Galactic Observer

John J. McCarthy Observatory

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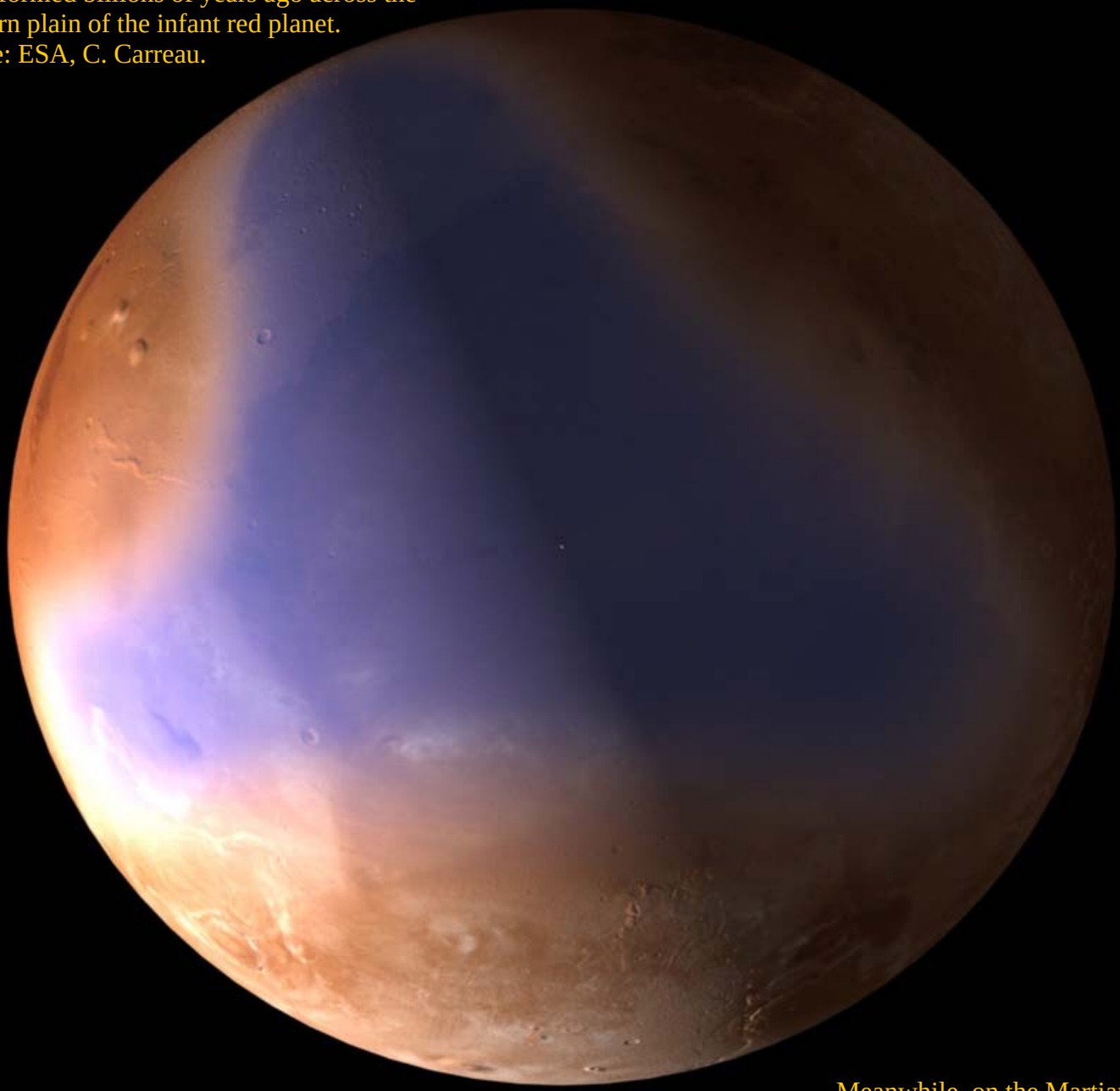
Sedimental Journey

An artist's rendering of radar images from the ESA Mars Express Orbiter paints an outline of a vast ocean formed billions of years ago across the northern plain of the infant red planet. Source: ESA, C. Carreau.



Meanwhile, on the Martian surface, NASA's Curiosity and Opportunity Rovers continue to probe the Martian landscape for ancient seas and rivers (see inside, pages 6-9).

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It is through their efforts that the McCarthy Observatory has established itself as a significant educational and recreational resource within the western Connecticut community.

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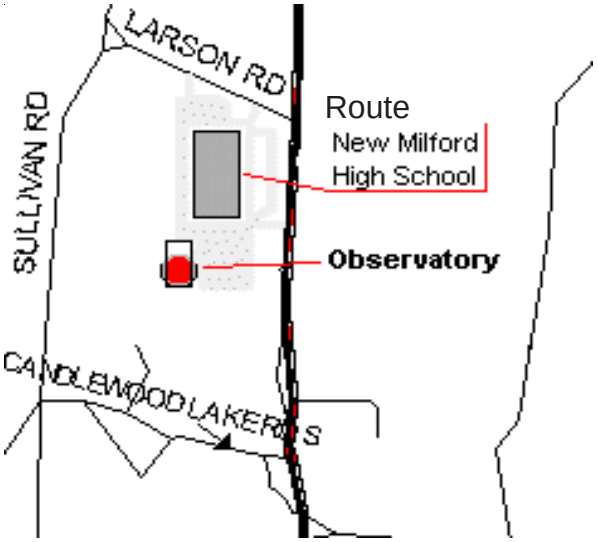

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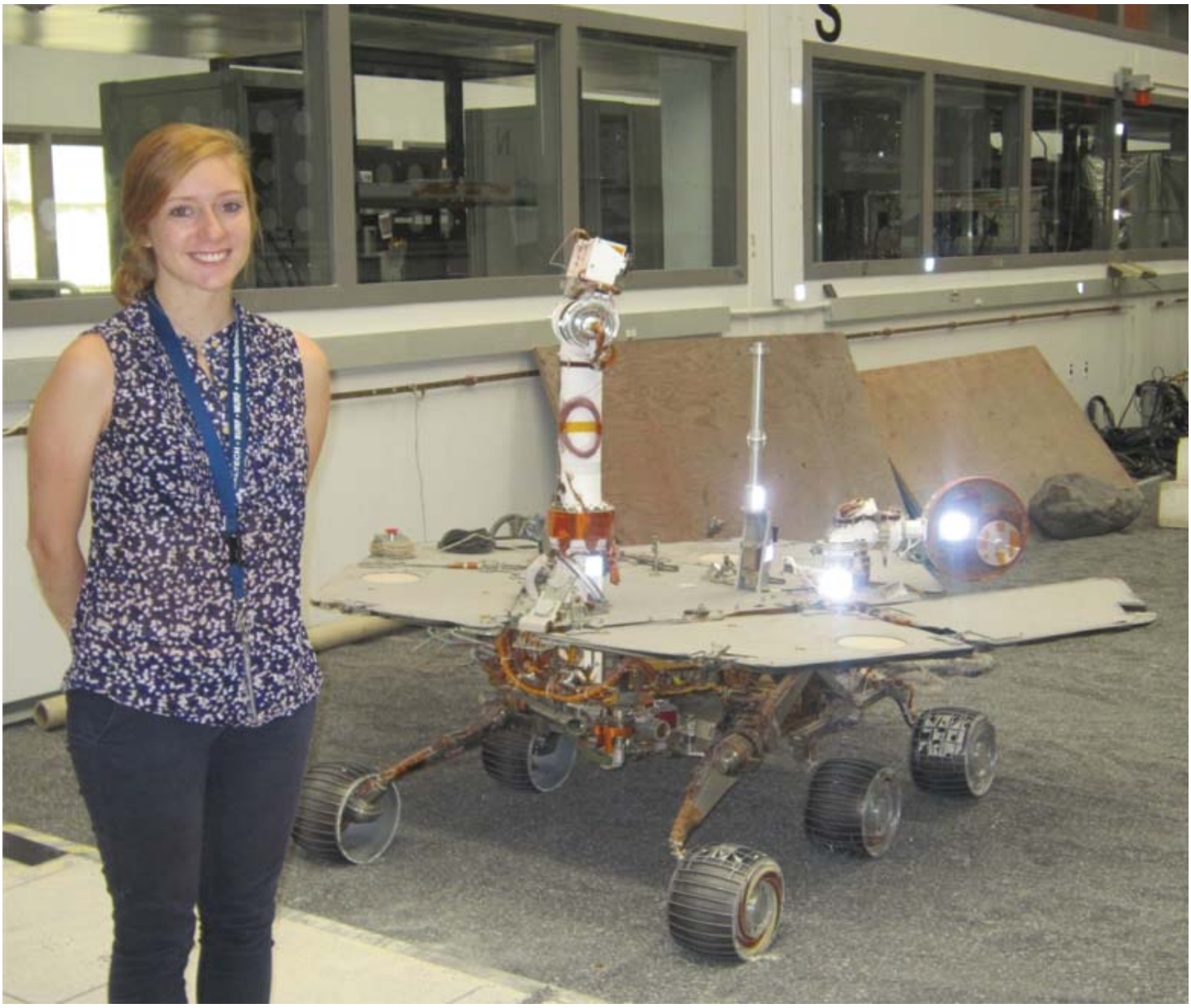
January Calendar and Space Exploration Almanac



Ms. Kyle Cloutier poses with an Earth-bound version of the Mars Exploration Rover at the Jet Propulsion Laboratory (JPL) in Pasadena, California. The rover is used by engineers at JPL to perfect proposed maneuvers and test software changes prior to uploading new commands to its twin, Opportunity, currently spending the winter on the rim of Endeavour Crater on Mars.

Opportunity landed on Mars on January 25, 2004 and has spent the last ten years exploring Meridiani Planum. The intrepid little rover has traveled over 24 miles between stops to explore several craters, rock outcroppings, boulder fields, and even several meteorites.

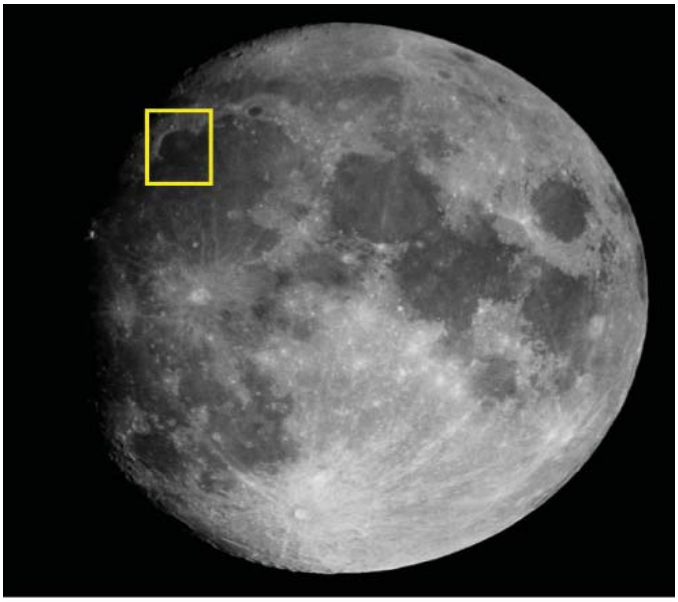
"Out the Window on Your Left"

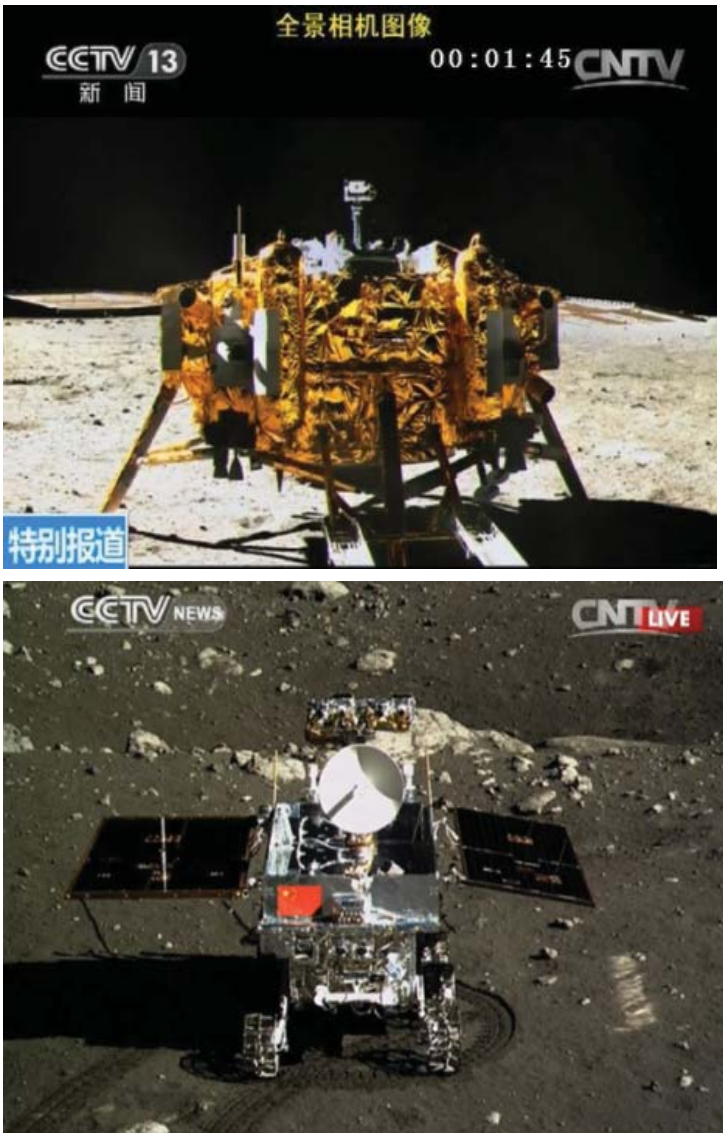
IT'S BEEN OVER 40 YEARS since we left the last footprint on the dusty lunar surface. Sadly, as a nation founded on exploration and the conquest of new frontiers, we appear to have lost our will to lead as a space-faring nation. But, what if the average citizen had the means to visit our only natural satellite; what would they see out the window of their spacecraft as they entered orbit around the Moon? This column may provide some thoughts to ponder when planning your visit (if only in your imagination).

On Saturday morning, December 14, 2013, China successfully soft-landed a spacecraft on the surface of the Moon. China joined the United States and former Soviet Union with the landing as the only nations that have accomplished such a feat (the Soviet Union's Luna 24 was the last mission, 37 years ago).

The Chinese spacecraft landed at 8:11:18 am EST, one-half hour earlier than anticipated and east of Sinus Iridum, the expected landing site (the actual landing site is identified by a yellow star in the photo on the following page). The lander used an autonomous navigation and obstacle avoidance system to find a relatively level area to set down. Coordinates for the landing site, provided by the Chinese, are 19.51° west and 44.12° north. The U.S. Lunar Reconnaissance Orbiter is scheduled to pass over the landing site on December 24th and 25th, and should be able to see the 2,600 pound (1,200 kg) octagonal-shaped Chang'e 3 lander.

Solar panels and a radioisotope thermoelectric generator provide power to the lander. Mounted on the lander is a near-ultraviolet telescope (detecting light that would be absorbed by the Earth's atmosphere). The telescope will be used to observe galaxies, binary stars, active galactic nuclei and bright stars. U.S. scientists will be able to use the telescope through an agreement with the International Lunar Observatory Association.

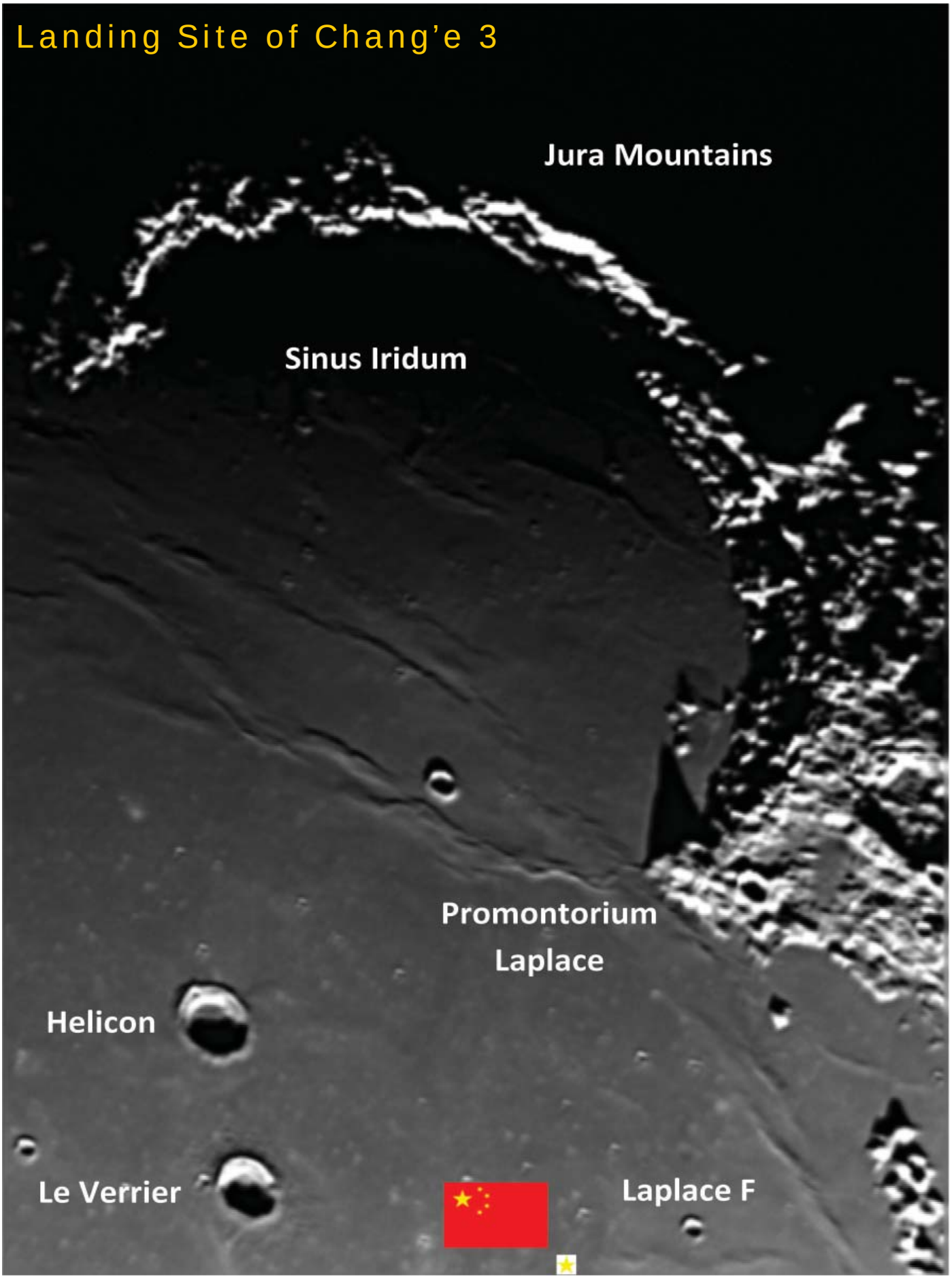




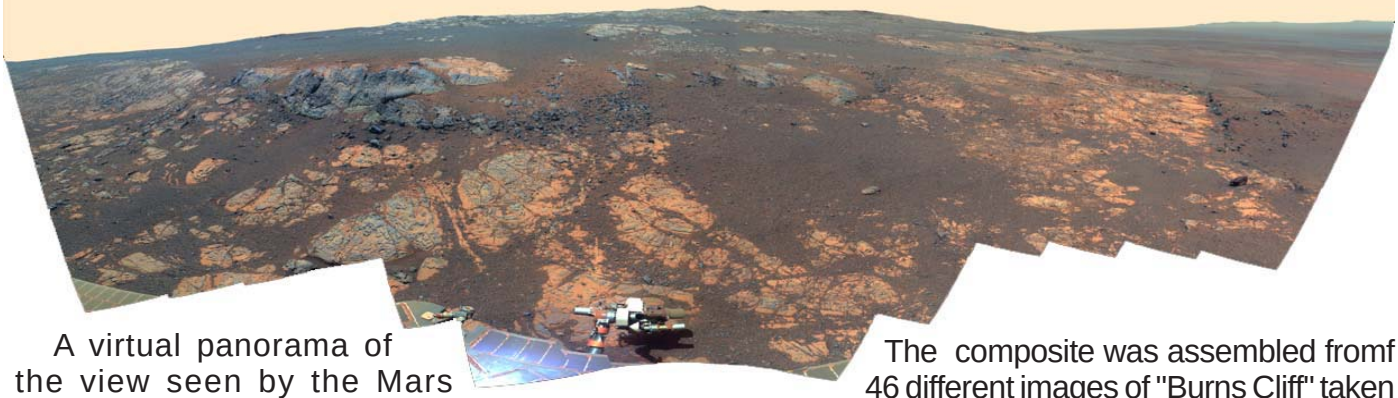
Chang'e 3 lander (above) and rover (below);
Photo Credit: CNSA/CCTV

Less than eight hours after landing, the lander deployed a six-wheeled rover (Yutu or "Jade Rabbit") onto the surface. The solar powered rover is designed to operate on the surface for up to three months. It is also equipped with radioisotope heaters to keep critical systems warm during the long, cold lunar nights.

The 300 pound (140 kg) rover is equipped with several instruments, including ground penetrating radar. The radar will allow Chinese scientists to study the composition of the underlying lava layers and basin floor, down to the depth of several hundred feet. The Mare Imbrium landing site appears to be adjacent to a boundary area where different types of lava flows intersect or overlap. It is also near several small, relatively new craters, including one that can be seen in the roll-off image of the rover.


Landing Site of Chang'e 3
Jura Mountains
Sinus Iridum
Promontorium
Laplace
Helicon
Le Verrier
Laplace F

Ten Years on Mars



A virtual panorama of the view seen by the Mars Exploration Rover from inside Endurance Crater. The composite was assembled fromf 46 different images of "Burns Cliff" taken by Opportunity Rover's camera in November 2004. Credit: NASA/JPL-Caltech/Cornell.

ON JANUARY 25, 2004, the Mars Exploration Rover Opportunity entered the Martian atmosphere after a six month journey and bounced along the Martian surface in an inflatable cocoon before coming to rest in Eagle crater. While only 72 feet (22 meters) in diameter, small nodules of hematite (dubbed blueberries) in the rock layers that formed the crater wall provided the first clear evidence that liquid water played a role in geologic processes that transformed the Red Planet over the past 4 billion years. Eagle would be the first of several impact craters that Opportunity would explore as it traveled across the plains of Meridiani Planum.

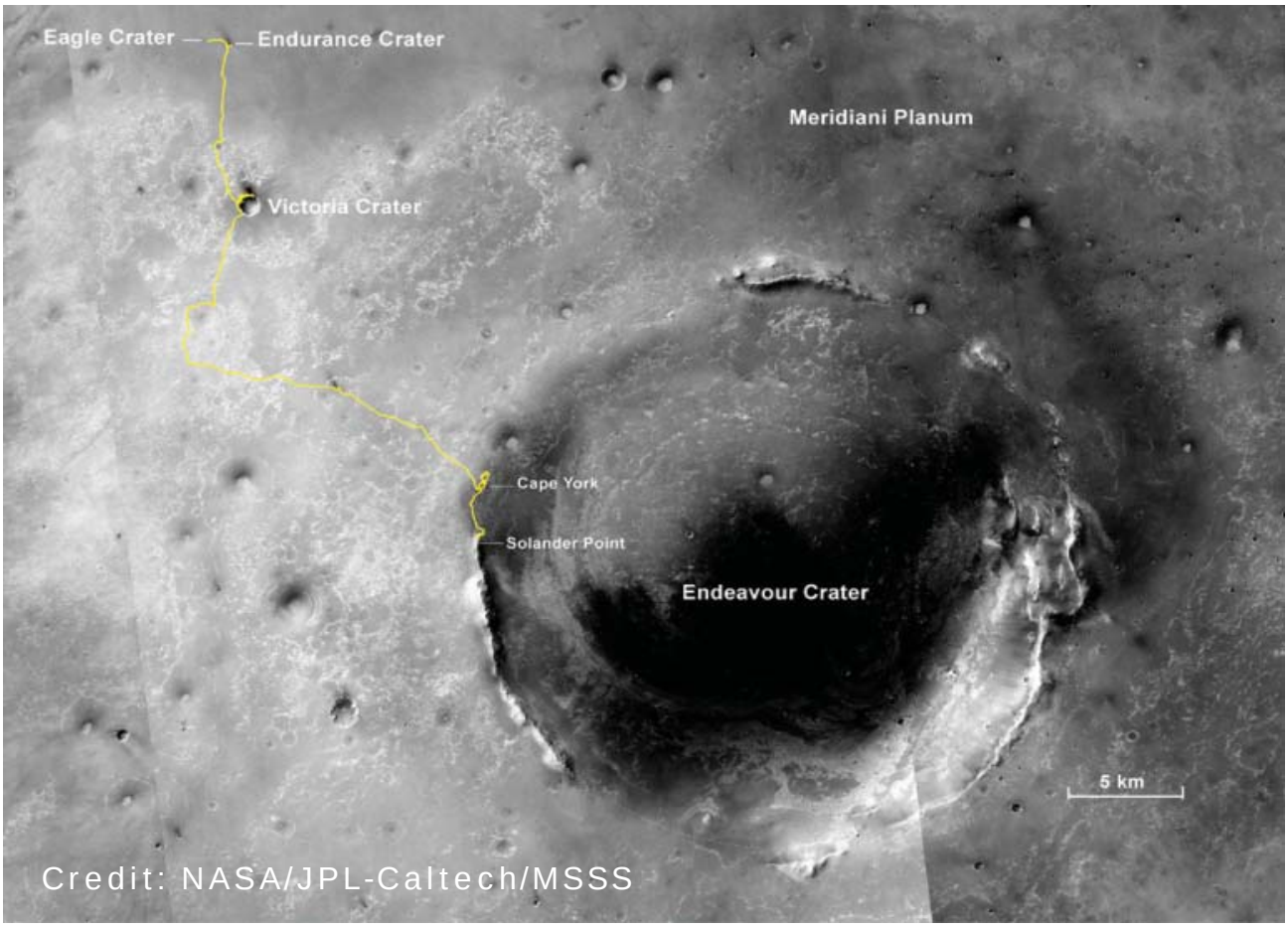
Opportunity would spend the second half of 2004 traveling to and exploring nearby Endurance crater. In April 2005, the mission would be threatened when the rover became stuck in a sand dune. It would take six weeks of planning and many, centimeter-sized maneuvers to extract the rover. After escaping "Purgatory Dune," Opportunity narrowly avoided another dune when newly installed software stopped the rover before it lost traction. Circumventing the dune, Opportunity continued on its trek to Victoria crater, stopping by the smaller Erebus crater along the way. On its way, it would pass by its own discarded heat shield and the first of several meteorites.

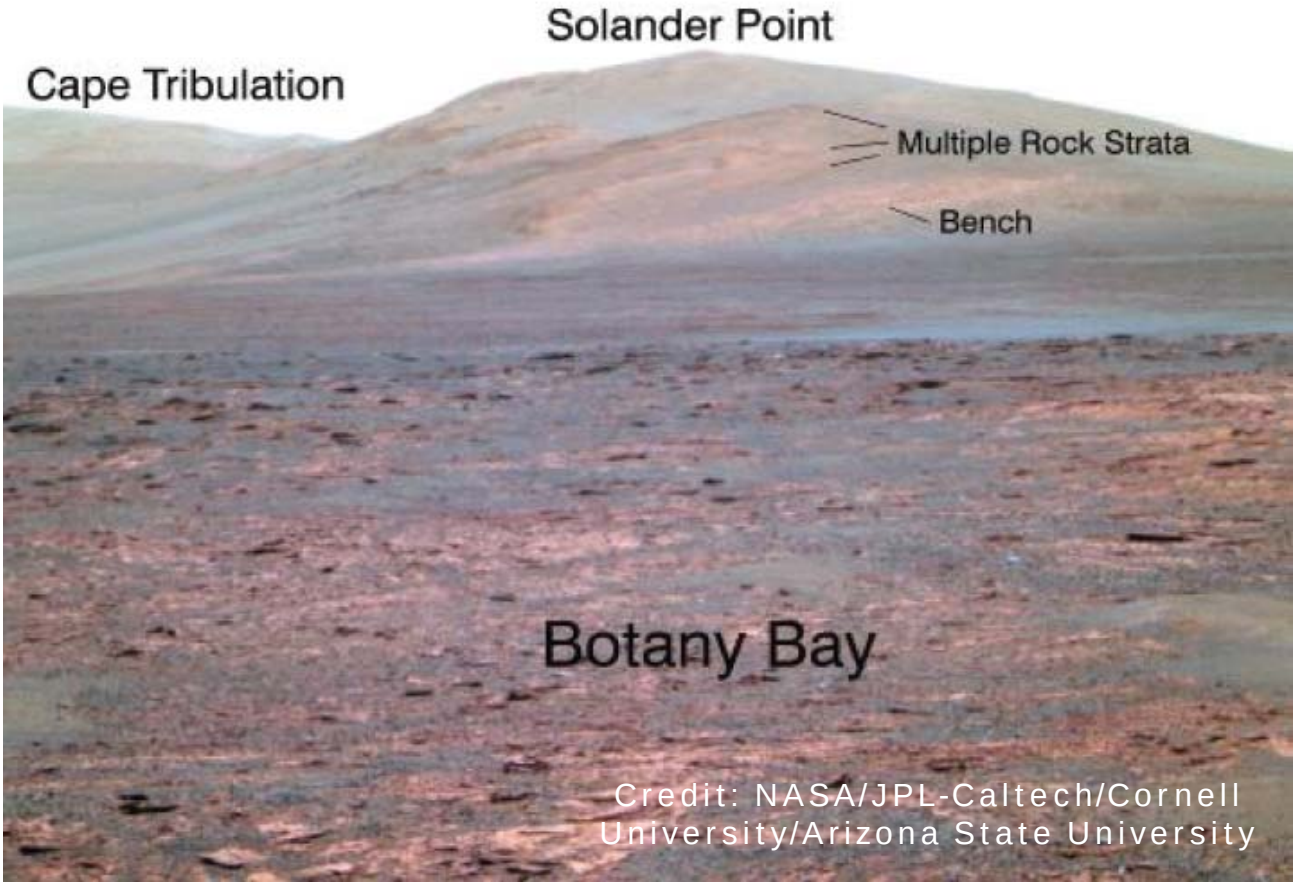
The rover reached Victoria crater in September of 2006, after traveling 4.3 miles (7 km) from its landing site. It would spend the first nine months circumnavigating the crater's rim, during which it was photographed by the Mars Reconnaissance Orbiter. In mid-2007, a series of dust storms blotted out the Sun. The loss of power threatened to discharge the rover's battery and permanently disable the rover. By late August, however, the storms began to subside and Opportunity was receiving enough sunlight to recharge its battery and return to normal operation. The rover would spend another year exploring rock outcroppings within the crater.

Leaving Victoria, Opportunity would begin a three year journey to Endeavour crater, reaching the rim of the 14 mile (22km) diameter impact crater in August 2011. Shortly after arriving, the rover would discover gypsum deposits on the surface, a clear indication that water once flowed through the surrounding rock. In May 2013, the rover was directed to drive to a high ridge on the rim, designated Solander Point. The sun-facing slope of the ridge would allow Opportunity to continue to work through the Martian winter. On its trek, the rover would discover rocks dating back to the earliest geologic (Noachian) period, approximately 4 billion years ago.

During Opportunity's ten years on Mars, the rover has travel over 24 miles (39 km) from its landing site. Opportunity has found water-borne materials and minerals deposited by water (including hematite, clay and gypsum); conclusive signs that liquid water once flowed across or percolated through the Martian surface.

The 4.9 foot (1.5 m) high rover has survived dust storms, sand traps and equipment breakdowns. A malfunctioning heater switch has increased the electrical load. An inoperative shoulder azimuth joint limits the robotic arm movement. Non-functioning science instruments, sporadic issues with flash memory, and other glitches with software have affected Opportunity's operations as well. The rover drives backwards in an effort to prolong the life of a failing front wheel. Opportunity's most recent issue involves a failed potentiometer in the arm, causing the rover to believe the arm has come unstowed (an event that would preclude driving). Despite the many issues, Opportunity is still extremely capable of executing its mission.


Eagle Crater
Endurance Crater
Meridiani Planum
Victoria Crater
Cape York
Solander Point
Endeavour Crater
5 km
Credit: NASA/JPL-Caltech/MSSS


Solander Point
Cape Tribulation
Multiple Rock Strata
Bench
Botany Bay
Credit: NASA/JPL-Caltech/Cornell University/Arizona State University

Ten Years of Dust Accumulation

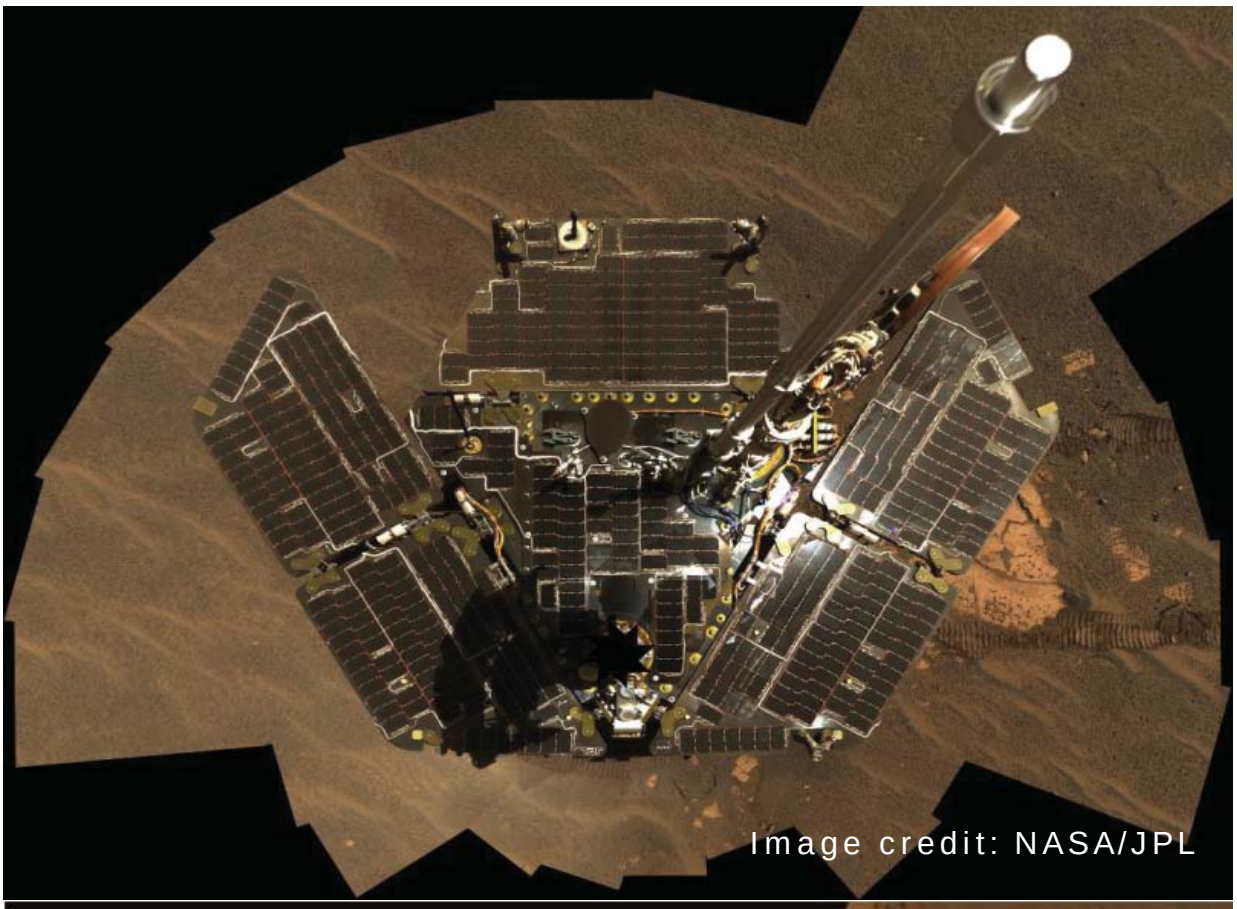


Image credit: NASA/JPL

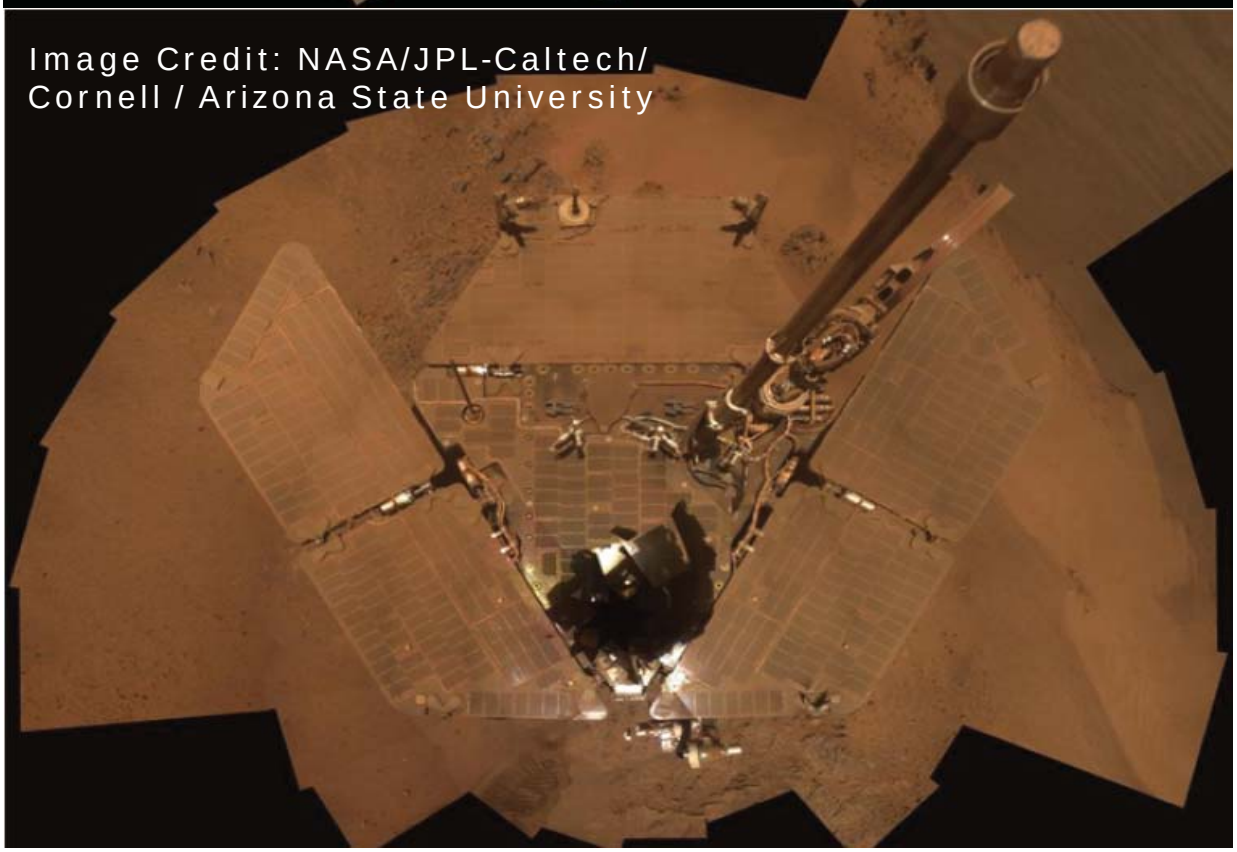


Image Credit: NASA/JPL-Caltech/
Cornell / Arizona State University

Curiosity Update

NASA's Mars Science Laboratory Curiosity continues to work its way towards Mt. Sharp, a 3 mile (5 km) high layered mound located near the center of the Gale crater. As can be seen in the recent photo, the landscape is diverse and shows evidence of erosion by water. The rover's analysis of sedimentary deposits and mudstone within the crater supports the existence of an ancient lake. The lake was most likely formed billions of years ago by water pooling between the mountain and the crater wall. The rover's camera is looking west-northwest with the crater wall in the distance.

Image credit: NASA/JPL-Caltech/MSSS

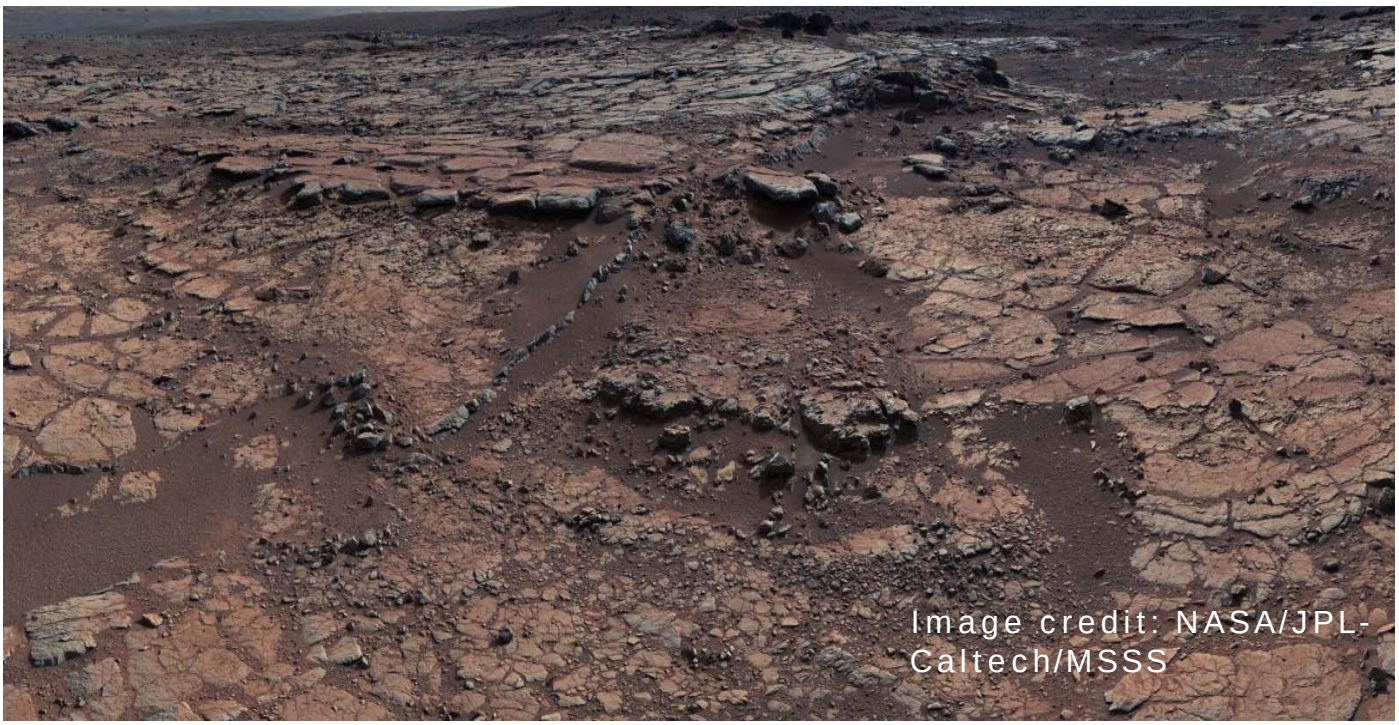
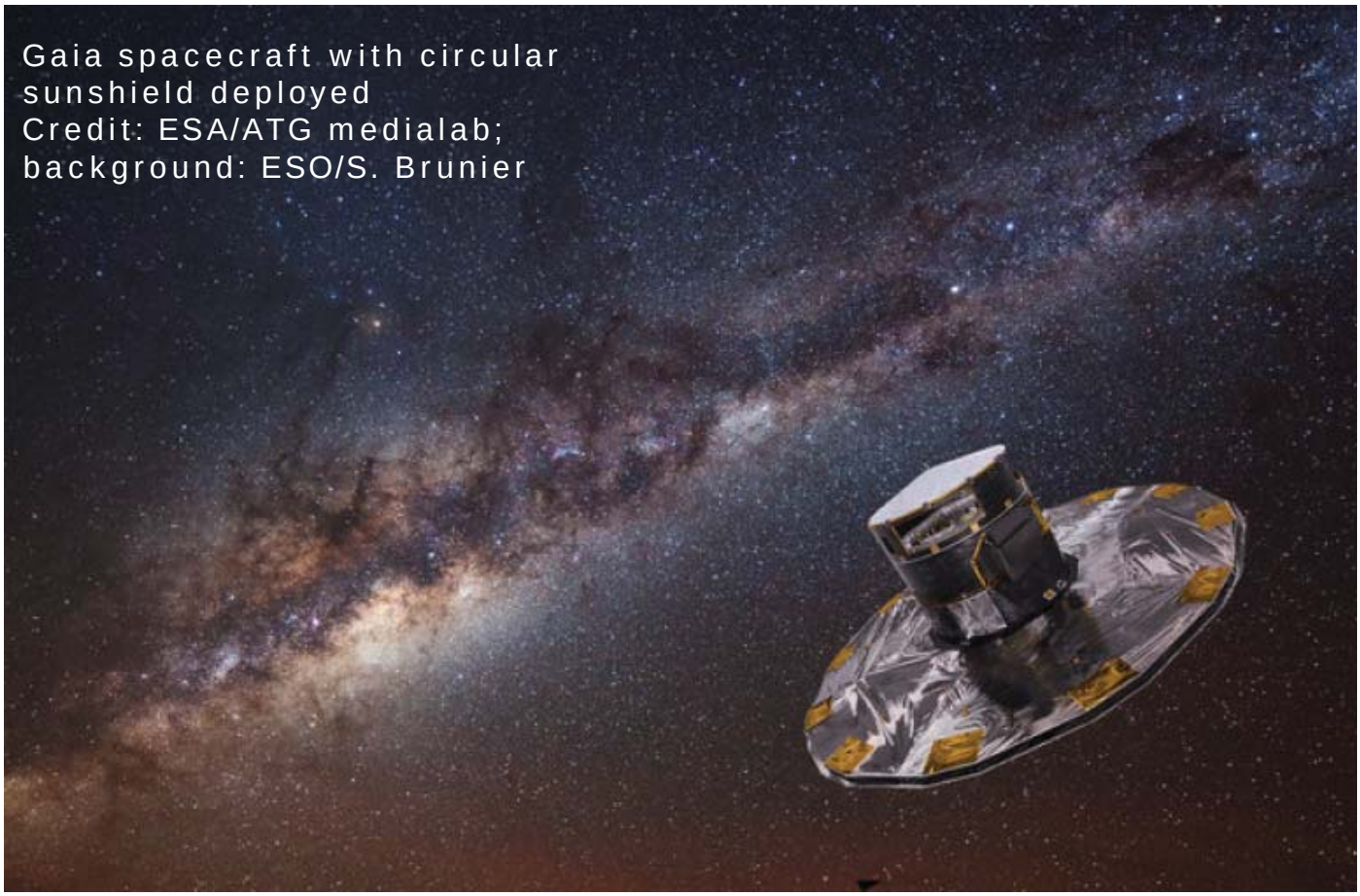


Image credit: NASA/JPL-Caltech/MSSS

GAIA Heads for the Stars

On December 19th, a Soyuz rocket lifted off from the coastal town of Kourou, French Guiana carrying the European Space Agency's (ESA) Gaia spacecraft (see illustration on next page). The spacecraft deployed its circular Sun shield shortly after launch and is now cruising towards its L2 observing station 932,000 miles (1.5 million km) away (see Reference section for more information on the L2 location). Gaia is a star-mapping mission and a follow-on to the earlier Hipparcos mission launched in 1989.

During Gaia's planned five year mission, the spacecraft will observe a billion stars, each approximately 70 times. By observing nearby stars at different points along the Earth's orbit (and the parallax or apparent change in position of the stars relative to more distant objects), Gaia can accurately measure the star's distance and motion across the sky. Gaia will also be able to measure the star's brightness, temperature and chemical composition. With the data, scientists will be able to chart the course of the stars both in the past and future, as well as the evolution of the Milky Way Galaxy.



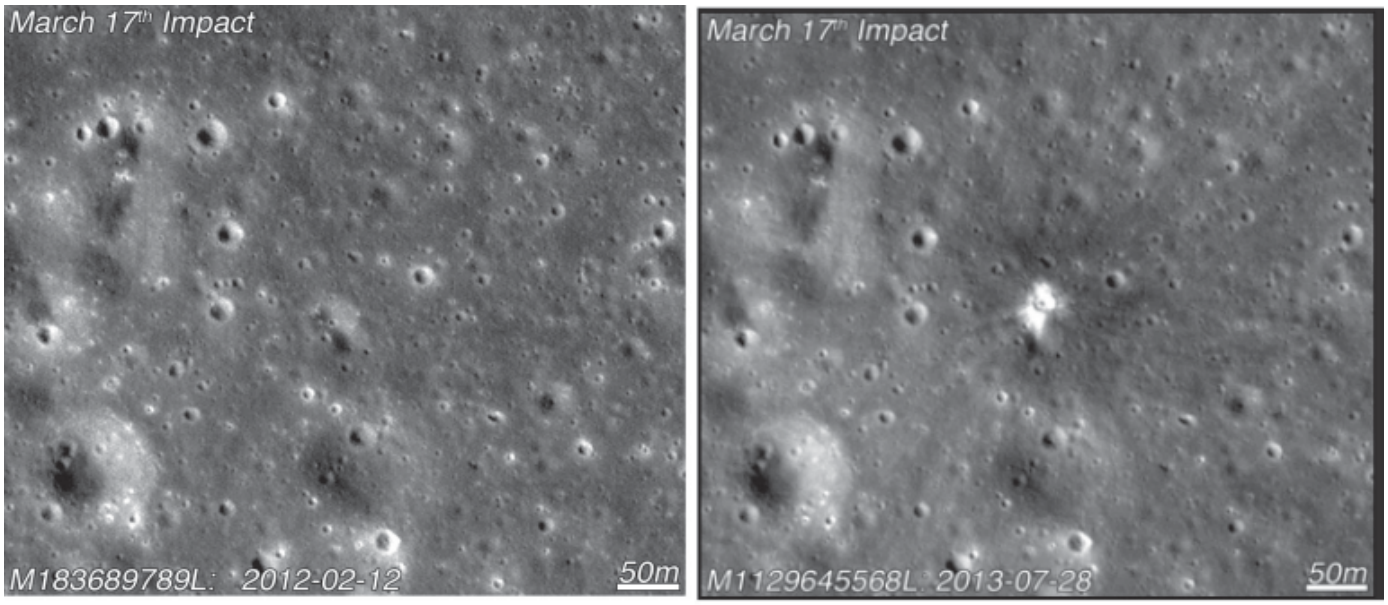
Gaia spacecraft with circular sunshield deployed
Credit: ESA/ATG medialab; background: ESO/S. Brunier

Recent Lunar Impact

While the Moon is an ancient, seemingly unchanging world, it is being constantly modified on a small scale by the bombardment of tiny meteoroids. Without a substantial atmosphere, the stony or metallic debris left over from the formation of the solar system or collisions of larger bodies (asteroids) rain down upon the lunar surface. The high energy impacts can produce flashes of light that can be seen by observers on Earth. One such impact occurred on March 17, 2013, and was noticed by scientists reviewing imagery from NASA's Lunar Reconnaissance Orbiter (LRO) from coincident passes over Mare Imbrium. Several months later, the impact area was reimaged. Post-impact images displayed a new crater, approximately 59 feet (18 meters) across. Characteristic of a geologically recent event, the crater is surrounded by a halo of bright debris, radiating from impact site. It is believed that the meteoroid was the size of a small boulder. However, traveling at an estimated velocity of 56,000 mph (or 90,000 km/h), the resulting crater can be a factor of 10, or more, larger than the meteoroid.

A dedicated telescope at the Marshal Space Flight Center monitors the dark portion of the Moon before that First Quarter and after the Last Quarter Moon. It has recorded over 300 flashes on the surface since 2005, the brightest of which was the March 17th event.

Additional information on NASA's Lunar Impact Monitoring Program can be found on the internet at http://www.nasa.gov/centers/marshall/news/lunar/index.html. The site provides details on the equipment used, the process, as well as the latest impact candidates.



New impact crater. Photo Credit: NASA/GSFC/Arizona State University

January History

The month of January has been a difficult one for both the American and Soviet space programs. Untimely deaths set back both the American and Soviet moon programs. The two space shuttles that have been lost were also launched in January.

Sergei Korolyov, the "Chief Designer" of the Soviet space program, died on January 14, 1966 from a botched medical procedure. Korolyov co-founded the Moscow rocketry organization in the 1930s before being thrown into prison during the peak of Stalin's purges. He spent a year in the Kolyma gold mine, the most dreaded part of the Gulag in Siberia before he was recalled to Moscow to aid the Red Army in developing new weapons. Korolyov went on to lead the Soviet space effort. Unfortunately, the Soviet Moon program died with Korolyov in 1966. While the race continued for some time after his death, his N-1 moon rocket never made a successful flight.

In January of 1967, after a successful Gemini program, NASA was moving forward with testing the new Apollo spacecraft. On the afternoon of the 27th, Gus Grissom, Ed White and Roger Chaffee were sealed inside the Apollo 1 command module sitting on top of an unfueled Saturn rocket in a simulated countdown. The command module had been plagued with problems and was in a state of constant redesign. At 6:31 pm, a spark from a damaged wire ignited the pure oxygen atmosphere in the spacecraft. Within seconds the temperature reached 2,500°. The astronauts never had a chance to undo the bolts of the hatch before they were asphyxiated. Following their deaths, the spacecraft was completely redesigned. Lessons learned from this accident served to make the spacecraft much safer and contributed to the success of the six moon landings.

Twenty-two years ago, on January 28, 1986, the United States lost its first space shuttle, the Challenger. Due to the low temperature on the launch pad, a rubber-like O-ring used to seal the joints of the solid rocket boosters failed to seat and stop the hot gasses from

escaping. The gas produced a blowtorch-like flame that penetrated the external tank filled with liquid oxygen and hydrogen. The tank exploded 73 seconds after liftoff, destroying the shuttle and killing all seven crew members. Among the crew was Christa McAuliffe, a New Hampshire teacher.

Christa graduated from Framingham State College (Framingham, Massachusetts) in 1970. Following her death, the college established *The Christa McAuliffe Center* on the campus as a means to continue the educational mission which was Christa's life's work.

On February 1, 2003, a second space shuttle, the Columbia, was lost. The Columbia was the oldest shuttle in the fleet, having been first flown in 1981 by astronauts John Young and Robert Crippen. On its 28th flight, Columbia broke apart during reentry at an altitude of some 200,000 feet and a speed of 12,500 miles per hour. The shuttle and its crew of seven had just completed a 16 day science mission. The most likely cause of the accident was damage to a seal on the left wing from a piece of insulating foam that broke loose from the external fuel tank at launch, striking the wing. The resulting gap in the wing allowed the superheated atmosphere to penetrate the wing during reentry and destroy the spacecraft.

The Columbia accident ultimately led to the decision to stop flying the space shuttle once the International Space Station was complete and to develop a safer manned vehicle.

January Nights

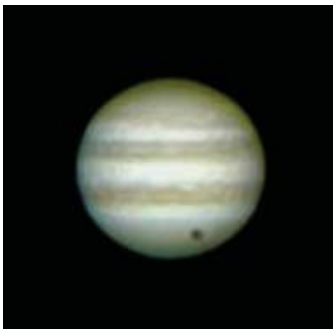
January nights can be clear and cold with frigid blasts of polar wind. They also present an opportunity to see stars at every stage in their life cycle, from birth (Orion Nebula) to fiery demise (Crab supernova remnant).

If you are out observing the open star clusters Pleiades or Hyades in the constellation Taurus, don't overlook the red giant Aldebaran. This star is receding from us more rapidly than any other 1st magnitude star in the sky. It was the brightest star in the sky some 320,000 years ago when it was 21½ light years from Earth. Moving away, Aldebaran is currently 65 light years in distance and the thirteenth brightest star in the sky.

Jupiter and its Moons

Jupiter reaches Opposition on January 5th and is well placed in the evening sky in January. As one of the brightest star-like objects in the night sky, Jupiter can be found in the constellation Gemini.

One of the more interesting and easier events to observe through a telescope is the projection of a shadow from one of Jupiter's moons on the Jovian disk as the moon passes in front of (or transits) the planet. The photo on the right shows the shadow of Ganymede on the Jovian disk. On nights of good visibility the following events should be visible through a moderately-sized telescope (between approximately 5 pm and midnight).



Date	Moon	Transit Begins	Transit Ends
1st	Europa	4:21 pm	7:02 pm
3rd	Callisto	4:04 pm	7:26 pm
4th	Io	10:12 pm	12:28 am (5th)
6th	Io	4:41 pm	6:56 pm
8th	Europa	6:57 pm	9:39 pm
13th	Io	6:35 pm	8:51 pm
15th	Europa	9:34 pm	12:16 am (16th)
20th	Io	8:30 pm	10:45 pm
27st	Io	10:24 pm	12:40 am (28th)
29th	Io	4:53 pm	7:09 pm

Transit of Jupiter's Red Spot

The Red Spot is a large cyclone in the upper Jovian atmosphere. The rapid rotation of this gas giant (10 hours) may be responsible for the longevity of this storm, which has been observed for over 300 years. The Red Spot will cross the center line of the planetary disk on the following evenings during the hours between 5 pm to midnight local time (EST):

Date	Transit Time	Date	Transit Time
1st	11:16 pm	16st	8:37 pm
2nd	7:07 pm	18st	10:15 pm
4th	8:45 pm	20th	11:54 pm
6th	10:23 pm	21th	7:45 pm
7th	6:14 pm	23th	9:23 pm
9th	7:52 pm	25th	11:01pm
11th	9:30 pm	28th	8:30 pm
13th	11:08 pm	30th	10:08 pm
14th	6:59 pm		

Sunrise and Sunset

Sun	Sunrise	Sunset
January 1st (EST)	07:20	16:34
January 15th	07:18	16:49
January 31st	07:06	17:09

Astronomical and Historical Events

1st New Moon
1st Moon at perigee (closest distance from Earth)
1st Scheduled flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
1st History: GRAIL-B spacecraft enters lunar orbit (2012)
1st History: Giuseppe Piazzi discovers the first asteroid, now dwarf planet, *Ceres* (1801)
2nd History: flyby of Comet Wild 2 by the Stardust spacecraft (2004)
2nd History: launch of the Soviet spacecraft Luna 1; first probe to fly by the Moon (1959)
3rd Quadrantids meteor shower peaks; radiates from the constellation Boötes (name from an obsolete constellation called Quadrans Muralis)
3rd History: exploration rover Spirit lands on Mars in Gusev Crater; operational for six years before getting bogged down in loose soil at a winter haven called Troy (2004)
3rd History: Stephen Synnott discovers Uranus' moons *Juliet* and *Portia* (1986)
4th Earth at Perihelion; closest approach to the Sun (0.983 AU)
4th History: Isaac Newton born; inventor of the reflecting telescope, described universal gravitation, compiled the laws of motion, and invented calculus (1643)
5th Jupiter at Opposition; rising with the setting Sun and visible all night
5th History: launch of the Soviet atmospheric probe, Venera 5, to Venus (1969)
5th History: discovery of Jupiter's moon *Elara* by Charles Perrine (1905)
6th History: launch of the Lunar Prospector spacecraft; detected signs of water ice in permanently shadowed craters, mapped surface composition and Moon's gravity field and detected outgassing events in the vicinity of craters Aristarchus and Kepler (1998)
6th History: La Criolla (Argentina) meteorite fall (1985)
6th History: launch of Surveyor 7, the last of the unmanned Surveyor spacecrafts; soft-landed near Tycho crater; first probe to detect a faint glow on lunar horizon - thought to be sunlight reflected from electrostatically levitated moon dust (1968)
7th First Quarter Moon
7th History: discovery and first recorded observations of Jupiter's four largest moons by Galileo Galilei (1610)
8th History: launch of Japanese spacecraft Sakigake with mission to rendezvous with Comet Halley; measured the solar wind and magnetic field (1985)
8th History: launch of Luna 21 and the Lunokhod 2 moon rover (1973)
8th History: Stephen Hawking born (exactly 300 years after the death of Galileo); discovered that black holes could emit radiation - subsequently known as Hawking radiation (1942)
9th Scheduled distant flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
10th History: launch of the Soviet atmospheric probe, Venera 6, to Venus (1969)
10th History: U.S. Army first bounces radio waves off the Moon (1946)
11th Second Saturday Stars – Open House at the McCarthy Observatory
11th History: the Lunar Prospector spacecraft enters lunar orbit for a nineteen month chemical mapping mission (1998)
11th History: William Herschell discovers Uranus' moons *Titania* and *Oberon* (1787)
12th History: launch of the Deep Impact spacecraft for a flyby of Comet Tempel 1; a small "impactor" was later released from the main spacecraft for a July 4th collision with the comet's nucleus (2005)
12th History: Sergei Pavlovich Korolyov born, Chief Designer of the Soviet space program (1907)
13th History: Stephen Synnott discovers Uranus' moons *Desdemona*, *Rosalind* and *Belinda* (1986)
13th History: discovery of the Martian meteorite EETA 79001 in Antarctica; second largest Martian meteorite recovered after Zagami (1980)
14th History: first of three flybys of the planet Mercury by the Messenger spacecraft (2008)
14th History: landing of the Huygens probe on Saturn's largest moon Titan (2005)

Astronomical and Historical Events (continued)

15th Full Moon
15th Moon at Apogee (furthest distance from Earth)
15th History: Stardust spacecraft returns samples of Comet P/Wild 2 (2006)
15th History: launch of the spacecraft Helios 2, solar orbiter (1976)
15th History: Lunokhod 2, the second of two Soviet unmanned lunar rovers, lands in Le Monnier crater; covered a total distance of 23 miles in almost five months of exploring the floor of the crater and its southern rim (1973)
16th Kuiper Belt Object 20000 Varuna at Opposition (42.720 AU)
16th History: final launch of space shuttle Columbia (STS-107); lost on re-entry (2003)
19th Kuiper Belt Object 208996 (2003 AZ84) at Opposition (44.030 AU)
19th History: launch of the New Horizons spacecraft to Pluto; due to arrive in July 2015 (2006)
19th History: discovery of the Martian meteorite SAU 090, a basaltic shergottite, in Oman (2002)
19th History: Johann Bode born, popularized an empirical law on planetary distances originally developed by J.D. Titius, known as "Bode's Law" or "Titius-Bode Law" (1747)
19th History: discovery of Saturn's moon *Janus* by the Voyager 1 spacecraft (1980)
20th History: Rich Terrile discovers Uranus' moons *Cordelia* and *Ophelia* (1986)
21st History: launch of the rocket Little Joe-1B and a rhesus monkey named "Miss Sam" in a successful test of the Mercury capsule's escape system (1960)
21st History: John Couch Adams born, astronomer and mathematician who was the first person to predict the position of a planet beyond Uranus (1792)
22nd History: launch of Apollo 5, the first Lunar Module flight (1968)
23rd History: Brad Smith discovers Uranus' moon *Bianca* (1986)
24th Last Quarter Moon
24th History: discovery of the Martian meteorite Dhofar 019 in Oman (2000)
24th History: launch of Japan's Hiten spacecraft; first use of a low-energy transfer to modify an orbit and the first demonstration of a transfer to the Moon requiring no change in velocity for capture (1990)
24th History: flyby of Uranus by the Voyager 2 spacecraft (1986)
25th History: exploration rover Opportunity lands on Mars at Meridiani Planum; still operational and currently exploring Endeavour Crater (2004)
25th History: launch of the Infrared Astronomical Satellite (IRAS); first space telescope to survey of the entire sky at infrared wavelengths (1983)
25th History: launch of the U.S. Moon orbiter Clementine (1994)
25th History: Joseph Lagrange born (1736); mathematician who discovered five special points in the vicinity of two orbiting masses where a third, smaller mass can orbit at a fixed distance from the larger masses. The L1 Lagrange Point of the Earth-Sun system is the current home of the Solar and Heliospheric Observatory Satellite (SOHO).
26th History: discovery of Saturn's moon *Epimetheus* by the Voyager 1 spacecraft (1980)
26th History: launch of the International Ultraviolet Explorer (IUE); space telescope and spectrographs; designed to take ultraviolet spectra (1978)
27th History: fire in the Apollo 1 spacecraft kills astronauts Gus Grissom, Edward White and Roger Chaffee (1967)
27th History: Philibert Melotte discovers Jupiter's moon Pasiphae (1908)
28th History: final launch of the space shuttle Challenger (STS-51L); lost on lift-off (1986)
28th History: Johannes Hevelius born; leading observational astronomer of the 17th century, published detailed maps of the moon and determined the rotational period of the sun (1611)
29th History: Soviet spacecraft Phobos 2 enter orbit around Mars; successfully returned 38 images before contact was lost; its lander was not deployed (1989)
30th Moon at perigee (closest distance from Earth)
30th New Moon
31st Mercury at its Greatest Eastern Elongation shortly after sunset (18°)

Astronomical and Historical Events (continued)

31st History: launch of Apollo 14; third manned moon landing with astronauts Alan Shepard, Stuart Roosa and Edgar Mitchell (1971)
31st History: launch of Soviet Moon lander Luna 9; first spacecraft to land and to transmit photographs from the Moon's surface (1966)
31st History: launch of Mercury-Redstone 2 rocket with Ham the chimpanzee (1961)
31st History: launch of the first U.S. satellite, Explorer 1; detected inner radiation belt encircling the Earth (1958)

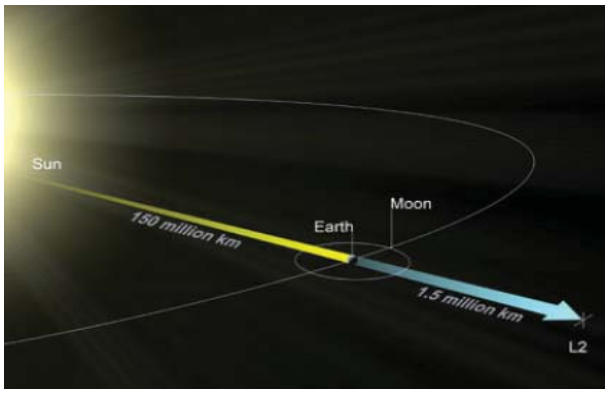
References on Distances

• The apparent width of the Moon (and Sun) is approximately one-half a degree (½°), less than the width of your little finger at arm's length which covers approximately one degree (1°); three fingers span approximately five degrees (5°)

• One astronomical unit (AU) is the distance from the Sun to the Earth or approximately 93 million miles

Lagrange Points

Five locations discovered by mathematician Joseph Lagrange where the gravitational forces of the Sun and Earth (or other large body) and the orbital motion of the spacecraft are balanced, allowing the spacecraft to hover or orbit around the point with minimal expenditure of energy. The L2 point (and destination of the Gaia spacecraft) is located 1.5 million kilometers beyond the Earth (as viewed from the Sun).



International Space Station/Space Shuttle/Iridium Satellites

Visit *www.heavens-above.com* for the times of visibility and detailed star charts for viewing the International Space Station, the Space Shuttle (when in orbit) and the bright flares from Iridium satellites.

Solar Activity

For the latest on what's happening on the Sun and the current forecast for flares and aurora, check out *www.spaceweather.com.*

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Second Saturday Stars

FREE EVENT

Every Month at the
John J. McCarthy Observatory
Behind the New Milford High School
860.946.0312
www.mccarthyobservatory.org

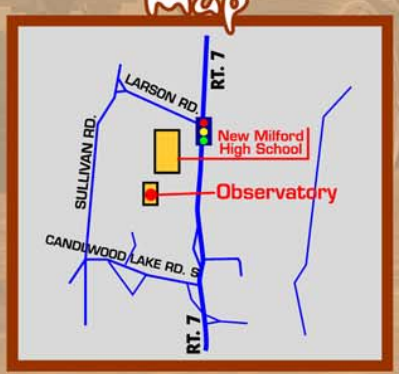
January 11th
7:00 - 9:00 pm

from JJMO to NASA

A STUDENT'S and INTERNSHIP MARS EXPERIENCE

Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

Map



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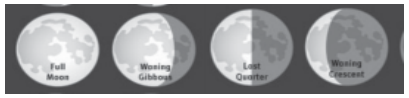
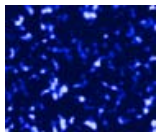
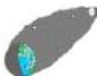
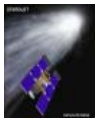
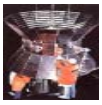
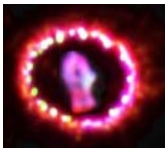
January 2014

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Phases of the Moon  Jan 1 — Jan 7  Jan 15 — Jan 24			**1** Moon at perigee (closest to Earth)   Giuseppe Piazzi discovers Ceres, 1st asteroid, now dwarf planet (1801) GRAIL-B spacecraft enters lunar orbit (2012) 	**2** Soviet spacecraft Luna 1 circles Moon (1959)   Flyby of comet Wild 2 by Stardust spacecraft (2004)	**3**  Rover Spirit on Mars (2004)  Quadrantids meteor shower peak	**4**  Isaac Newton born (1643)  Earth at Perihelion; closest to the Sun (0.983 AU)
5  Discovery of Jupiter's moon Elara by Charles Dillon Perrine (1905)	**6**  La Criolla (Argentina) meteorite fall (1985)  Launch of Lunar Prospector: detected signs of water ice in shadowed craters, mapped surface composition and Moon's gravity field (1998)	**7**  Launch of Surveyor 7, the last of the Surveyor Lunar landers; soft-landed near Tycho crater (1968)  Discovery and first recorded observations of Jupiter's four largest moons by Galileo Galilei (1610)	**8** launch of Luna 21 and the Lunokhod 2 moon rover (1973)   Launch of Japanese spacecraft Sakigake to Comet Halley (1985) Stephen Hawking born (1942) 	**9**  Physicists at Fermilab and Lawrence Berkeley National Laboratory (Berkeley Lab) unveil maps of the invisible scaffolding of the universe - dark matter - opening new ways for understanding dark energy with ground-based telescopes (2012)	**10**  U.S. Army bounces radio waves off the Moon (1946) Surveyor 7 lands on Moon (1968) 	**11**  William Herschell discovers Uranus moons Titania and Oberon (1787)  2nd Saturday Stars Open House McCarthy Observatory
12 Launch of Deep Impact spacecraft for flyby of comet Tempel 1 (2005)   Sergei Pavlovich Korolyov born, designer of Soviet space program (1907)	**13** Discovery of Uranus moons Desdemona, Rosalind and Belinda by Stephen Synnott (1986)   Discovery of Martian meteorite EETA 79001 in Antarctica (1980)	**14**  Landing of the Huygens probe on Saturn's largest moon Titan (2005) Messenger spacecraft flyby of Mercury (2008) 	**15**  Moon at apogee (farthest from Earth)  Stardust spacecraft returns with samples of comet P Wild 2 (2006) Launch of Helios 2, solar orbiter (1976) 	**16**  Final launch of space shuttle Columbia (2003)	**17**  Harvey H.Nininger born, American meteoriticist and founder of the American Meteorite Museum near Meteor Crater, Arizona (1887)	**18**  Astronomers discover a pulsar in remnants of Supernova 1987A, but observation not later confirmed (1989)
19 discovery of the Martian meteorite SAU 090 in Oman (2002)   Launch of New Horizons spacecraft to Pluto (2006) Johann Bode born, developed law on planetary distances (1747) 	**20**  Rich Terrile discovers Uranus' moons Cordelia and Ophelia (1986)	**21** Launch of the rocket Little Joe-1B and a rhesus monkey "Miss Sam" (1960) John Couch Adams born, predicted planet beyond Uranus (1792)	**22** Apollo 5 launch to Moon (1968)	**23** Discovery of Uranus' moon Bianca by Brad Smith (1986)	**24** Discovery of the Martian meteorite Dhofar 019 in Oman (2000) Rover Opportunity arrives on Mars (2004) Flyby of Uranus by Voyager 2 (1986)	**25** Launch of the Infrared Astronomical Satellite (IRAS): first space telescope to survey of the entire sky at infrared wavelengths (1983) Joseph Louis Lagrange born (1736) Launch of U.S. Moon orbiter Clementine (1994)
26 Launch of the International Ultraviolet Explorer (IUE); space telescope and spectrographs; designed to take ultraviolet spectra (1978) Discovery of Saturn's moon Epimetheus by the Voyager I spacecraft (1980)	**27** Philibert Melotte discovers Jupiter's moon Pasiphae (1908) Fire in Apollo 1 spacecraft (1967)	**28** Johannes Hevelius born (1611) Space shuttle Challenger lost on lift-off (1986)	**29** Phobos 2, Soviet spaecraft enters Mars orbit in study of solar environment. Mission, with cooperation of U.S and 3 others (1989)	**30** John Herschel uses camera obscura and hyposulphite to fix "snapshot" images from 48" (120cm) telescope (1839)	**31** Apollo 14, 3rd Moon mission (1971) Explorer 1, first U.S. satellite (1958) Launch of Mercury-Redstone 2 rocket with Ham, the astrochimp (1961)	