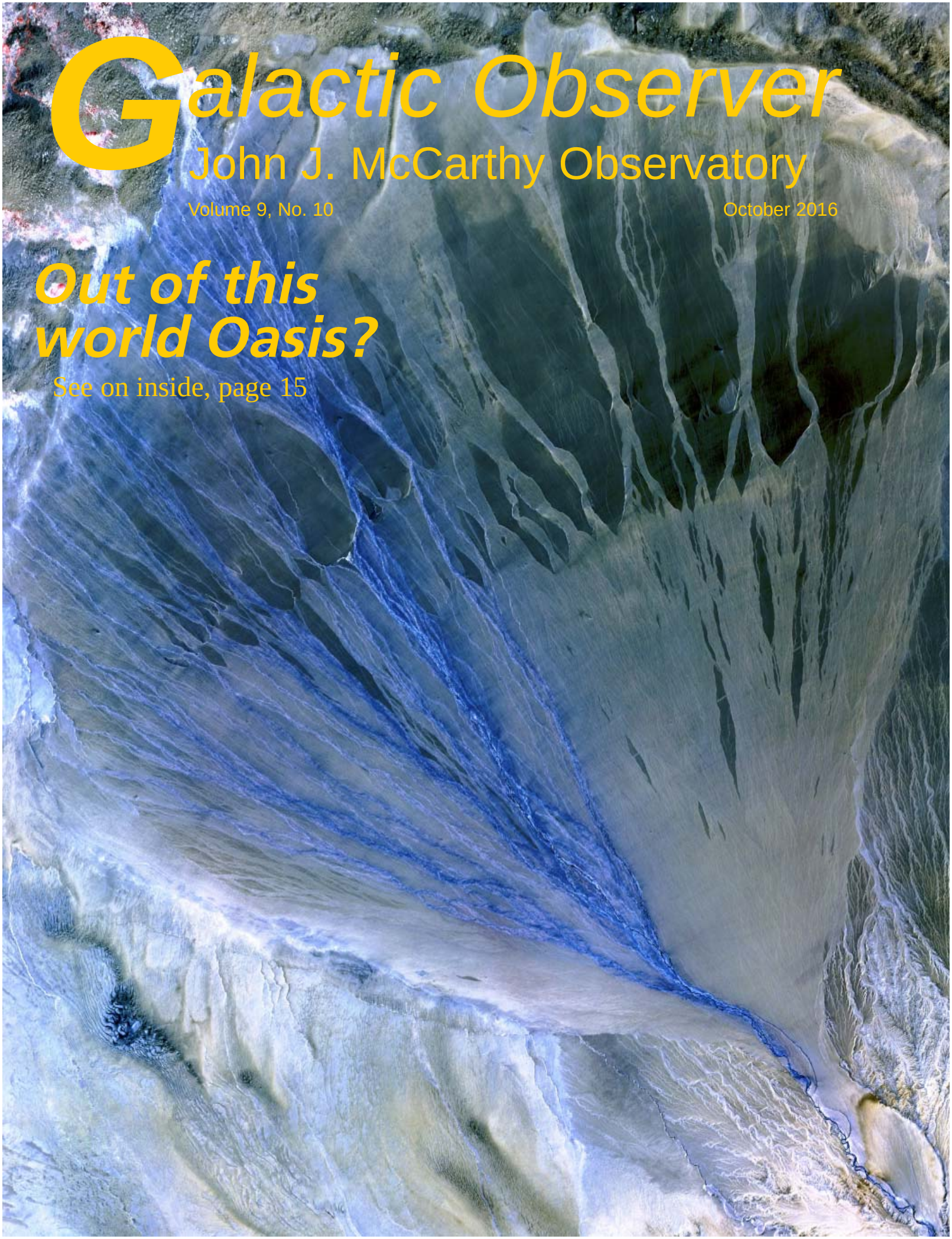

Galactic Observer

John J. McCarthy Observatory

Volume 9, No. 10 October 2016

Out of this world Oasis?

See on inside, page 15

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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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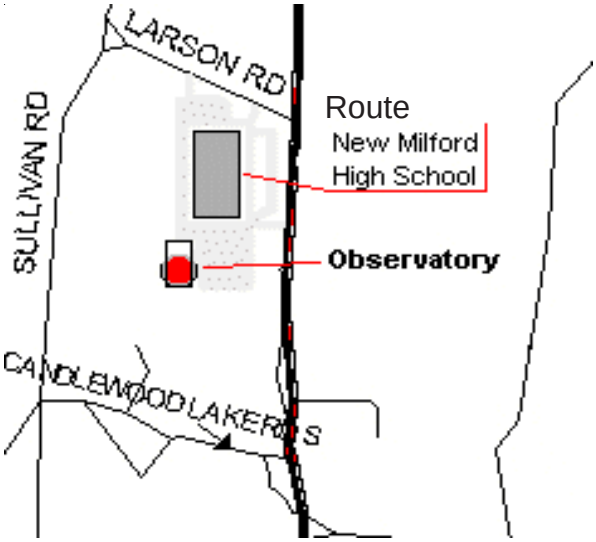

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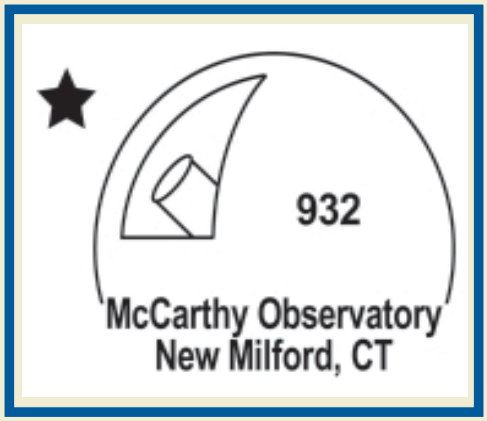
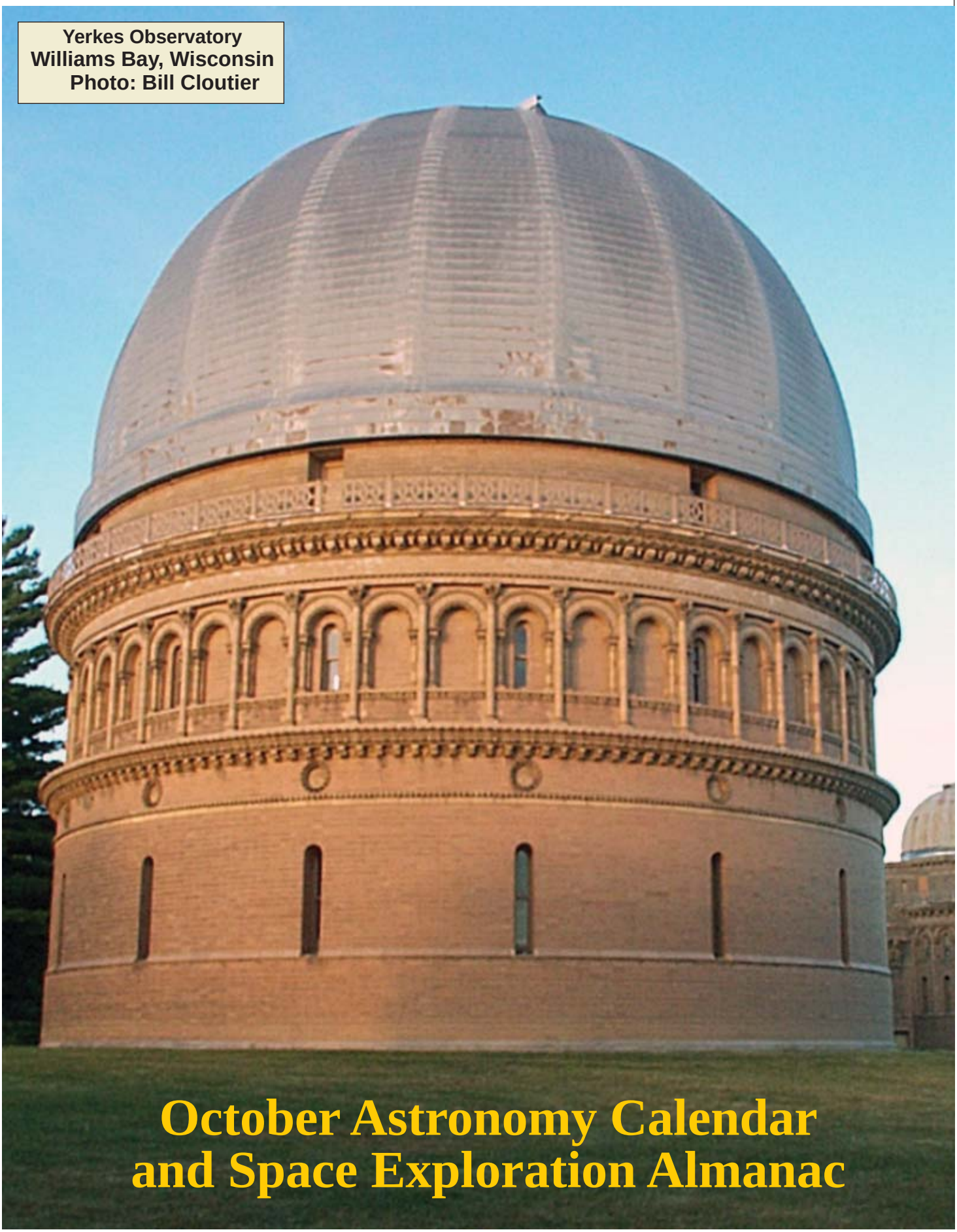


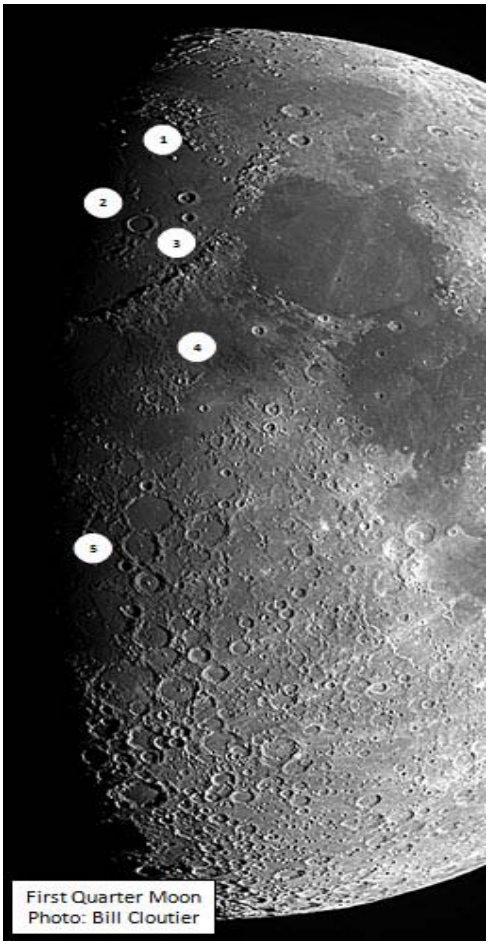


Yerkes Observatory
Williams Bay, Wisconsin
Photo: Bill Cloutier

October Astronomy Calendar and Space Exploration Almanac

International Observe the Moon Night

OCTOBER 8TH IS THE International Observe the Moon Night (InOMN). The event was first inspired by public outreach events held in August 2009 by the Lunar Reconnaissance Orbiter (LRO) and Lunar CRater Observation and Sensing Satellite (LCROSS) educational teams at the Goddard Space Flight Center in Greenbelt, Maryland and at the Ames Research Center in Moffett Field, California, respectively. In 2010, the Lunar and Planetary Institute and Marshall Space Flight Center joined Goddard and Ames in a world-wide event to raise public awareness of lunar science and exploration. The McCarthy Observatory will be participating this year with a program open to the public and starting at 7 pm. Information on InOMN events is available on their website *http://observethemoonnight.org/*.



First Quarter Moon
Photo: Bill Cloutier

The Moon will rise at 1:37 pm (EDT) on the 8th. Approximately 50% of the near-side surface will be illuminated as the Sun sets and twilight deepens. With clear skies, the following lunar features will be visible along the terminator (day/night boundary):

1. Vallis Alpes (Alpine Valley): a graben (displacement) traversing the lunar Alps;
2. Archimedes crater: a 50 mile (81 km) diameter impact crater flooded with mare basalt;
3. Montes Apenninus (Apennine Mountains): segment of the Imbrium impact basin rim and landing site of Apollo 15;
4. Hyginus crater and intersecting linear rille: likely formed by the collapse of a lava tube roof;
5. Alphonsus crater: a 68 mile (110 km) diameter crater with dark halo deposits from volcanic eruptions

Final Countdown

The countdown clock is reading "T-1 year" for Cassini's plunge into Saturn's atmosphere and the termination of a mission. The spacecraft arrived at the ringed planet in 2004 after a seven year journey.

Beginning at the end of November, Cassini will be placed in a polar orbit that will send the spacecraft just beyond the F-ring, a thin, active ring just beyond the large, bright A-ring. Twenty F-ring orbits are planned with the spacecraft passing within 4,850 miles (7,800 kilometers) of the outermost, discrete ring. The F-ring orbits will take the spacecraft across the ring plane, allowing scientists to gain a detailed look at the structure of the rings along with the moonlets embedded within rings.

JPL Control Room
Photo: Kyle Cloutier

In April 2017, the spacecraft will use an encounter with the moon Titan to reshape its orbit for the final time. The "Grand Finale" orbits (22) will send the spacecraft through the gap between the top of Saturn's atmosphere and its innermost ring (a gap of approximately 1,500 miles (2,400 km)). The close encounter with Saturn will provide unprecedented views of the gas giant's atmosphere, facilitate mapping of the planet's gravity and magnetic fields and assist scientists in determining the total mass of the ring system. The Grand Finale will conclude on September 15th when the spacecraft plunges into Saturn's atmosphere.

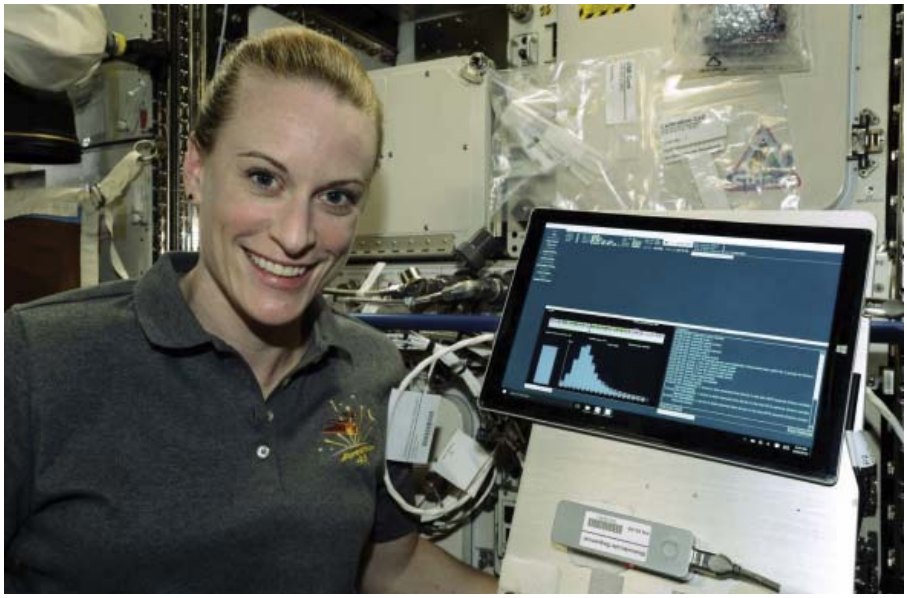
Space Diagnostics

For the first time, DNA (deoxyribonucleic acid), has been successfully sequenced in space. Sequencing is used to determine the order of the chemical building blocks that make up the DNA molecule and identify the kind of generic information carried by a particular segment.

The sequencing was performed on the International Space Station (ISS) by NASA Astronaut Kate Rubins using a portable biomolecule sequencer developed by Oxford Nanopore Technologies. Researchers on Earth conducted simultaneous sequencing on samples that were due to those available to Rubins (in an attempt to isolate any differences in the experiment to the microgravity conditions on the space station).

DNA sequencing could prove to be an invaluable tool in diagnosing illnesses in space during a long-duration mission, monitoring changes in the astronaut's genetic material, or analyzing health threats aboard a spacecraft. It's also possible that a portable sequencer could be used to analyze DNA-based life forms on other worlds.

Kate Rubins was born in Farmington, Connecticut and raised in California. She has a Ph.D. in Cancer Biology from Stanford University Medical School Biochemistry Department and Microbiology and Immunology Department. Rubins was selected by NASA in 2009 and trained as the Flight Engineer for ISS Expedition 48/49. She arrived at the ISS aboard a Soyuz spacecraft on July 9th along with Russian cosmonaut Anatoly Ivanishin and Japanese astronaut Takuya Onishi. She is scheduled to return (land in Kazakhstan with her two crew members) on October 30th.



Rubins with portable DNA sequencer (rectangular, silver-colored device). Photo Credit: NASA

Not So Distant Neighbor

The hunt for habitable planets in the far reaches of our galaxy took an unexpected turn with the recent discovery of a rocky world around the nearest star system. One-eighth the mass of our Sun, Proxima Centauri is a red dwarf that is likely gravitationally bound to the Alpha Centauri binary star system. It is currently the closest star to our solar system (4.25 light years).

The newly discovered rocky world (Proxima b) is slightly more massive than Earth and orbits Proxima Centauri every 11 days. While Proxima b is closer to its star than the planet Mercury is to our Sun, the habitable zone of the red dwarf is also much smaller due to Proxima Centauri's lower temperature. As such, it is likely that liquid water could exist on the surface of Proxima b.

Life, however, may have a difficult time gaining a foothold on Proxima b as Proxima Centauri is a flare star that undergoes random and dramatic increases in brightness with accompanying ultraviolet and x-ray flares. Being so close to its star, Proxima b may also be tidally locked, showing the same hemisphere to Proxima Centauri, while the far side of the planet experiences perpetual night.

An artist's impression of the surface of the candidate planet Proxima b orbiting the red dwarf star Proxima Centauri. Credit: ESO/M. Kornmesser

Proxima b was discovered with the European Southern Observatory's 3.6 meter telescope in La Silla, Chile and HARPS (High Accuracy Radial velocity Planet Searcher) spectrograph in collaboration with other telescopes around the world in the "Pale Red Dot" campaign.

Sentinel Satellite Damaged

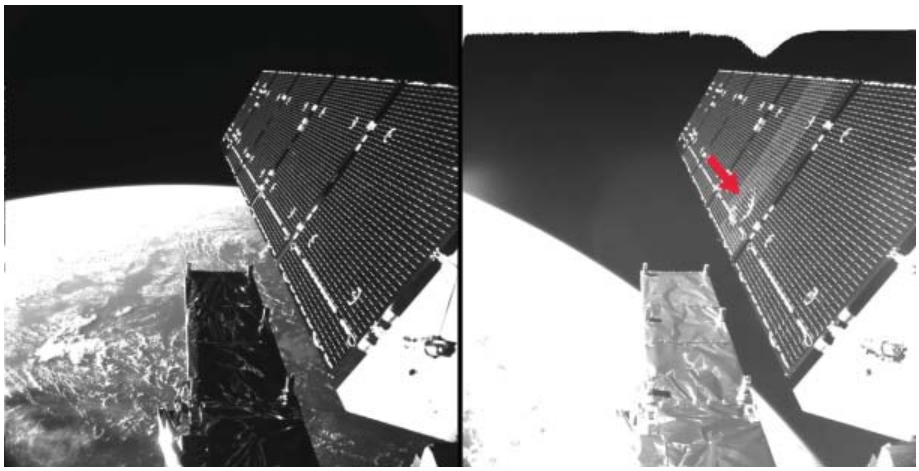
Approximately 18,000 objects larger than 4 inches (10 cm) are currently being tracked as orbital debris. It is estimated that there are 500,000 additional objects between ½ inch and 4 inches (1 and 10 cm) and more than 100 million even smaller particles in a cloud encircling the Earth.

Particle size is a secondary concern to their kinetic energy. In low-Earth orbit, debris travels between 15,000 and 18,000 mph (25,200 to 28,800 km/hr) with collision speeds reaching 22,000 mph (36,000 km/hr).

On August 23rd, European Space Agency engineers detected a small, but sudden drop in power from the solar array on their Copernicus Sentinel-1A satellite. Suspecting a possible impact from space debris or a micrometeoroid, a camera placed on board for launch was reactivated to survey the array.

The camera was able to confirm an impact to the solar panel. Engineers estimate that the particle was only a few millimeters in size. It struck the back of the panel, creating a damaged area approximately 16 inches (40 cm) in diameter on the front. The damage did not appreciably diminish the output of the panel and is not expected affect satellite operations.

The Sentinel impact was not an isolated incident. The orbit of the International Space Station (ISS) is adjusted several times each year to avoid larger pieces of debris that get too close. On a flexible cover from the ISS, engineers found twenty-six impact-related features. The cover had been installed on the forward port of a pressurized mating adapter from July 2013 to February 2015 before being returned to Earth.



Sentinel-1A's Solar Array (before and after) Copyright ESA

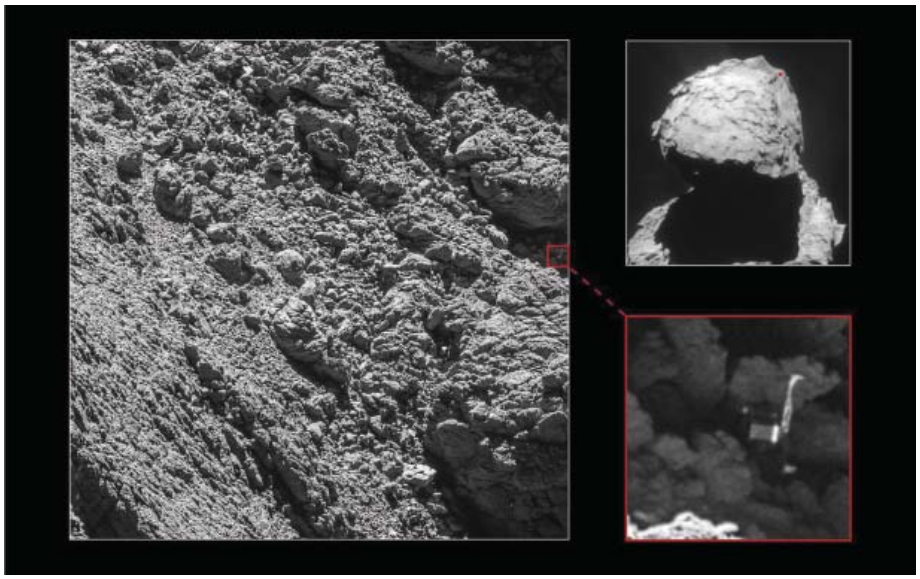
Lost Lander Found

Shortly after the Rosetta spacecraft arrived in orbit around comet

67P/Churyumov-Gerasimenko, a lander (Philae) was deployed to the comet's surface. With the comet's feeble gravity, the lander failed to maintain contact with the surface, bouncing and tumbling over the jumbled terrain (the lander's active capture systems, including a rocket thruster, ice screws and harpoons, also

failed to stabilize the lander and create a secure attachment to the surface). Philae eventually came to rest although its location could not be determined. The lander was operational for approximately three days, transmitting data on its surroundings, until its batteries were depleted. Since the batteries were not being recharged, scientists surmised that the lander had come to rest in a heavily shadowed area of the comet or in such a configuration that sunlight could not reach the body-mounted solar panels.

Philae remained hidden for almost two years. In early September, less than a month before mission end, Rosetta's high resolution camera imaged an area on the smaller lobe of the comet from a distance of only 9,000 feet (2.7 km). Within that image, scientists found the missing lander, lying on its side among boulders and at the base of an outcropping. Two of its three landing legs are visible in the image as well as its 3-foot (1 meter) wide body.



Copyright Main image and lander inset: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

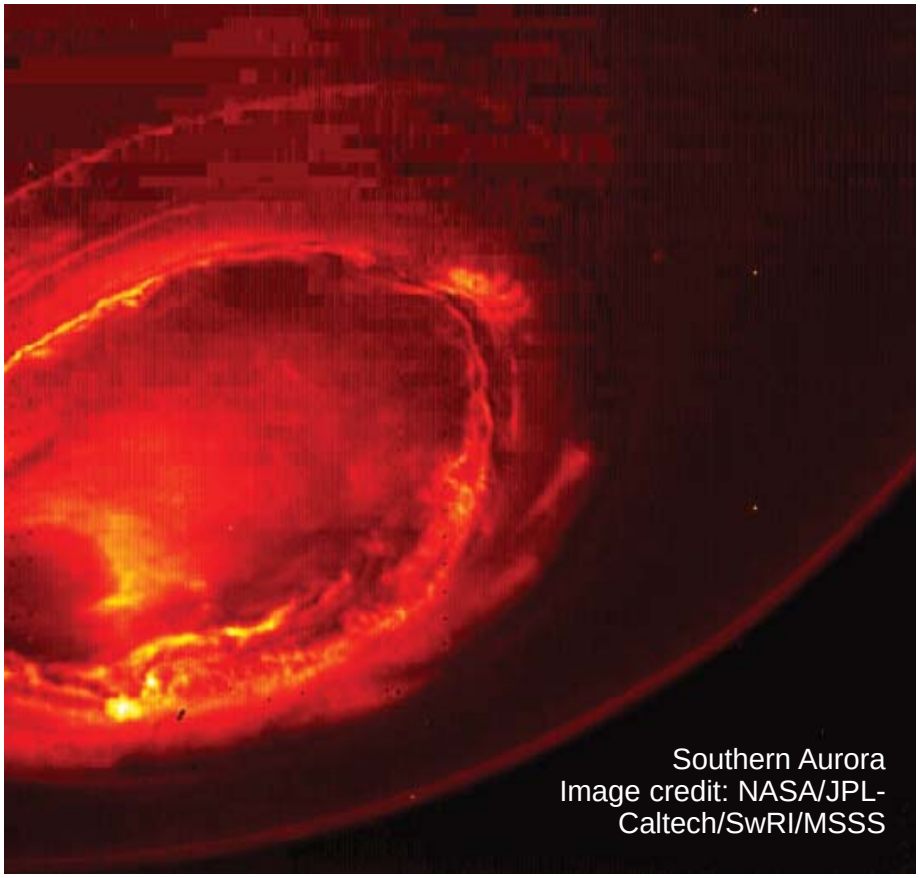
Rosetta completed its two year mission on September 30th, as the ever increasing distance from the Sun has significantly reduced the power available from its solar panels. At the end, ESA set the spacecraft down on the comet's surface and shut down the spacecraft's systems (the comet's rotation made it impractical to maintain communications with Earth).

Hidden Jupiter Revealed

Since entering orbit in July, NASA's Juno spacecraft has been providing scientists unprecedented views of Jupiter's north and south poles, regions hidden from Earth-based telescopes.

The southern aurora was captured by Juno's Jovian Infrared Auroral Mapper instrument. The image (a mosaic of three images) was captured shortly after the spacecraft had completed its closest pass over the planet's cloud tops on August 27th.

The view of the planet's northern polar region was captured by the spacecraft's JunoCam, a visible-light camera. Also captured on August 27th, approximately two hours prior to closest approach, the image shows a chaotic and turbulent atmosphere, devoid of the familiar and orderly belts and zones of the equatorial



Southern Aurora
Image credit: NASA/JPL-Caltech/SwRI/MSSS

region. Instead, the polar region appears teeming with pinwheel-shaped rotating storms. It is also much different than the views provided by the Cassini spacecraft of Saturn's polar regions with its semi-permanent, hexagonal-shaped cloud pattern in the north and gargantuan vortex in the south.

Northern Turbulence
Image credit: NASA/JPL-Caltech/SwRI/MSSS

Space Race History

On October 11, 1968, a Saturn 1-B rocket carried the first manned Apollo command and service module into low-Earth orbit. The test flight would ast almost 11 days and complete 163 orbits of the Earth. Walter Schirra (5th American in space when he flew the Mercury-Atlas 8 mission on October 3, 1962), commanded the crew along with command module pilot Donn Eisele and lunar module pilot Walter Cunningham.

The Block II command module was a redesigned and much improved version of the Block I model that was involved in the Apollo 1 accident. The two piece, inward opening and bolted hatch on the Block I model was replaced with a one-piece, outward opening, quick release hatch on the Block II module. The 100% oxygen atmosphere used in the Block I

module was also replaced with a less flammable 60% oxygen and 40% nitrogen mixture at launch. The air in the Block II module was purged and converted to 100% oxygen as the flight progressed.

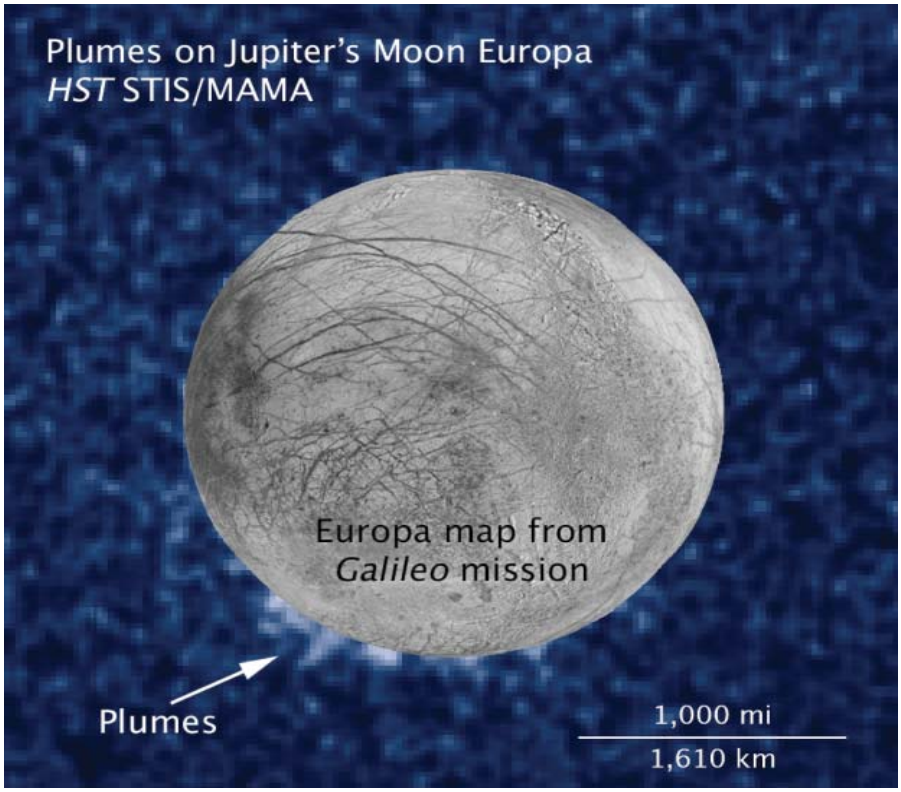
Apollo 7 did not carry a lunar lander, however, a simulated docking with the third stage was planned (the lunar lander would be carried within the third stage in future flights). Schirra canceled the docking maneuvers when one of the adapter panels on the third stage did not fully deploy (the panels were jettisoned with explosive charges on future flights to avoid such a reoccurrence since access to the lunar module was vital to a lunar mission).

There were relatively few problems with the spacecraft and most were resolved before Apollo 8 made its historic trip to the Moon in the following December. The service module's main engine, required to enter into and leave lunar orbit performed flawlessly, restarting eight times during the mission. The overall performance of the Apollo 7 command and service module was a significant factor in NASA's decision to send Apollo 8 to the Moon after only one low-Earth test flight.

An Active Europa

Two independent teams have now provided evidence of active water plumes on Jupiter's moon Europa. In 2012, a Southwest Research Institute (SwRI) team found evidence of water vapor erupting from the moon's south polar region with the Hubble Space Telescope's Imaging Spectrograph instrument. The plumes were estimated to extend more than 100 miles (160 km) into space.

In a NASA press conference on September 26th, a team led by an investigator from the Space Telescope Science Institute (STScI) announced that they had imaged, what they believed to be, plumes erupting from the moon. The team also used the telescope's Imaging Spectrograph, but with a different technique. Europa was imaged on ten separate occasions over a period of 15 months as the moon transited the disk of Jupiter. On three occasions, ghostly tendrils were seen erupting from the southern hemisphere. The eruptions were similar in estimated mass, height above the surface and appeared in the same approximate location as the SwRI observations (the two teams have not imaged the plumes at the same time).



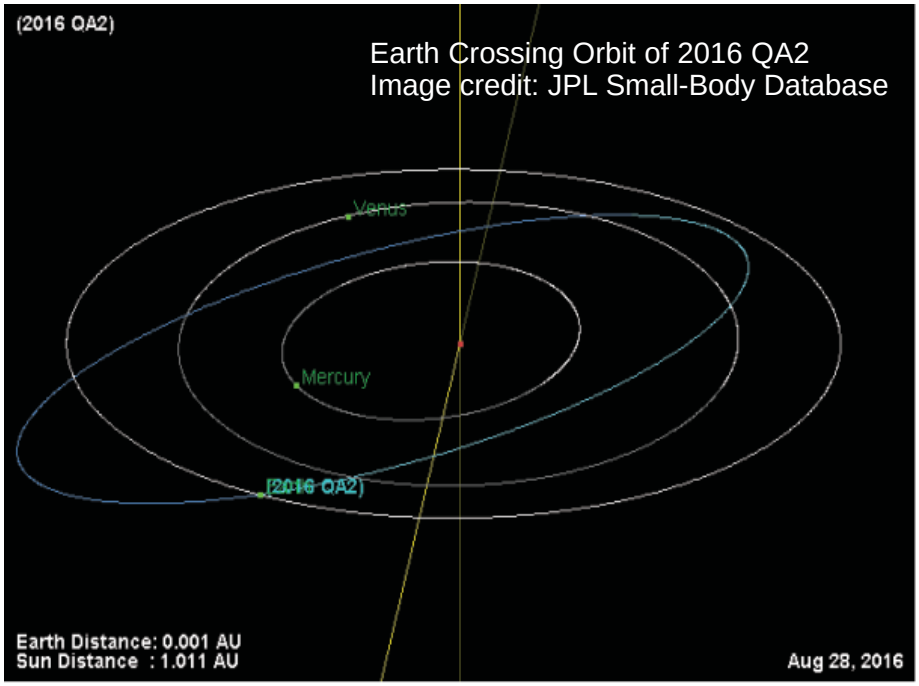
Credit: NASA, ESA, W. Sparks (STScI), the USGS Astrogeology Science Center, and Z. Levay (STScI

If Europa is active (much like Saturn's moon Enceladus), then sampling of the subsurface ocean may just have gotten a bit easier. With plume material raining down on the surface, samples could be gathered by a lander without having to penetrate the icy crust.

Planetary Threats

On August 28th, a newfound asteroid (2016 QA2) passed within 50,000 miles (80,000 km) of Earth. The object was estimated to be between 80 and 180 feet (25 to 55 meters) wide, slightly larger than the object that exploded over the Russian city of Chelyabinsk in February 2013.

The asteroid's elliptical orbit carries it inside the Earth's orbit (Aten class of Near Earth Objects) completing one circuit every 350 days. 2016 QA2 had been discovered only hours earlier.



Retrospective: Hallow**een 2008**

Close encounters of cosmic debris happen frequently and many of the smaller rocks go undetected until they are relatively nearby. As a general rule, meteoroids smaller than 82 feet (25 meters) cause little damage as they breakup in the Earth's atmosphere. Meteoroids up to ½ mile or 1 km in size would cause localized damage with anything larger having a global impact.

The Torino Scale is used to communicate the risks of an asteroid or comet colliding with the Earth in the next hundred years. The scale ranks the impact potential of Near Earth Objects (NEOs) from 0 to 10. An object with little or no chance of collision is assigned a value of 0 while a certain, catastrophic impact would be a 10. To date NEO has been ranked higher than 4.

October Nights

As the nights grow longer and cooler our view of the night sky begins to change. Summer evenings showcase our own galaxy, the Milky Way. The center of our spiral galaxy is in the direction of the constellation Sagittarius, which appears in the southern sky throughout the summer. In the autumn, as Sagittarius disappears into the west, the stars forming the Great Square of Pegasus rise in the east. Following Pegasus is the Andromeda Galaxy, one of the most distant objects that can be seen with the unaided eye at approximately 2.5 million light years (14.7 million trillion miles). With the rising of Andromeda, we begin to look outward to the outer arms of our own galaxy and to other galaxies far, far away.

Sunrise and Sunset
(from New Milford, CT)

Sun	Sunrise	Sunset
October 1st (EDT)	06:51	18:35
October 15th	07:06	18:12
October 30th	07:25	17:49

Astronomical and Historical Events

30th Connecticut Star Party (CSP), Goshen, Connecticut (through the 2nd) (*http://asnh.org/slideshow/CSPpicIndex.php*)
1st History: NASA created by the National Aeronautics and Space Act (1958)
2nd Comet 2P/Encke at Opposition (1.420 AU)
2nd History: opening of the Hayden Planetarium (1935)
3rd Distant flyby of Saturn's moons *Titan* and *Helene* by the Cassini orbiter
3rd History: launch of the fifth Mercury flight, piloted by astronaut Walter Schirra (1962)
3rd History: fall of the Zagami Martian meteorite in Katsina Province, Nigeria; the meteorite is classified as a Shergottite and is the largest single individual Mars meteorite ever found at 40 pounds (1962)
3rd History: fall of the Chassigny Martian meteorite in Haute-Marne province, France; the meteorite is distinctly different from other Martian meteorites (shergottites and nakhilites) and is classified as its own subgroup – "chassignites" (1815)
4th Moon at apogee (furthest distance from Earth in its orbit)
4th History: Japanese lunar probe "Selenological and Engineering Explorer" (SELENE) enters lunar orbit; also known as Kaguya, the spacecraft was designed to study the geologic evolution of the Moon (2007)
4th History: SpaceShipOne rockets to an altitude of almost 70 miles to win the $10 million Ansari X Prize (2004)
4th History: launch of Luna 3; Soviet spacecraft was first to photograph the far side of the Moon (1959)
4th History: launch of Sputnik 1, world's first artificial satellite (1957)
5th History: launch of the space shuttle Challenger (STS-41-G), crew included astronaut Kathryn Sullivan, first American women to walk in space (1984)
5th History: Robert Goddard born, founding father of modern rocketry (1882)
6th Comet 86P/Wild at Opposition (2.884 AU)
6th Apollo Asteroid 462959 (2011 DU) near-Earth flyby (0.039 AU)
6th Apollo Asteroid 2005 UO near-Earth flyby (0.088 AU)
6th Kuiper Belt Object 2008 ST291 at Opposition (59.140 AU)

Astronomical and Historical Events (continued)

- 6th History: Asteroid 2008 TC3 discovered by astronomers on Mt. Lemmon less than 24 hours before exploding over the Sudan. The McCarthy Observatory submitted the last accepted observation. Fragments of the asteroid were eventually recovered. (2008)
- 6th History: launch of the space shuttle Discovery and the solar polar orbiter spacecraft Ulysses (1990)
- 7th Apollo Asteroid 2016 LB9 near-Earth flyby (0.098 AU)
- **8th Second Saturday Stars** at the McCarthy Observatory (7:00 PM)
- 8th History: discovery of Supernova 1604 (Kepler's Nova) (1604)
- 9th First Quarter Moon
- 9th Draconids Meteor Shower peak (produced by debris from Comet Giacobini-Zinner)
- 9th Apollo Asteroid 2012 SL50 near-Earth flyby (0.085 AU)
- 9th Aten Asteroid 2100 Ra-Shalom closest approach to Earth (0.150 AU)
- 9th History: LCROSS impacts crater Cabeus near the Moon's south pole in search of water (2009)
- 9th History: Peekskill meteorite fall; 27 pound meteorite hits a 1980 Chevy Malibu sitting in its driveway in Peekskill, NY (1992)
- 10th Amor Asteroid 2010 SG15 near-Earth flyby (0.088 AU)
- 10th Aten Asteroid 2013 LC1 near-Earth flyby (0.097 AU)
- 10th Kuiper Belt Object 303775 (2005 QU182) at Opposition (50.813 AU)
- 10th History: inauguration of the Very Large Array, one of the world's premier astronomical radio observatories; located west of Socorro, New Mexico (1980)
- 10th History: enactment of the Outer Space Treaty: 1) prohibited placement of nuclear and other weapons of mass destruction in orbit, on the Moon or other celestial body and 2) limited the use of the Moon and other celestial bodies to peaceful purposes (1967)
- 10th History: discovery of Neptune's moon Triton by William Lassell (1846)
- 11th History: NASA's historic 100th space shuttle flight as Discovery carries the Z1 Truss (first piece of the ISS structural backbone) into space (2000)
- 11th History: Magellan spacecraft burns up in the Venusian atmosphere after completing its mission to map the planet with its imaging radar (1994)
- 11th History: launch of first manned Apollo mission (Apollo 7) with astronauts Schirra, Eisele and Cunningham (1968)
- 11th History: launch of WAC Corporal, first man-made object (16 foot rocket) to escape Earth's atmosphere (1945)
- 12th Kuiper Belt Object 19308 (1996 TO66) at Opposition (46.310 AU)
- 12th History: launch of Voskhod 1; Soviet spacecraft was first to carry multiple (3) cosmonauts (a pilot, scientist and physician) into space. Due to the cramped conditions the crew flew without spacesuits, ejection seats, or an escape tower (1964)
- 12th History: first Symposium on Space Flight held at the Hayden Planetarium in New York City; participants included Wernher von Braun, Willy Ley, and Fred L. Whipple; topics included an orbiting astronomical observatory, survival in space, circumlunar flight, a manned orbiting space station, and the question of sovereignty in outer space (1951)
- 13th Aten Asteroid 2007 TR68 near-Earth flyby (0.050 AU)
- 13th History: launch of Shenzhou 6, China's second manned spacecraft (2005)
- 13th History: launch of Explorer 7; spacecraft measured solar X-rays, energetic particles, and cosmic rays (1959)
- 13th History: formation of the British Interplanetary Society by Phillip Cleator in Liverpool (1933)
- 14th Apollo Asteroid 2016 RW near-Earth flyby (0.056 AU)
- 14th Apollo Asteroid 6063 Jason closest approach to Earth (1.522 AU)
- 14th History: three main belt asteroids discovered by the McCarthy Observatory while searching for NEOs. 2003 TG10 (its provisional name) was subsequently named after Monty Robson (115449 Robson), the founder and director of the observatory (2003)
- 14th History: launch of Shenzhou 5, first Chinese manned spacecraft (2003)

Astronomical and Historical Events (continued)

14th History: Air Force Captain Chuck Yeager breaks the sound barrier in the Bell X-1 rocket plane (called "Glamorous Glennis" as a tribute to his wife). The plane reached a speed of 700 miles per hour after being launched from the bomb bay of a Boeing B-29 (1947)
15th History: launch of the Cassini spacecraft to the planet Saturn (1997)
16th Moon at perigee (closest distance to Earth)
16th Full Moon (Full Hunter's Moon)
16th Apollo Asteroid 2016 PR38 near-Earth flyby (0.053 AU)
16th Kuiper Belt Object 202421 (2005 UQ513) at Opposition (47.311 AU)
16th History: launch of GOES 1, first weather satellite placed in geosynchronous orbit (1975)
17th Dwarf Planet 136199 Eris (formally 2003 UB313 and/or Xena) at Opposition (95.226 AU)
18th Aten Asteroid 2014 UR near-Earth flyby (0.031 AU)
18th History: launch of the space shuttle Atlantis (STS-34) and Galileo spacecraft to Jupiter (1989)
18th History: discovery of Chiron by Charles Kowal; Chiron has the characteristics of both a comet and an asteroid. These types of objects are called Centaurs after a mythological being that are half human/half horse (1977)
18th History: Soviet spacecraft Venera 4 enters the atmosphere of Venus; first probe to analyze the environment (in-situ) of another planet (1967)
18th History: discovery of Asteroid 8 Flora by John Hind (1847)
19th History: flyby of the planet Venus by the Mariner 5 spacecraft (1967)
19th Moon occults Aldebaran
19th Apollo Asteroid 2013 EC20 closest approach to Earth (1.974 AU)
19th History: Subrahmanyan Chandrasekhar born; awarded Nobel Prize in Physics (1983) for studies of the structure and evolution of stars; NASA named its premier X-ray observatory the Chandra X-ray telescope in his honor (1910)
20th Scheduled launch of a Russian cargo-carrying Progress spacecraft from the Baikonur Cosmodrome in Kazakhstan to the International Space Station
20th Kuiper Belt Object 308379 (2005 RS43) at Opposition (42.385 AU)
20th History: launch of the Soviet spacecraft Zond 8; moon flyby mission (1970)
20th History: discovery of asteroid 577 Rhea by Max Wolf (1905)
21st Orionids Meteor Shower peak (produced by debris from Comet Halley)
21st History: NASA's Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft successfully entered orbit around Mars - first spacecraft dedicated to studying the Martian atmosphere and its connection to the Red Planet's climate (2014)
21st History: dedication of the Yerkes Observatory in Williams Bay, Wisconsin; home of the world's largest refractor with its 40-inch objective lens ground and polished by Alvan Clark and Sons (1897)
22nd Last Quarter Moon
22nd Asteroid 18 Melpomene at Opposition (7.4 Magnitude)
22nd History launch of Chandrayaan-1, India's first mission to the Moon (2008)
22nd History: Soviet spacecraft Venera 9 touches down on Venus and transmits first pictures (black and white) of its surface (1975)
22nd History: launch of the Soviet Moon orbiter Luna 12 to take high-resolution photos of the Moon's surface from lunar orbit (1966)
23rd Distant flyby of Saturn's moon *Telesto* by the Cassini orbiter
23rd Apollo Asteroid 2015 HE10 near-Earth flyby (0.076 AU)
23rd Apollo Asteroid 2013 UD1 near-Earth flyby (0.090 AU)
23rd Dwarf Planet Ceres closest approach to Earth (1.900 AU)
23rd History: India's Mars Orbiter Mission (MOM) entered orbit around Mars (2014)
23rd History: first time female commanders led orbital missions at the same time: Pamela Melroy commanded space shuttle Discovery (STS-120) to the ISS while Peggy Whitson led the Expedition 16 team aboard the ISS in the installation of a new orbital node (2007)

Astronomical and Historical Events (continued)

- 24th Kuiper Belt Object 55636 (2002 TX300) at Opposition (41.446 AU)
- 24th History: launch of Chang'e-1, Chinese lunar orbiter, from the Xichang Satellite Launch Center in the southwestern province of Sichuan (2007)
- 24th History: Mars Odyssey enters orbit around Mars (2001); science goals included mapping the elemental composition of the surface
- 24th History: launch of Deep Space 1; first of a series of technology demonstration probes developed by NASA's New Millennium Program; propulsion was provided by a xenon ion engine that operated for a total of 16,265 hours (1998)
- 24th History: Over 100 people killed in a launch pad explosion when Air Marshal Mitrofan Nedelin, commander of the USSR's Strategic Rocket Forces, orders workers back to the pad to repair a defective R-16 missile without first unloading the unstable fuel (1960)
- 24th History: discovery of Uranus' moons Umbriel and Ariel by William Lassell (1851)
- 25th Aten Asteroid 2015 KA near-Earth flyby (0.097 AU)
- 25th History: launch of the twin Solar Terrestrial Relations Observatories (STEREO A and B); 3-D studies of the Sun and coronal mass ejections (2006)
- 25th History: Soviet spacecraft Venera 10 touches down on Venus 2,200 km from its twin Venera 9; lands on a flat boulder that was determined to be similar in composition to basalt on Earth (1975)
- 25th History: discovery of Saturn's moon Iapetus by Giovanni Cassini (1671)
- 26th Amor Asteroid 7088 Ishtar closest approach to Earth (0.658 AU)
- 26th Aten Asteroid 3362 Khufu closest approach to Earth (1.221 AU)
- 26th Apollo Asteroid 29075 (1950 DA) closest approach to Earth (1.785 AU)
- 27th Aten Asteroid 413260 (2003 TL4) near-Earth flyby (0.026 AU)
- 27th Aten Asteroid 2012 UA34 near-Earth flyby (0.095 AU)
- 27th Kuiper Belt Object 15760 (1992 QB1); first resident of the Kuiper Belt found beyond Pluto, at Opposition (40.284 AU)
- 27th History: first test flight of the Saturn I rocket (1961)
- 28th History: first (and last) test flight of the Ares I-X rocket; a two minute powered suborbital flight (2009)
- 28th History: launch of Prospero spacecraft, Great Britain's first space launch (1971)
- 29th Distant flyby of Saturn's largest moon *Titan* by the Cassini orbiter
- 29th Plutino 47171 (1999 TC36) at Opposition (29.578 AU); 47171 is comprised of three trans-Neptunian objects. It is classified as a plutino with a 2:3 mean motion resonance with Neptune
- 29th Kuiper Belt Object 42301 (2001 UR163) at Opposition (51.524 AU)
- 29th History: launch of the space shuttle Discovery (STS-95) with astronaut and then U.S. Senator, John Glenn (1998)
- 29th History: flyby of asteroid *Gaspra* by the Galileo spacecraft on mission to Jupiter (1991)
- 30th New Moon
- 30th Centaur Object 20461 *Dioretsa* at Opposition (27.633 AU)
- 30th History: discovery of the Los Angeles (Mars) Meteorite (1999)
- 30th History: launch of Venera 13, Soviet Venus lander; lander survived for 127 minutes on the surface where the temperature was recorded at 855 °F (1981)
- 30th History: Mercury Theatre broadcasts Orson Welles' adaptation of H.G. Wells "War of the Worlds" (1938)
- 31st Moon at apogee (furthest distance from Earth in its orbit)
- 31st Apollo Asteroid 164121 (2003 YT1) near-Earth flyby (0.035 AU)
- 31st Aten Asteroid 3753 Cruithne closest approach to Earth (0.511 AU)
- 31st History: Walter Baade's discovery of the first Centaur Object, 944 Hidalgo (1920)
- 31st History: birthday of Apollo 11 Command Module pilot Michael Collins (1930)
- 31st History: first rocket engine tests by three young rocketeers that would be the beginning of what would become the Jet Propulsion Laboratory (1936)

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

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.*

Commonly Used Terms

- Apollo: a group of near-Earth asteroids whose orbits also cross Earth's orbit; Apollo asteroids spend most of their time outside Earth orbit.
- Aten: a group of near-Earth asteroids whose orbits also cross Earth's orbit, but unlike Apollos, Atens spend most of their time inside Earth orbit.
- Atira: a group of near-Earth asteroids whose orbits are entirely within Earth's orbit
- Centaur: icy planetesimals with characteristics of both asteroids and comets
- Kuiper Belt: region of the solar system beyond the orbit of Neptune (30 AUs to 50 AUs) with a vast population of small bodies orbiting the Sun
- position: celestial bodies on opposite sides of the sky, typically as viewed from Earth
- Plutino: an asteroid-sized body that orbits the Sun in a 2:3 resonance with Neptune
- Trojan: asteroids orbiting in the 4th and 5th Lagrange points (leading and trailing) of major planets in the Solar System

Image Credits

Front page design and graphic calendars: Allan Ostergren. Image by Bill Cloutier.

Second Saturday Stars poster: Marc Polansky.

Front Page

An active water plume on Jupiter's moon Europa? No, it's a vast alluvial fan in China's western desert of Takla Machan. A key transit point along the ancient Silk Road, Takla Machan can be an oasis of small mountain streams and warm caves, or a vicious dust bowl and permanent rest area,

The image was taken in May,2002, by NASA's Terra satellite (Thermal Emissions and Reflection Radiometer). The satellite's mission is to monitor the Earth's climate and atmosphere.For more information on Terra, go to http://terra.nasa.gov/. . . For more on Europa's water plumes, go to page 9.

Page 3 Photo

The Yerkes Observatory is home to the largest refracting telescope in the world. The 40-inch lenses were ground and polished by Alvan Clark and Sons in Cambridgeport, Massachusetts from glass disks cast by Mantois of Paris. Warner and Swasey of Cleveland built the telescope mount and the 90-foot diameter dome seen in the cover photo. The telescope's tube that houses the optics is 63 feet long (dictating the large dome).

The observatory was the brainchild of George Ellery Hale with funding provided by transit tycoon Charles Tyson Yerkes. The observatory was dedicated on October 21, 1897. Photo by Bill Cloutier

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

October 8th
7:00 - 9:00 pm

A Lunar
Sunrise

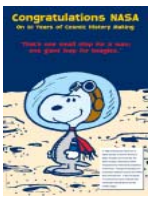
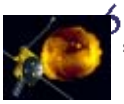
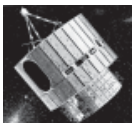
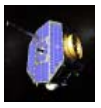
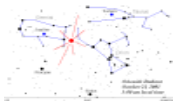
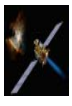
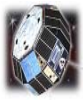
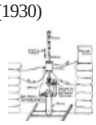
Celebrating International
Observe the Moon Night

Refreshments
Family Entertainment
Handicapped Accessible
ASL Interpretation Available
with Prior Notice
Rain or Shine

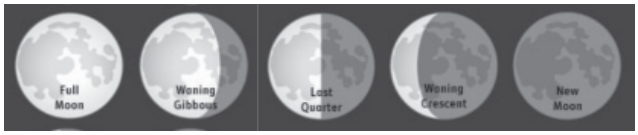
Map

October 2016

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Phases of the Moon  Oct 4 — Oct 9					30  Connecticut Star Party (CSP), Goshen, Connecticut (April 30 through May 2)	1  NASA created by the National Aeronautics and Space Act (1958)
2  Hayden Planetarium founded (1935)	3 Launch of Mercury-Atlas 8 with Walter Schirra (1962)  Chassigny meteorite, determined origin of Mars (1815)  Zagami Martian meteorite in Katsina Province, Nigeria (1962) 	4  Luna 3: Soviet spacecraft, first to photograph the far side of the Moon (1959) SpaceShipOne, 70 miles up, to win Ansari X Prize (2004)   World Space Week, Oct. 4-10 "The Era of Deep Space Discovery" Launch of first manned Apollo mission (1968)	5  Robert Goddard born, founding father of modern rocketry (1882)	6  Launch of space shuttle Discovery and solar polar orbiter spacecraft Ulysses (1990) Asteroid 2008 TC3, tracked by McCarthy Observatory, explodes over Sudan (2008) 	7  Launch of Explorer 6, with "paddlewheel satellite," a photocell scanner transmitting a crude picture of the earth's surface and cloud cover (1959))	8  Discovery of Supernova 1604 - Kepler's Nova (1604) Pioneer Venus orbiter concludes mission and begins fiery plunge into Venusian atosphere (1992)  2nd Saturday Stars Open House McCarthy Observatory 
9  Draconids meteor shower peak LCROSS impacts Moon's south pole (2009)   Peekskill meteorite hits Chevy Malibu (1992)	10 Enactment of outerspace treaty (1967)   Inauguration of the Very Large array in New Mexico (1980)	11  WAC Corporal, first rocket to escape Earth's atmosphere (1945) 100th space shuttle flight carries Z1 Truss, backbone of the ISS (2000) 	12  First symposium on space travel, held at Hayden Planetarium (1951) Launch of Voskhod 1, Soviet spacecraft, first to carry multiple cosmonauts (1964) 	13  Launch of Explorer 7 spacecraft (1959) Launch of Shenzou 6, China's 2nd manned spacecraft (2005)   British Interplanetary Society founded (1933)	14  Launch of Shenzou 5, China's 1st manned spacecraft (2003) Chuck Yeager breaks sound barrier (1947)   Three main belt asteroids discovered by McCarthy Observatory (2003)	15 Dwarf Planet Eris (formally 2003 UB313 and/or Xena) at Opposition (95.542 AU)   Launch of Cassini spacecraft to planet Saturn (1997)
16  Moon at Perigee (closest to earth)  Launch of GOES 1, first weather satellite in geosynchronous orbit (1975)	17  Mae Carol Jemison born, American physician and NASA astronaut; became first black woman in space aboard the Shuttle Endeavour on September 12, 1992; has appeared on television several times, including an episode of *Star Trek: The Next Generation.* (1956)	18  Discovery of Asteroid 8 Flora by John Hind (1847) Soviet spacecraft Venera 4 probes atmosphere of Venus; (1967)   Discovery of asteroid/ comet Chiron in Taurus by Charles Kowal (1977) Launch of space shuttle Atlantis and Galileo spacecraft to Jupiter (1989) 	19  launch of IBEX (Interstellar Boundary Explorer) to explore the edge of solar system (2008) Subrahamanyan Chandrasekar wins Nobel physics prize for study of star evolution (1983) 	20  Discovery of asteroid 577 Rhea by Max Wolf (1905)  Launch of Soviet spacecraft Zond 8, Moon flyby mission (1970)	21  Opening of the Yerkes Observatory, Williams Bay, Wisonsin, with world's largest refractor lens (40") (1897)  Orionids meteor shower peak	22 Soviet spacecraft Venera 9 lands on Venus, takes first b/w pictures of planet's surface (1975)   Launch of the Soviet orbiter Luna 12 to take high-resolution photos of the Moon's surface from lunar orbit (1966) Launch of India's first Moon mission Chandrayaan-1 (2008) 
23  Partial Solar Eclipse, visible from eastern United States   Pamela Melroy and Peggy Whitson first women to lead two missions at same time (shuttle and space station) (2007)	24  Launch of Deep Space 1 (1998) Launch of Chang'e-1, Chinese lunar orbiter (2007)   Discovery of Uranus' moons Umbriel and Ariel by William Lassell (1851)	25  Discovery of Saturn's moon Iapetus by Giovanni Cassini (1671) Launch of twin Solar Terrestrial Relations Observatories (STEREO A&B) for 3-D studies of Sun (2006)   Soviet spacecraft Venera 10 touches down on Venus (1975)	26  Soviet Union releases first images of the far side of the Moon, taken by Luna III spacecraft, showing a more mountainous terrain than seen from Earth and only two dark, low-lying regions. (1959)	27 first test flight of the Saturn I rocket (1961)   Cañon City, Colorado meteor hits garage - 1973	28 First test flight of the Ares I-X rocket; a two minute powered suborbital flight (2009)   Launch of Prospero, Britain's first space mission (1971)	29  Launch of space shuttle Discovery (STS-95) with astronaut and former senator John Glenn (1998)  Flyby of asteroid Gaspra by the Galileo spacecraft on mission to Jupiter (1991)
30  Mercury Theatre War of Worlds broadcast with Orson Welles produces panic(1938) Discovery of the Los Angeles (Mars) Meteorite (1999)   Launch of Venera 13, Soviet Venus lander; survived for 127 minutes on the surface where the temperature was recorded at 855 °F (1981)	Moon at Apogee (farthest from earth) 31   Apollo 11 Command module pilot Michael Collins born (1930) First rocket engine tests that spawned the Jet Propulsion Laboratory (1936) 					

Phases of the Moon



Oct 16 — Oct 22 — Oct 30