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1. Hitchhiking to Mars

Could some of the hardiest bacteria on Earth hitchhike on a **Journey to Mars** and survive after landing in a new world? NASA researchers intend to find out.

A helium-filled scientific balloon will soon carry bacteria to the edge of space—Earth’s stratosphere—exposing them to conditions similar to those found on the surface of Mars. NASA researchers will measure how long the bacteria can endure up there, and they also will study the biological underpinnings of bacterial survival in harsh conditions.

Earth’s stratosphere is an extreme environment. Situated above 99 percent of Earth’s protective atmosphere, conditions are dry, cold, and bathed with intense ultraviolet solar radiation. The air pressure is so low it’s nearly a vacuum. For these reasons, Earth’s stratosphere is a great stand-in for the surface of Mars.

“If we want to discover life on other planets we need to know if we are introducing Earth life as we explore,” said David J. Smith, scientist in the Space Biosciences Division at [NASA’s Ames Research Center](https://nasa.gov), Moffett Field, California, and principal investigator for the study. “There are terrestrial microorganisms that can survive space-like conditions. We know some of these same microorganisms are onboard robotic spacecraft so we need to be able to predict what will happen when they get to Mars.”

A specialized hardware system that will be used for the study, Exposing Microorganisms in the Stratosphere (E-MIST), was developed at NASA’s Kennedy Space Center in Florida. The E-MIST system was **successfully**
flight tested during a five hour balloon flight in 2014. A report on the test flight was published in the December 2014 issue of Gravitational And Space Research.

Following this successful validation of the E-MIST system, the first full science mission using the E-MIST system is planned to launch from NASA's Columbia Scientific Balloon Facility in Fort Sumner, New Mexico on September 26. During this mission, similar to the 2014 test flight, the balloon will ascend to altitudes upward of 120,000 feet.

“This weekend’s flight will be a long duration float in the stratosphere” said Smith. With the extended mission time, the researchers expect to expose the bacteria to the Mars analog environmental conditions for separate intervals of six, 12, 18 and 24 hours. “I suspect the bacteria will survive, but we just don’t know until we fly them up there and take a look afterwards in our lab,” said Smith.

Before launch, NASA researchers will load bacteria samples into specialized containers that can be opened or closed during flight by the E-MIST system. Launching with closed containers will protect the bacteria from the elements during ascent to Earth’s stratosphere. Once the balloon reaches a target altitude, the containers that hold the samples of bacteria will open. At a series of specified time points, each container will close. To terminate the flight, an explosive charge will detonate, tearing a hole in the balloon. E-MIST and other science payloads attached to the balloon’s gondola will return to Earth under a parachute, where waiting researchers will recover biological samples for analysis.

The E-MIST hardware system was built with funding from Rocket University, a training program developed by Kennedy's Engineering and Technology Directorate and supported by the NASA Office of the Chief Engineer. The E-MIST 2015 science mission is supported by the Core Technical Capabilities Special Studies project at NASA's Kennedy Space Center in Florida; the NASA Balloon Program Office at NASA's Wallops Flight Facility, Wallops Island, Va.; and NASA's Space Biology Project at Ames.

Balloon launches are sensitive to local weather conditions and the launch time may vary. Whatever the exact time the balloon takes flight, “I’ll be watching online from my office, and so can anyone else with a computer,” said Smith. During the experiment the public can watch the progress of the flight unfold by following the links to Fort Sumner Operations from NASA's Columbia Scientific Balloon Facility website at: http://towerfts.csbf.nasa.gov/.

For more information about NASA’s scientific balloon program watch the video "B-Line to Space: The Scientific Ballooning Story."

Source: NASA
Around 37,000 citizen scientists combed through 430,000 images to help an international team of researchers to discover 29 new gravitational lens candidates through Space Warps, an online classification system which guides citizen scientists to become lens hunters.

Gravitational lens systems are massive galaxies that act like special lenses through their gravity, bending the light coming from a distant galaxy in the background and distorting its image. Dark matter around these massive galaxies also contributes to this lensing effect, and so studying these gravitational lenses gives scientists a way to study this exotic matter that emits no light.

Since gravitational lenses are rare, only about 500 of them have been discovered to date, and the universe is enormous, it made sense for researchers to call on an extra pair of eyes to help scour through the mountain of images taken from the Canada-France-Hawaii Telescope Legacy Survey (CFHTLS). Details of the discoveries will be published in Monthly Notices of the Royal Astronomical Society.

"Computer algorithms have been somewhat successful in identifying gravitational lenses, but they can miss lensed images that appear similar to other features commonly found in galaxies, for example the blue spiral arms of a spiral galaxy," said Anupreeta More, co-principal investigator of Space Warps and project researcher at the University of Tokyo's Kavli Institute for the Physics and Mathematics of the Universe.

"All that was needed was the ability to recognise patterns of shapes and colours," said citizen scientist and paper co-author Christine Macmillan from Scotland. "It was fascinating to look at galaxies so far away, and realize that there is another behind it, even further away, whose light gets distorted in an arc."
Not only did this project give the public a chance to make scientific discoveries, it also gave them a chance to develop as researchers themselves. "I benefited from this project with an increase of my knowledge and some experience on making models of lenses," said citizen scientist and paper co-author Claude Cornen from France.

More, and two other collaborators, Phil Marshall at the Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, and Aprajita Verma at the Department of Physics, University of Oxford, are co-principal investigators of Space Warps, which taps into the unique strength of humans in analysing visual information essential for finding gravitational lenses.

The team will now move onto studying some of the interesting gravitational lens candidates by observing them with telescopes to uncover some of the mysteries related to dark matter. They are keen to work together with more volunteers in the near future as they are preparing new images from other ongoing imaging surveys to discover many more lenses.

For more information, see SpaceWarps.

Source: Spaceref.com
For the first time in more than 30 years, you can witness a supermoon in combination with a lunar eclipse. Late on Sept. 27, 2015, in the U.S. and much of the world, a total lunar eclipse will mask the moon’s larger-than-life face.

Watch NASA’s live stream from 8:00 p.m. until at least 11:30 p.m. EDT broadcast from Marshall Space Flight Center in Huntsville, Ala., with a live feed from the Griffith Observatory, Los Angeles, Calif. Mitzi Adams, a NASA solar physicist at Marshall will discuss the eclipse and answer questions from Twitter. To ask a question, use #askNASA.

Throughout human history, lunar eclipses have been viewed with awe and sometimes fear. Today, we know that a total lunar eclipse happens when the full moon passes through the darkest part of Earth's shadow, the umbra.

Sunday’s supermoon eclipse will last 1 hour and 11 minutes, and will be visible to North and South America, Europe, Africa, and parts of West Asia and the eastern Pacific. Weather permitting, you can see the supermoon after nightfall, and the eclipse will cast it into shadow beginning at 8:11 p.m. EDT. The total eclipse starts at 10:11 p.m. EDT, peaking at 10:47 p.m. EDT.

The moon does not make its own light; it reflects light it receives from the sun. During a lunar eclipse, the moon appears less and less bright as sunlight is blocked by the Earth’s shadow. As totality approaches, sunlight reaches the moon indirectly and is refracted around the “edges” of Earth, through Earth’s atmosphere. Because of this, almost all colors except red are “filtered” out, and the eclipsed moon appears reddish or dark brown. This filtering is caused by particulates in our atmosphere; when there have been a lot of fires and/or volcanic eruptions, lunar eclipses will appear darker and redder. This eerie -- but harmless -- effect has earned the phenomenon the nickname “blood moon.”

The live feed from NASA’s Marshall Space Flight Center will offer views of the eclipse from not only the Griffith Observatory, but the Adler Planetarium in Chicago, Fernbank Observatory in Atlanta and other locations across the United States. The live feed is an alternative for those experiencing less-than-optimal weather or light-polluted night skies.

Learn more about eclipses and how NASA’s Lunar Reconnaissance Orbiter (LRO) will wait as Earth blots out the sun and the moon goes dark. LRO scientists embrace new possibilities, extending their scientific exploration to include eclipses and other events that can reveal more of the moon’s secrets.

If you miss this event, you’ll have to wait a while -- the next supermoon eclipse won’t occur until 2033.

Source: NASA
The Night Sky

Friday, September 25

Look far below the Moon this evening for 1st-magnitude Fomalhaut coming into view. Fomalhaut rises in late twilight. How soon can you spot it?

Algol should be at minimum brightness for a couple hours centered on 6:09 p.m. EDT (according to Algol’s recently updated schedule). It takes several additional hours to rebrighten.

Saturday, September 26

With the equinox past and fall under way, Deneb is taking over from Vega as the zenith star at nightfall (for skywatchers at mid-northern latitudes). Look straight up after the end of twilight.

Sunday, September 27 Total eclipse of the Moon! The eclipse happens for North America in the evening, South America later at night local time, and for Europe and much of Africa on the morning of Monday the 28th local time. Timetables, map, what to watch for. And see the September Sky & Telescope, page 26.

Is it cloudy? Are you on the other side of the world? We’ll webcast the lunar eclipse, with commentary by S&T editors and lunar scientists. Tune in! Starts at 9 p.m. Sunday evening EDT; 1:00 Sept. 28 UT (GMT). On a night when the Moon gets eclipsed, it’s always full.

Monday, September 28

The Moon, a day past full, rises in the east in twilight. When the stars come out, look high above it for the Great Square of Pegasus.

Tuesday, September 29

Vesta, the brightest asteroid, it at opposition. All week it remains magnitude 6.2, easy in binoculars, as it creeps through western Cetus. Use the finder charts in the September Sky & Telescope, pages 48–49.

Source: Sky & Telescope
ISS Sighting Opportunities

For Denver:

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Sighting information for other cities can be found at NASA’s [Satellite Sighting Information](https://www.nasa.gov/).  

**NASA-TV Highlights**  
*(all times Eastern Daylight Time)*

**Monday, September 28**

11 a.m., Departure of the “Kounotori” HTV-5 Cargo Craft from the ISS (Canadarm2 release of the HTV-5 is scheduled at 11:20 a.m. ET) (all channels)

11:30 a.m., NASA Science Update (all channels)

**Tuesday, September 29**

8 a.m., ISS Expedition 45 In-Flight Event for JAXA for the Kawakami Village Province in the Nagano Prefecture for JAXA with Flight Engineer Kimiya Yui of JAXA (starts at 8:15 a.m.) (all channels)

Watch NASA TV on the Net by going to the [NASA website](https://www.nasa.gov/).
Space Calendar

- Sep 25 - TW 1A/1B/1C CZ-11 Launch
- Sep 25 - Comet 207P/Hill Closest Approach To Earth (2.401 AU)
- Sep 25 - Apollo Asteroid 2015 SV6 Near-Earth Flyby (0.006 AU)
- Sep 25 - Asteroid 4099 Wiggins Closest Approach To Earth (1.532 AU)
- Sep 25 - Asteroid 42998 Malinafrank Closest Approach To Earth (1.908 AU)
- Sep 26 - Goddard Space Flight Center Open House, Greenbelt, Maryland
- Sep 26 - Comet C/2015 F2 (Polonia) At Opposition (1.686 AU)
- Sep 26 - Apollo Asteroid 2015 RU36 Near-Earth Flyby (0.038 AU)
- Sep 26 - Apollo Asteroid 153591 (2001 SN263) Closest Approach To Earth (1.534 AU)
- Sep 26 - 10th Anniversary (2005), Cassini, Hyperion Flyby
- Sep 27 - Aten Asteroid 2006 WV1 Near-Earth Flyby (0.085 AU)
- Sep 27 - Atira Asteroid 1998 DK36 Closest Approach To Earth (0.576 AU)
- Sep 27 - Asteroid 4464 Vulcan Closest Approach To Earth (0.845 AU)
- Sep 27 - Asteroid 4798 Mercator Closest Approach To Earth (1.271 AU)
- Sep 27 - Asteroid 1801 Titicaca Closest Approach To Earth (2.010 AU)
- Sep 27 - Plutino 2001 QF298 At Opposition (42.359 AU)
- Sep 27 - 190th Anniversary (1825), Honolulu Meteorite Fall in Hawaii
- Sep 28 - Total Lunar Eclipse
- Sep 28 - Cassini, Titan Flyby
- Sep 28 - HTV-5 Reenters Earth's Atmosphere
- Sep 28 - Comet 57P/du Toit-Neujmin-Delporte At Opposition (1.074 AU)
- Sep 28 - Comet 57P-A/du Toit-Neujmin-Delporte At Opposition (1.074 AU)
- Sep 28 - Comet 231P/LINEAR-NEAT At Opposition (4.015 AU)
- Sep 28 - Asteroid 3498 Belton Closest Approach To Earth (1.196 AU)
- Sep 28 - Asteroid 4238 Audrey Closest Approach To Earth (1.584 AU)
- Sep 28 - Phobos and Deimos Webcast: The Formation & Effects of Stickney Impact on Phobos
- Sep 28 - Paul Villard's 155th Birthday (1860)
- Sep 28 - Ismael Bullialdus’ 410th Birthday (1605)

Source: JPL Space Calendar

Ismaël Bullialdus
On the evening of Sept. 27, 2015, into the early morning of Sept. 28 EDT, operators of NASA’s Lunar Reconnaissance Orbiter (LRO) will wait as Earth blots out the sun and the moon goes dark. The flight operations team at NASA’s Goddard Space Flight Center in Greenbelt, Maryland, have seen LRO safely through three lunar eclipses in about a year and a half. Although it is certainly not an ordinary night, science operations planner Dawn Myers at Goddard said the team knows the routine.

“We have a method and it works well,” she said. “It’s always stressful during the approach of the eclipse, but we follow the same procedures every time and we haven’t had any trouble.”

Preparations begin months before the solar-powered spacecraft begins its journey into Earth’s shadow as scientists, engineers and the flight operations team meet to discuss what is possible.

Not every spacecraft can overcome the temperature drop and lack of sunlight associated with an eclipse. NASA’s Lunar Atmosphere and Dust Environment Explorer (LADEE) just barely survived one in April 2014, which was a “testament to its great engineering,” LRO deputy project scientist Noah Petro at Goddard said. LADEE scientists and engineers originally planned a 100-day mission during a period that would not include an eclipse.

LRO, by contrast, can withstand hours in the cold and dark. During its original mission to collect information about the lunar environment, the flight operations team shut down most of LRO’s systems to conserve battery
power as the lunar eclipse passed. Now, in its extended mission, LRO scientists embrace new possibilities, extending their scientific exploration to include eclipses and other events that can reveal more of the moon's secrets.

An instrument on LRO called Diviner is perfect for this purpose. As a radiometer, Diviner measures both the reflective energy off the surface of the moon and infrared emissions that indicate the temperature at the surface. By leaving this one instrument on during the eclipse, they could make valuable observations. But could they keep it on for the duration?

“Our power engineer looked at past eclipses and evaluated whether it would be feasible for us to leave an instrument on,” Myers said. “He told us if the voltage drops below a certain level, we would have to shut the instrument off, but that hasn't happened yet.”

Not only could they leave Diviner on, but also a star tracker and its associated heaters for improved navigation.

One by one by one, the instruments shut off, plunging the spacecraft into hibernation. From the operations facility at Goddard, science operations personnel take shifts over 24 hours to watch and monitor the spacecraft from the pre-heat period, all the way through recovery the next day when they slowly bring each instrument back to operational status. During the eclipse, lasting just over an hour, only Diviner keeps its eye on the moon, fulfilling a purpose totally outside the scope of its original design.

Petro said the science is worth the effort. As the moon, and by extension LRO, passes into Earth’s shadow, the temperature drops rapidly – nearly 280 degrees Fahrenheit (138 degrees Celsius), in minutes as the sunlight disappears.

“The rapid cooling of the surface during an eclipse gives us a view of how the top few centimeters cool differently than during a normal lunar night,” Petro said. “From this we learn about the size of particles at the surface.”

Still, LRO can only observe so much, moving in a narrow line across the moon's surface, never seeing all of it in one pass. With each eclipse, the spacecraft reveals more to eager scientists. This particular eclipse will be especially important as, for the first time, prior to the eclipse, LRO will be pass over the moon's surface at local noon time when it is nearly at its warmest. This means that LRO will be able to measure a dramatic drop in temperature resulting in a very unique set of measurements. Every eclipse feeds more data into the story, but so far Petro said the observations mainly fuel more questions.

Every bit of information scientists can collect from this mission is important. Petro said it may even help inform decisions about a potential lunar colony at a later date.

LRO was launched June 18, 2009, for what was to be a two-year mission. Now in its sixth year, the mission is funded through October 2016.

For more information about LRO, visit http://www.nasa.gov/lro.

Source: NASA
The Nile at Night

Explanation: NASA astronaut Scott Kelly, recently past the halfway mark of his one-year mission to the International Space Station, photographed the Nile River during a nighttime flyover on Sept. 22, 2015. Kelly (@StationCDRKelly) wrote, "Day 179. The #Nile at night is a beautiful sight for these sore eyes. Good night from @space_station! #YearInSpace."

Image Credit: NASA

Source: NASA Image of the Day