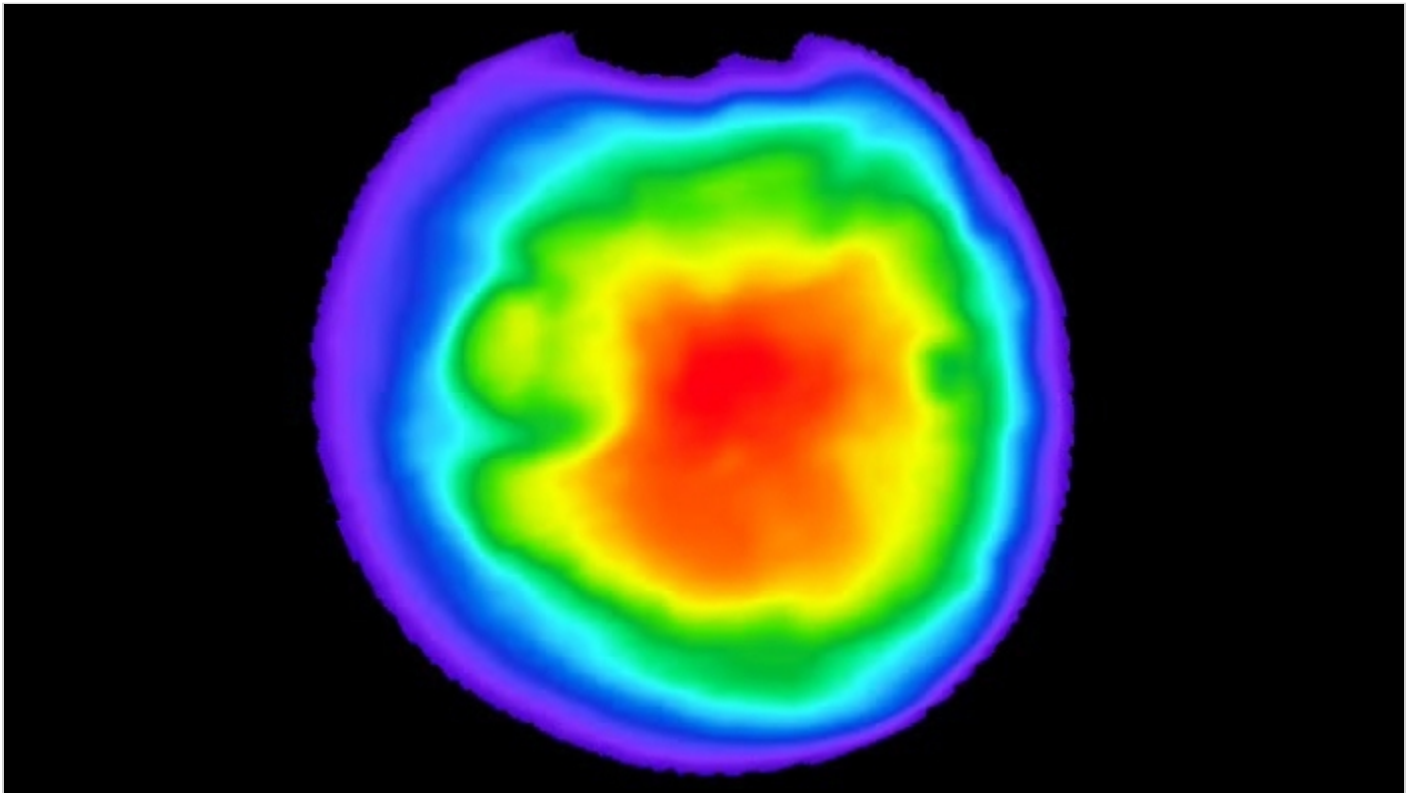
Managed by Caltech in Pasadena, California, [JPL](#) leads the development of the Europa Clipper mission in partnership with the Johns Hopkins Applied Physics Laboratory in Laurel, Maryland, for NASA's Science Mission Directorate in Washington.

APL designed the main spacecraft body in collaboration with JPL and NASA's Goddard Space Flight Center in Greenbelt, Maryland; NASA's Marshall Space Flight Center in Huntsville, Alabama; and Langley Research Center in Hampton, Virginia.

The Planetary Missions Program Office at Marshall executes program management of the Europa Clipper mission. NASA's Launch Services Program, based at Kennedy, managed the launch service for the Europa Clipper spacecraft.

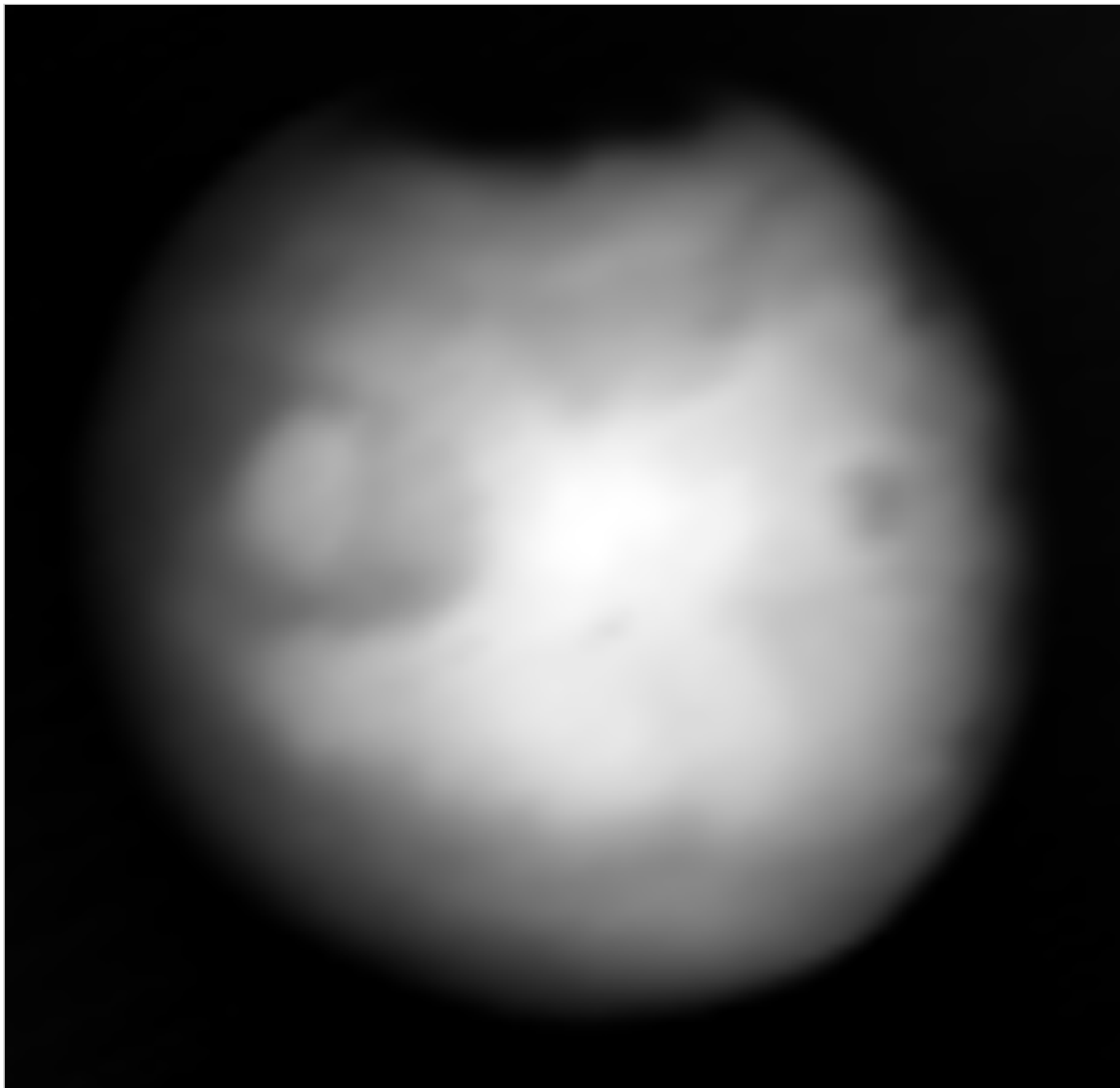
This story originally appeared on [ASU News](#).

Main image



This picture of Mars is a colorized composite of several images captured by Europa Clipper's thermal imager. Warm colors represent relatively warm temperatures; red areas are about 32 degrees Fahrenheit (0 degrees Celsius), and purple regions are about minus 190 F (minus 125 C). Image by NASA/JPL-Caltech/ASU

Text image(s)



This picture of Mars is a composite of several images captured by Europa Clipper's thermal imager on March 1 from 1 million miles away from the planet. Bright regions are relatively warm, with temperatures of about 32 degrees Fahrenheit (0 degrees Celsius). Darker areas are colder. The darkest region at the top is the northern polar cap and is about minus 190 F (minus 125 C). Image by NASA/JPL-Caltech/ASU