Space News Update
— February 14, 2014 —

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Researchers have determined the now-infamous Martian rock resembling a jelly doughnut, dubbed Pinnacle Island, is a piece of a larger rock broken and moved by the wheel of NASA's Mars Exploration Rover Opportunity in early January.

Only about 1.5 inches wide (4 centimeters), the white-rimmed, red-centered rock caused a stir last month when it appeared in an image the rover took Jan. 8 at a location where it was not present four days earlier.

More recent images show the original piece of rock struck by the rover's wheel, slightly uphill from where Pinnacle Island came to rest.

"Once we moved Opportunity a short distance, after inspecting Pinnacle Island, we could see directly uphill an overturned rock that has the same unusual appearance," said Opportunity Deputy Principal Investigator Ray Arvidson of Washington University in St. Louis. "We drove over it. We can see the track. That's where Pinnacle Island came from."

Examination of Pinnacle Island revealed high levels of elements such as manganese and sulfur, suggesting these water-soluble ingredients were concentrated in the rock by the action of water. "This may have happened just beneath the surface relatively recently," Arvidson said, "or it may have happened deeper below ground longer ago and then, by serendipity, erosion stripped away material above it and made it accessible to our wheels."

Now that the rover is finished inspecting this rock, the team plans to drive Opportunity south and uphill to investigate exposed rock layers on the slope.
Opportunity is approaching a boulder-studded ridge informally named the McClure-Beverlin Escarpment, in honor of engineers Jack Beverlin and Bill McClure. Beverlin and McClure were the first recipients of the NASA Medal of Exceptional Bravery for their actions on Feb. 14, 1969, to save NASA’s second successful Mars mission, Mariner 6, when the launch vehicle began to crumple on the launch pad from loss of pressure.

"Our team working on Opportunity's continuing mission of exploration and discovery realizes how indebted we are to the work of people who made the early missions to Mars possible, and in particular to the heroics of Bill McClure and Jack Beverlin," said rover team member James Rice of the Planetary Science Institute, Tucson, Ariz. "We felt this was really a fitting tribute to these brave men, especially with the 45th anniversary of their actions coming today."

Opportunity's work on the north-facing slope below the escarpment will give the vehicle an energy advantage by tilting its solar panels toward the winter sun. Feb. 14 is the winter solstice in Mars' southern hemisphere, which includes the region where Opportunity has been working since it landed in January 2004.

"We are now past the minimum solar-energy point of this Martian winter," said Opportunity Project Manager John Callas of NASA’s Jet Propulsion Laboratory in Pasadena, Calif. "We now can expect to have more energy available each week. What's more, recent winds removed some dust from the rover's solar array. So we have higher performance from the array than the previous two winters."

During Opportunity's decade on Mars, and the 2004-2010 career of its twin, Spirit, NASA's Mars Exploration Rover Project has yielded a range of findings proving wet environmental conditions on ancient Mars -- some very acidic, others milder and more conducive to supporting life.


You can follow the project on Twitter and on Facebook at http://twitter.com/MarsRovers and http://www.facebook.com/marsrovers.

Source: NASA
2. Prehistoric Cave Pigment to Shield ESA’s Solar Orbiter

A pigment once daubed onto prehistoric cave paintings is set to protect the ESA-NASA Solar Orbiter mission from the Sun’s close-up glare. Burnt bone charcoal will be applied to the spacecraft’s titanium heatshield using a novel technique.

Solar Orbiter, due for launch in 2017, will carry a portfolio of instruments to perform high-resolution imaging of our parent star from as close as 42 million km – a little more than a quarter of the distance to Earth.

Operating in direct view of the Sun, the mission must endure 13 times the intensity of terrestrial sunlight and temperatures rising as high as 520°C. “The main body of the spacecraft takes cover behind a multi-layered 3.1 m by 2.4 m heatshield,” explained Pierre Olivier, Solar Orbiter’s safety engineer. “And Solar Orbiter’s instruments will operate at the far end of ‘feed-through’ lines that run through the shield, some under protective covers of beryllium or glass.”

Back in 2010, during the ‘Phase-A’ planning stage, ESA’s materials specialists began checking that the mission was indeed achievable with current manufacturing methods and materials. “We soon identified a problem with the heatshield requirements,” said Andrew Norman, a materials technology specialist. “To go on absorbing sunlight, then convert it into infrared to radiate back out to space, its surface material needs to maintain constant ‘thermo-optical properties’ – keep the same colour despite years of exposure to extreme ultraviolet radiation. At the same time, the shield cannot shed material or outgas vapour, because of the risk of contaminating Solar Orbiter’s highly sensitive instruments. And it has to avoid any build-up of static charge in the solar wind because that might threaten a disruptive or even destructive discharge.”

The initial choice – carbon-fibre fabric – was ruled out. Instead the team began looking for the answer outside the space business.

They found it in the shape of Irish company Enbio and its CoBlast technique, originally developed to coat titanium medical implants. “The process works for reactive metals like titanium, aluminium and stainless steel, which possess a surface oxide layer,” commented John O’Donoghue, Managing Director of Enbio. “We spray the metal surface with abrasive material to grit-blast this layer off, but – as the CoBlast name suggests – we also include a second ‘dopant’ material possessing whatever characteristics are needed. This simultaneously takes the place of the oxide layer being stripped out. The big advantage is that the new layer ends up bonded, rather than only painted or stuck on. It effectively becomes part of the metal – when you handle metal you never worry about its surface coming off in your hands.”

The material Enbio will apply to the outermost titanium sheet of Solar Orbiter’s multi-layered heatshield is called ‘Solar Black’ – a type of black calcium phosphate processed from burnt bone charcoal.

Source: ESA
The 64th and final foundation for the MeerKAT telescope antenna was poured yesterday (Tuesday, February 11th, 2014) at South Africa's SKA site in the Karoo.

Close to 5,000 cubic meters of concrete and more than 570 tons of steel were used to construct the foundations over the last nine months.

MeerKAT is the South African precursor to the Square Kilometre Array (SKA) telescope, to be built in Africa and in Australia. The SKA Project is an international enterprise to build the largest radio telescope in the world.

"The completion of the foundations and the soon-to-be completed first antenna represents a major milestone on building of the MeerKAT which will become an integral part of the SKA project," says Derek Hanekom, South Africa's Minister of Science and Technology. "I am very pleased with the progress and the quality of the work that our scientists and engineers are delivering on this challenging assignment and wish them well with the enormous task ahead of meeting the tight schedule in the next two years."

"The foundations were constructed to stringent specifications to ensure that the antennas will be exceptionally stable," said Tracy Cheetham, general manager for infrastructure and site operations at SKA South Africa. "Even at wind gusts of up to 69 km/h scientists must be able to point the dishes at distant celestial objects in an exact manner, and the antennas must be able to survive wind speeds of up to 144 km/h."

To meet these stability requirements, each foundation consists of eight steel-reinforced concrete piles at depths of between 5 to 10 m, depending on the local soil conditions. A square slab of concrete (5.2 m x 5.2 m, and 1.25 m thick) rests on top of the piles to add further stability. The 32 "holding down" bolts are pre-assembled in a circle to form a steel ring cage, or so-called "bird's nest," into which the concrete is cast.
All other MeerKAT infrastructure should be complete by the end of March this year. "We are on the last leg now," said Cheetham, adding that finishing touches are underway in the Karoo Array Processing Building (KAPB) and the power facility. The KAPB, a specialized underground bunker protected from radio frequency interference, will house all the data processing racks and the power and back-up equipment required for MeerKAT.

The primary focus for the next two months will be on verifying that all infrastructure functions according to the required specifications. Testing involves cold and hot commissioning -- Cheetham explains: "During cold commissioning the power is connected without switching on the equipment. During hot commissioning the machines are turned on and tested for a period of time."

Cheetham also said the ducting for the fiber optic cable has been completed, so all that is left now is for the optic fiber contractor, Plessey, to pull through and connect the cable.

**MeerKAT facts & figures:**

- Each MeerKAT antenna will be 19.5 m high.
- Each reflector (or dish) will be 13.5 x 16 m.
- Each complete antenna (base, pedestal and dish) will weigh 42 tons.
- The configuration (placement) of the antennas is determined by the science objectives of the telescope:
  - 48 foundations are in the core area which is approximately 1 km in diameter;
  - The longest distance between any two antennas (the so-called baseline) is 8 km.
- MeerKAT will be the most sensitive radio telescope in the southern hemisphere until the SKA comes online. Once all 64 antennas are operational, the instrument will be sensitive enough to pick up a cell phone signal from Saturn!
- Leading radio astronomy teams around the globe have already signed up to use the instrument as soon as it is ready. The 64 MeerKAT antennas will later also become part of the much larger SKA telescope which is co-hosted between South Africa and Australia.

More photos and animations: [www.ska.ac.za/media/visuals.php](http://www.ska.ac.za/media/visuals.php)
Artist's impression of a single MeerKAT dish: [www.ska.ac.za/media/meerkat.php](http://www.ska.ac.za/media/meerkat.php)
Multimedia resources from the SKA Organisation:


Text, images, and video:

Source: [Spaceref.com](http://www.spaceref.com)
The Night Sky

Friday, February 14

- Full Moon (exactly full at 6:53 p.m. EST). Look for Regulus in Leo to the Moon's left during evening, as shown here. A February full Moon is never far from Regulus.
- Algol in Perseus should be at its minimum light, magnitude 3.4 instead of its usual 2.1, for a couple hours centered on about 10:30 p.m. EST (7:30 p.m. PST). Algol takes several additional hours to fade and to rebrighten.

Saturday, February 15

- This is the time of year when, soon after dark, skywatchers at mid-northern latitudes see bright Capella crossing near the zenith and Orion standing highest in the south. Orion's diagonal belt points lower left toward bright Sirius, and upper right more or less toward Aldebaran. Beyond Aldebaran lie the Pleiades.

Sunday, February 16

- The thick waning gibbous Moon rises in the east around the end of twilight. Look higher above it now for Regulus. Extending upper left from Regulus is the Sickle of Leo.

Monday, February 17

- Sirius now shines at its highest in the south around 8 or 9 p.m. Use binoculars to look for the dim open star cluster M41 straight below it by 4° (a little less than the width of a typical binocular's field of view).
- And with a moderate to large telescope on a night of good seeing, this is when to try to detect the white-dwarf companion of Sirius, now 10.2 arcseconds east of the bright primary. See last October's Sky & Telescope, page 30, for tips and tricks when attempting this challenging project.
ISS Sighting Opportunities

For Denver:

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

NASA-TV Highlights
(all times Eastern Daylight Time)

No Special Programming

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

- **Feb 14** - [Updated] TurkSat 4A Proton M-Briz M Launch
- **Feb 14** - Comet 107P/Wilson-Harrington Closest Approach To Earth (1.817 AU)
- **Feb 14** - Comet 111P/Helin-Roman-Crockett Closest Approach To Earth (2.874 AU)
- **Feb 14** - Comet P/2011 R3 (Novichok-Gerke) Closest Approach To Earth (3.623 AU)
- **Feb 14** - Asteroid 2 Pallas Occults TYC 6045-00751-1 (10.2 Magnitude Star)
- **Feb 14** - [Updated] Asteroid 2014 CG13 Near-Earth Flyby (0.077 AU)
- **Feb 14** - Asteroid 5430 Sokrates Closest Approach To Earth (1.553 AU)
- **Feb 14** - Asteroid 1198 Atlantis Closest Approach To Earth (1.960 AU)
- **Feb 14** - Asteroid 6469 Armstrong Closest Approach To Earth (1.668 AU)
- **Feb 14** - Comet 111P/Helin - Roman - Crockett Closest Approach To Earth (1.668 AU)
- **Feb 14** - Kuiper Belt Object 55565 (2002 AW197) At Opposition (44.996 AU)
- **Feb 15** - Mars Summer Solstice
- **Feb 15** - Comet 169P/NEAT Perihelion (0.608 AU)
- **Feb 15** - Comet 260P/McNaught At Opposition (3.284 AU)
- **Feb 15** - Asteroid 2014 CB13 Near-Earth Flyby (0.053 AU)
- **Feb 15** - Asteroid 2014 BQ43 Near-Earth Flyby (0.055 AU)
- **Feb 15** - Asteroid 132904 Notkin Closest Approach To Earth (3.547 AU)
- **Feb 15** - 1st Anniversary (2013), Chelyabinsk Fireball Over Russia
- **Feb 15** - 5th Anniversary (2009), Ash Creek Meteorite Fall (Hit Farm House in Texas)
- **Feb 15** - Galileo Galilei’s 450th Birthday (1564)
- **Feb 16** - Comet 266P/Christensen Closest Approach To Earth (1.590 AU)
- **Feb 16** - Comet 111P/Helin-Roman-Crockett At Opposition (2.875 AU)
- **Feb 16** - Asteroid 2 Pallas Occults TYC 5487-00216-1 (10.3 Magnitude Star)
- **Feb 16** - Asteroid 3533 Toyota Closest Approach To Earth (1.142 AU)
- **Feb 16** - Asteroid 23990 Springsteen Closest Approach To Earth (1.281 AU)
- **Feb 16** - Asteroid 3018 Godiva Closest Approach To Earth (1.779 AU)
- **Feb 16** - Asteroid 243097 Batavia Closest Approach To Earth (1.787 AU)
- **Feb 16** - Asteroid 6128 Lasorda Closest Approach To Earth (1.926 AU)
- **Feb 16** - Asteroid 1941 Wild Closest Approach To Earth (3.807 AU)
- **Feb 17** - Cassini, Orbital Trim Maneuver #372 (OTM-372)
- **Feb 17** - Comet 86P/Wild At Opposition (2.433 AU)
- **Feb 17** - Comet C/2013 P2 (PANSTARRS) Perihelion (2.835 AU)
- **Feb 17** - Comet P/2004 FY140 (LINEAR) Closest Approach To Earth (3.436 AU)
- **Feb 17** - Comet P/2011 N1 (ASH) At Opposition (4.235 AU)
- **Feb 17** - Comet C/2012 T6 (Kowalski) At Opposition (4.677 AU)
- **Feb 17** - Asteroid 3487 Edgeworth Closest Approach To Earth (2.071 AU)
- **Feb 17** - Asteroid 991 McDonald At Opposition (3.623 AU)

Source: JPL Space Calendar

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While we’re unsure about the status of chocolates and flowers in locations far beyond Earth, there certainly is no lack of hearts for us to look at to enjoy Valentine’s Day. If you look at enough geologic features or gas clouds, statistically some of them will take on shapes that we recognize (such as faces).

On Universe Today, they’ve collected some hearts on Mars and other places in the universe. Have they missed any? Share other astronomy hearts in the comments!

Source: Universe Today
Views of Sochi from Orbit

**Explanation:** This photo taken Feb. 10 from the International Space Station with a 600mm lens shows the Sochi Olympic Park. Fisht Stadium where the Opening Ceremonies were held on Feb. 7 is easily recognizable as the bright circular structure.

More images of Sochi from various orbiting platforms can be found at:

**Image Credit:** NASA

Source: Spaceflight Now