Galactic Observer

John J. McCarthy Observatory

Volume 8, No. 2 February 2015

Fireball From Space

A Romulan plasma torpedo? . . .
Not exactly. ***See inside, page 19***

The John J. McCarthy Observatory

New Milford High School
388 Danbury Road
New Milford, CT 06776

Phone/Voice: (860) 210-4117
Phone/Fax: (860) 354-1595
www.mccarthyobservatory.org

JJMO Staff

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

Steve Barone
Colin Campbell
Dennis Cartolano
Mike Chiarella
Jeff Chodak
Bill Cloutier
Cecilia Dietrich
Dirk Feather
Randy Fender
Randy Finden
John Gebauer
Elaine Green
Tina Hartzell
Tom Heydenburg
Jim Johnstone
Carly KleinStern
Bob Lambert
Roger Moore
Parker Moreland, PhD
Allan Ostergren
Marc Polansky
Joe Privitera
Monty Robson
Don Ross
Gene Schilling
Katie Shusdock
Jon Wallace
Paul Woodell
Amy Ziffer

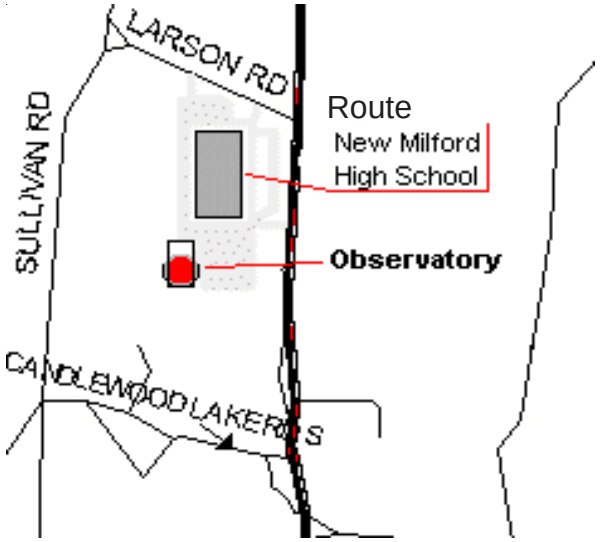
Galactic Observer Editorial Committee

Managing Editor
Bill Cloutier

Production & Design
Allan Ostergren

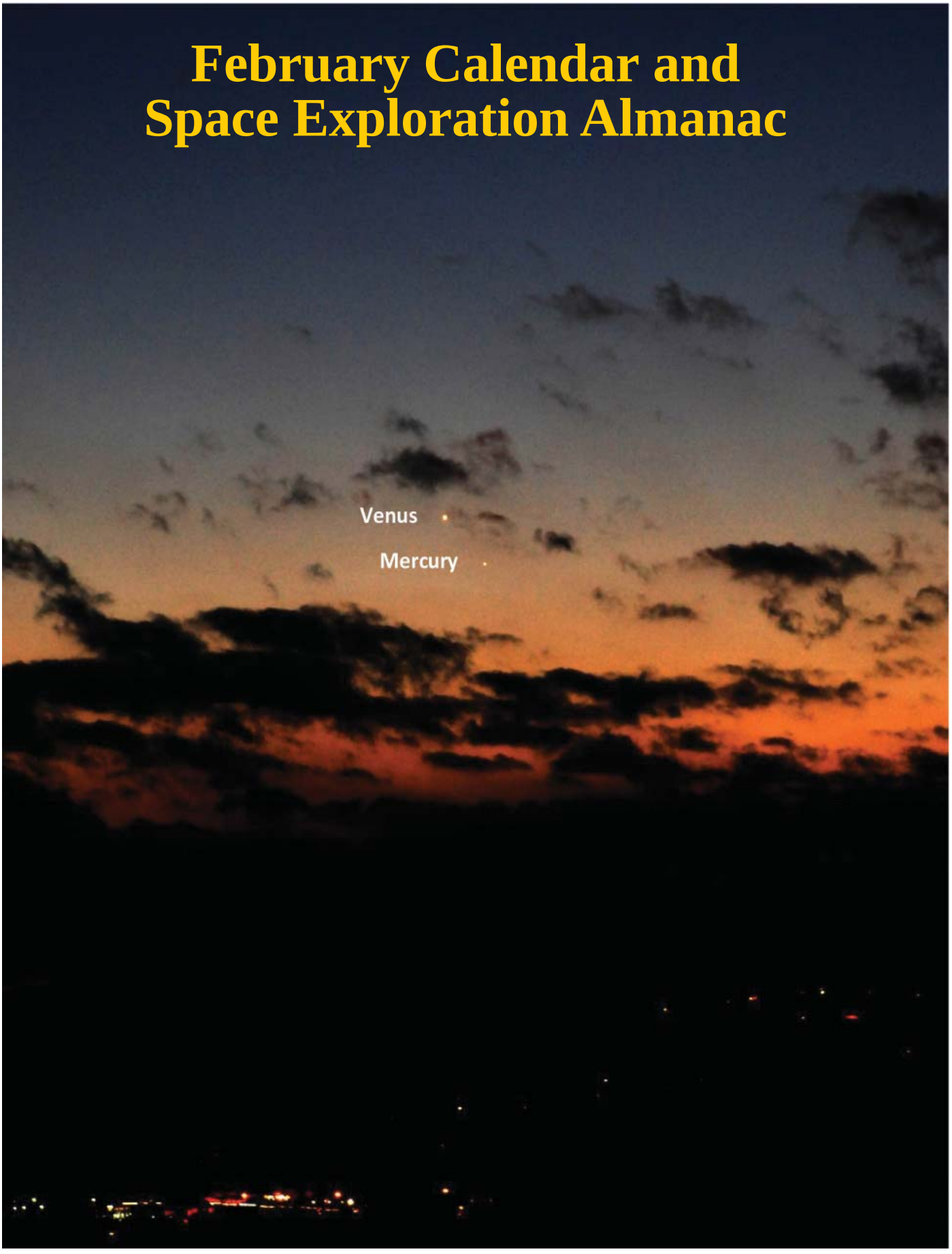
Website Development
Marc Polansky

Technical Support
Bob Lambert
Dr. Parker Moreland



In This Issue

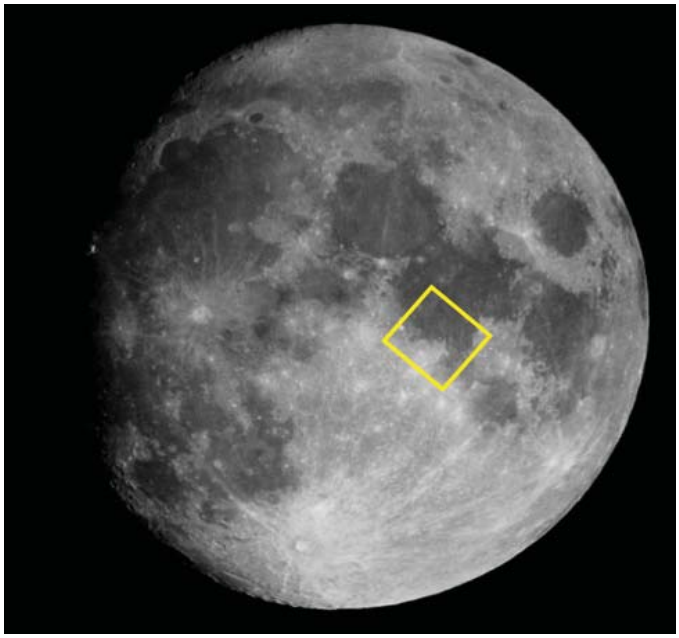
February Calendar and Space Exploration Almanac



A January Evening with Venus and Mercury on the Western Horizon

"Out the Window on Your Left"

It's been over 45 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



Lunar seas are actually expansive low-lying plains formed by ancient lava flows

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).

The Sun illuminates Mare Tranquillitatis (Sea of Tranquility) in this month's photo. The volcanic plain is home to a number of historic sites in the early history of lunar exploration.

The image on the following page includes the twin craters Ritter and Sabine (convenient landmarks for observers navigating the lunar landscape). The bright crater Moltke bounds the eastern reach of the Hypatia Rille. The rille (fault) was nicknamed U.S. 1 by the Apollo 10 crew due to its appearance from orbit as a lunar highway.

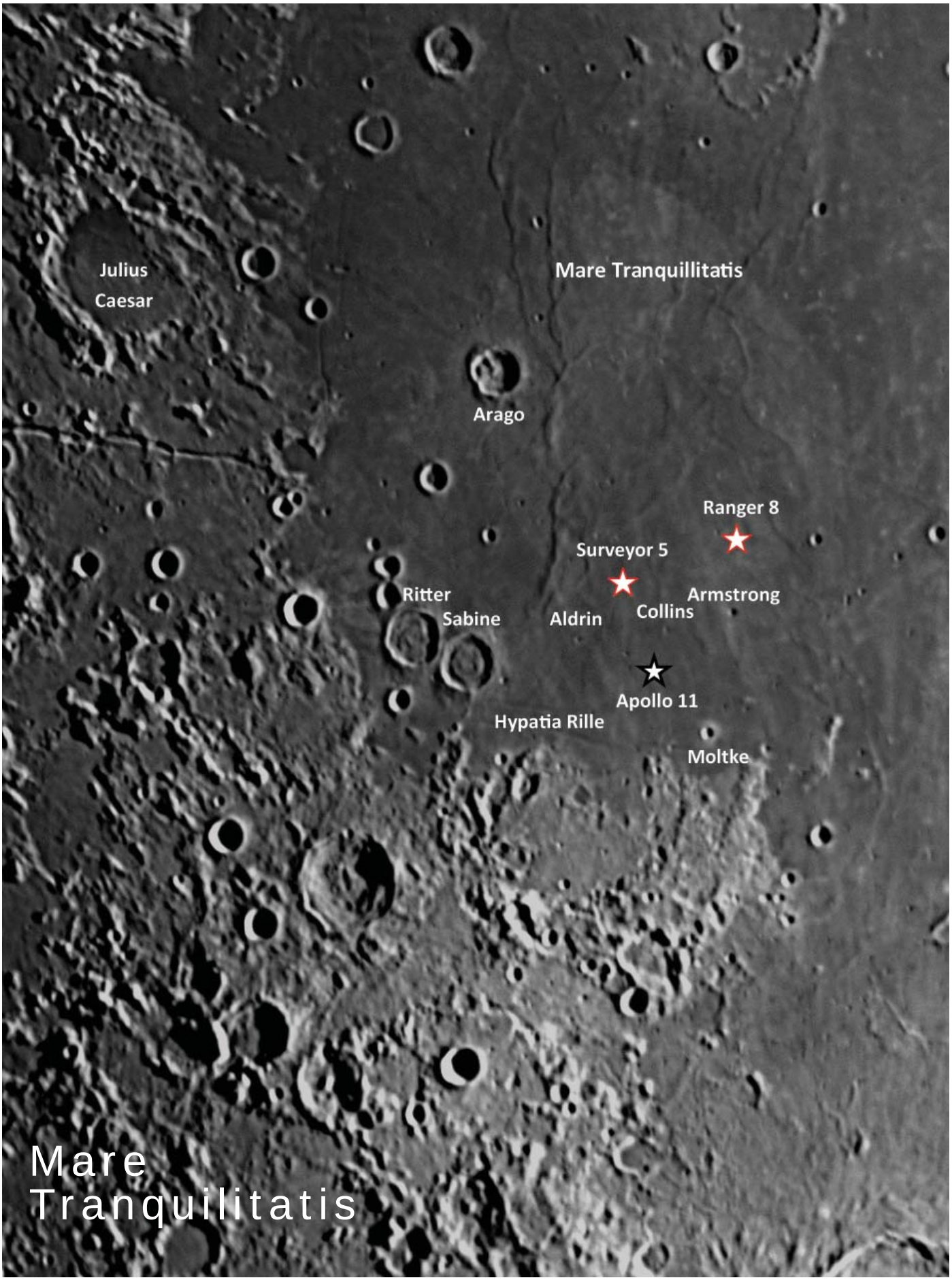
The Apollo 11 landing site is the most well-known. Not far from the site are three small craters named in honor of the three Apollo 11 astronauts. Lesser known is the impact site of Ranger 8 (1965) and landing site of Surveyor 5 (1967). The Ranger program sent a series of robotic probes to the Moon, taking close-up images of the lunar surface in the last few minutes before impact. The images were used to evaluate and select potential landing sites for the Apollo program. Ranger 8 was the second successful Ranger mission. The spacecraft transmitted 7,137 photographs from six television cameras before impacting on the plains of Mare Tranquillitatis on February 20, 1965, north of crater Sabine E (which would later be renamed for Neil Armstrong). The final image taken before impact had a resolution of 5 feet (1.5 meters).

Surveyor 5 landed 9 miles (15 km) to the west-northwest of crater Sabine D (which would later be renamed for Michael Collins). The Surveyor program was intended to validate the technology for soft landing on the Moon, evaluate landing site conditions and perform in situ analysis of the lunar regolith. Surveyor 5 was the third successful Surveyor mission. Following its landing on September 10, 1967, Surveyor returned a total of 19,118 pictures during its three months of operation (four lunar days).

Surveyor 5 was the most successful of the Surveyor lander series beginning with a precession landing on the slope of a small, rimless crater. It was the first to chemically analyze the lunar soil. Data returned from the lander's instruments established the volcanic origin of Moon's surface. It also confirmed the stability of the soil for future landings.

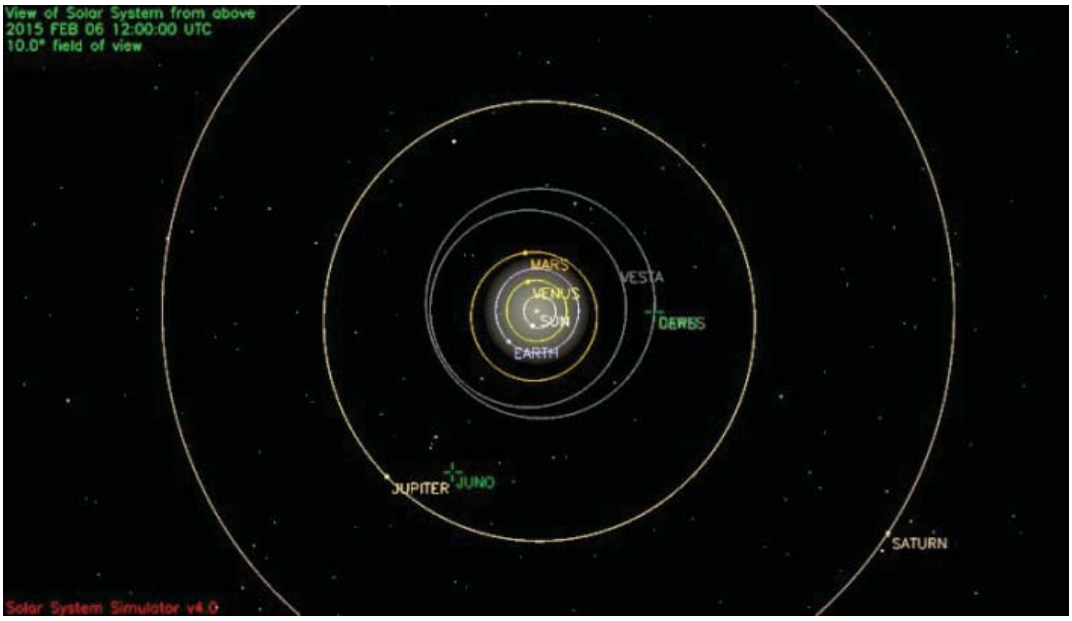
Lunar surface imaged by Surveyor 5. Source: NASA

West-looking image of the Apollo landing site during last orbit before descent, while still docked to the command module. Landing site is just to right of center; the dark image on left is LM thruster in the field of view. Source: NASA.


Julius
Caesar
Mare Tranquillitatis
Arago
Ranger 8
Surveyor 5
Ritter
Sabine
Aldrin
Collins
Armstrong
Apollo 11
Hypatia Rille
Moltke
Mare
Tranquilitatis

Jupiter at Opposition

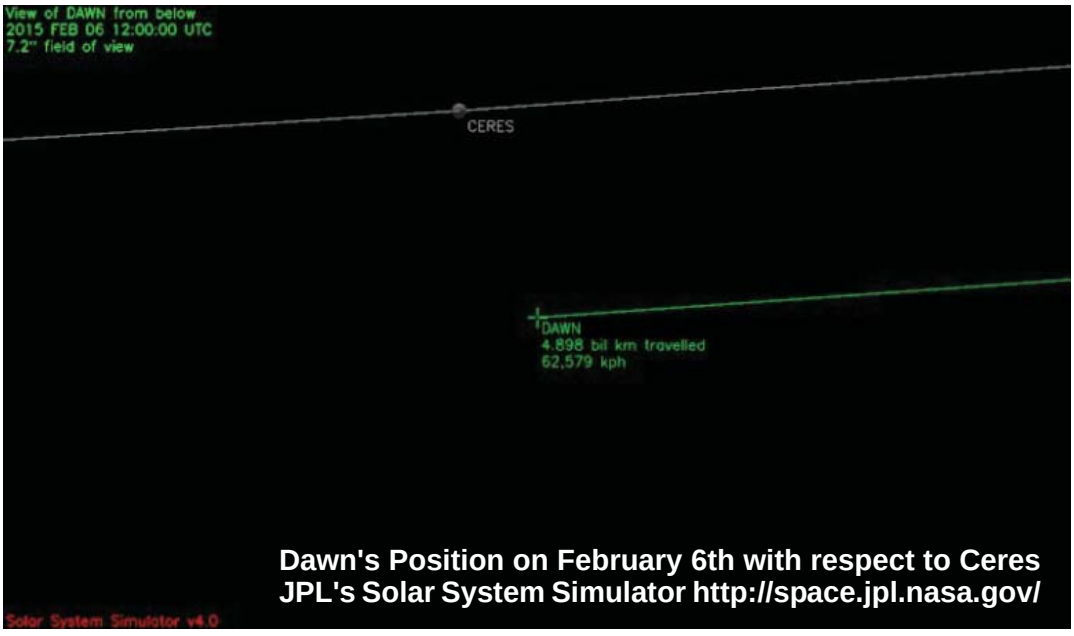
The Earth passes between the Sun and Jupiter on February 6th, placing Jupiter opposite the Sun in the Earth's sky. On that date ("Opposition"), Jupiter will rise as the Sun sets and remain visible throughout the night (highest in the sky at midnight). Opposition is also a time when Jupiter is closest to the Earth (occurring approximately every 13 months). On the 6th, Jupiter will be 404 million miles (650 million km) from Earth or 36.2 light minutes (time it would take light to travel between the two bodies). The next few months will offer excellent telescopic views of the gas giant and its four large Galilean moons.



Final Approach

The orbit diagram (above) for February 6th was produced by the Jet Propulsion Laboratory's Solar System Simulator (http://space.jpl.nasa.gov/). The graphic includes spacecraft as well as the planets. Approaching Jupiter is the Juno spacecraft (shown in green). Juno was launched in August 2011 and is scheduled to arrive at Jupiter in July 2016. More difficult to discern is the marker for the Dawn spacecraft, which at this scale is superimposed on the dwarf planet Ceres.

If you zoom in with the Simulator (below) Dawn can be seen in close pursuit of its target. After matching Ceres' velocity, Dawn is currently scheduled to slip into orbit around the dwarf planet on March 6, 2015.



Dawn's Position on February 6th with respect to Ceres
JPL's Solar System Simulator http://space.jpl.nasa.gov/

Dawn was launched in September of 2007. With an assist (gravity assist) from Mars, the spacecraft arrived at the asteroid Vesta in July of 2011. After a year of detailed study, Dawn restarted its ion engines, left orbit and began its 2½ year journey to Ceres.

Ceres is the largest body in the asteroid belt, with an average diameter of 590 miles (950 km). Large enough to be spherical in shape, little else is known about this world. Hypothesized to have formed later than Vesta, Ceres may have an icy crust and potentially, liquid water below its surface, similar to Saturn's moon Enceladus or Jupiter's moon Europa.

Our view of the dwarf planet will continue to improve as the distance narrows. The image on the right was captured on January 13th from a distance of 238,000 miles (383,000 km), the approximate distance from the Earth to the Moon.

While individual features are difficult to discern, the image does suggest the presence of large impact craters. By the beginning of February, the quality and resolution of the images will surpass that of any Earth-based telescope or Hubble Space Telescope image.

After capture, Dawn will spend at least 16 months studying Ceres as it spirals in closer to the planet.

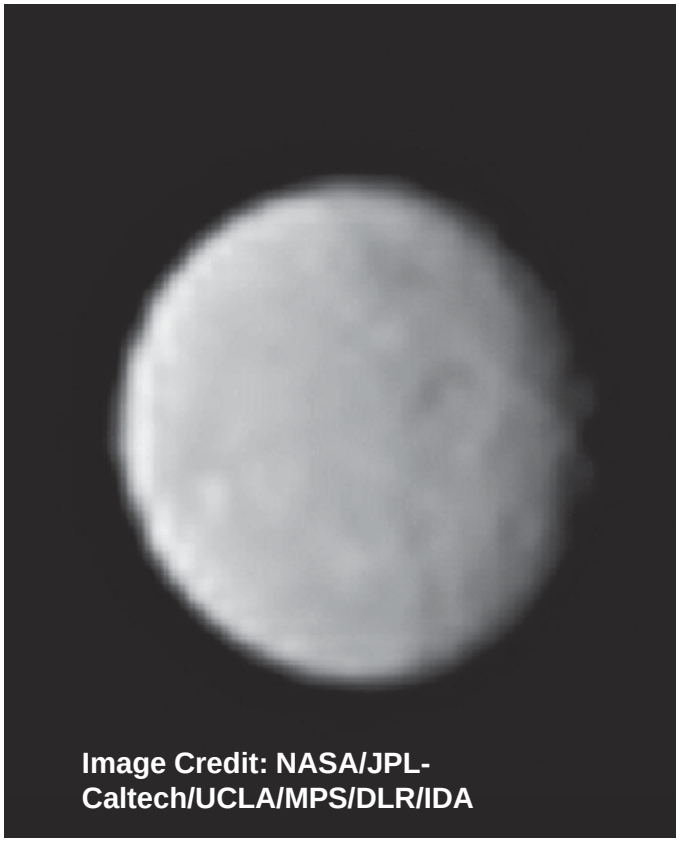
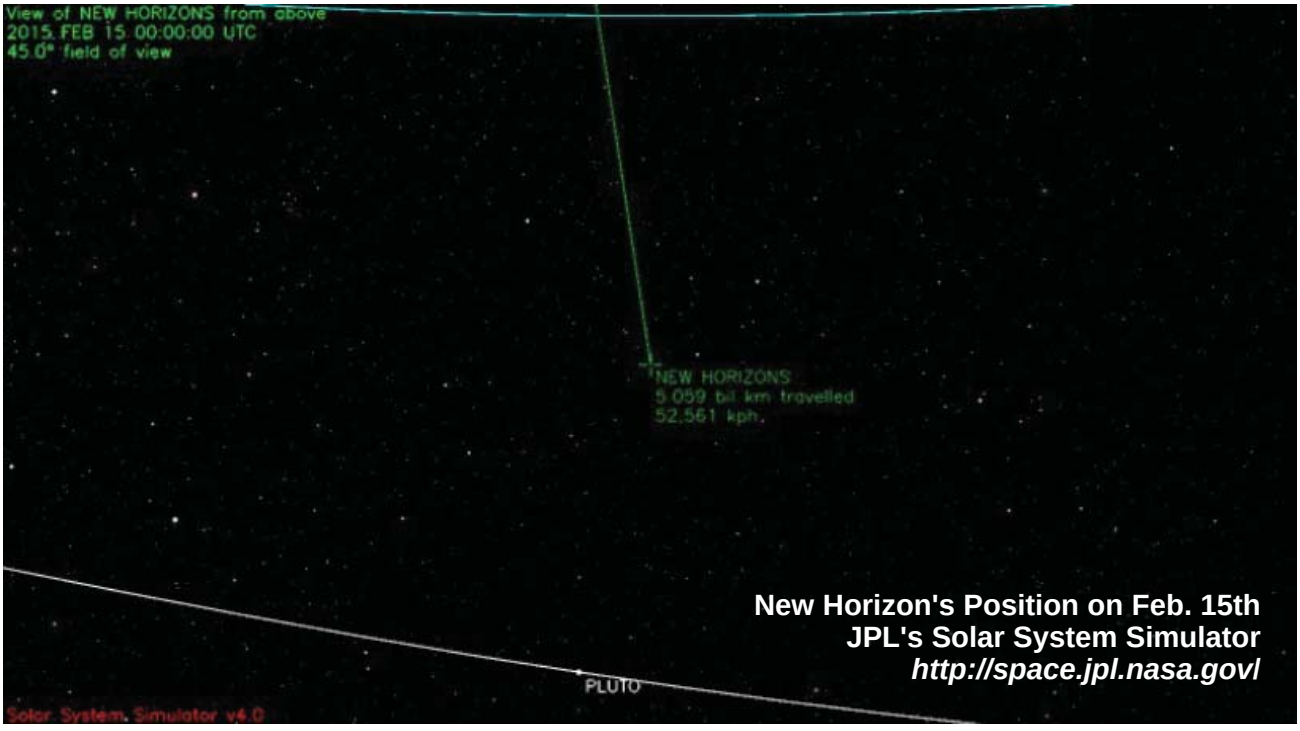


Image Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

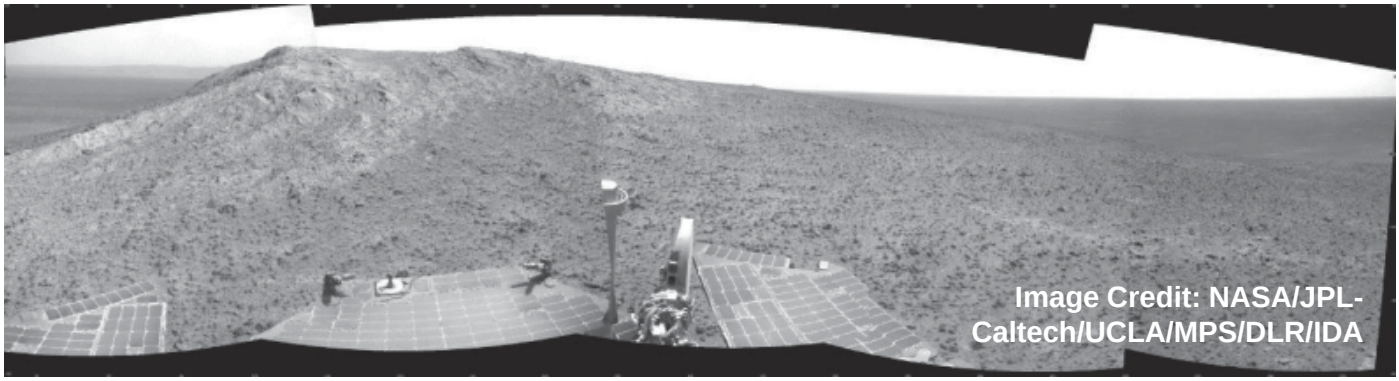
New Horizons Status

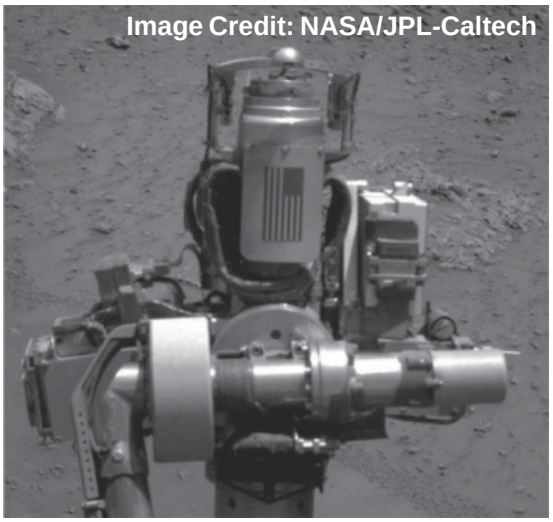
In January, New Horizons began long range observations of Pluto. Unlike the previous simulated images that showed the Juno and Dawn spacecraft approaching their targets in asymptotic trajectories as they maneuver to match the orbital speed of Jupiter and Ceres, respectively, New Horizons is going much too fast (with too little fuel) to enter orbit around Pluto. Instead, New Horizons will make a high speed pass by Pluto and its moons on July 14, 2015 before heading off into the Kuiper Belt.



New Horizon's Position on Feb. 15th
JPL's Solar System Simulator
http://space.jpl.nasa.gov/

King of the Mountain



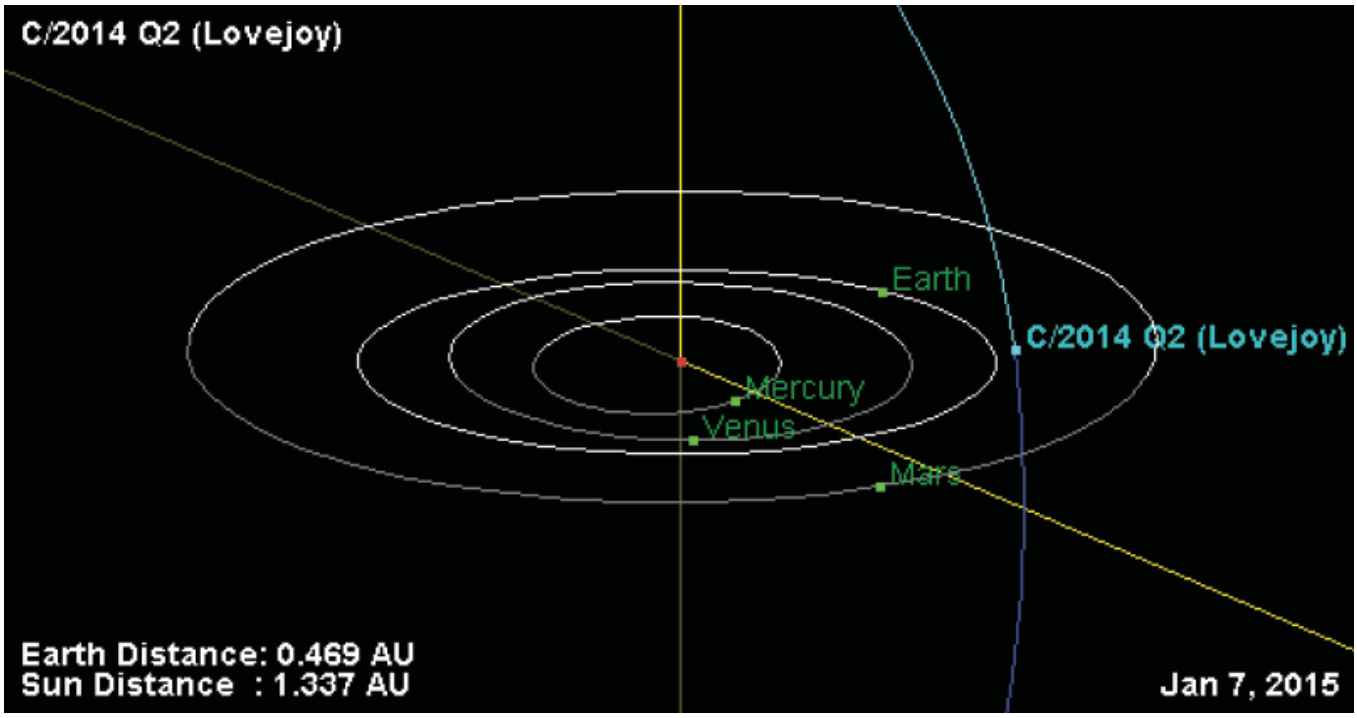


While exploring the rim of Endeavour Crater, the Mars Exploration Rover "Opportunity" reached the summit of Cape Tribulation and the highest elevation achieved in its three years of exploring the crater. On January 6th, the diminutive rover climbed up to the outcropping, 440 feet (135 meters) above the plain. From its vantage point Opportunity captured a panorama of the crater interior. Such an accomplishment would typically call for the planting of a flag on the summit. Without a flag handy, Opportunity raised its rock abrasion tool arm, upon which a dusty symbol of America is visible, in a silent salute.

The black and white panorama combines four images taken by Opportunity's cameras on January 5, 2015 approximately 40 feet (about 12 meters) southwest of the summit. The arm raising photo (at left) was taken at the summit two days later.

Comet Lovejoy

Discovered by Terry Lovejoy in August 2014 from his observatory in Australia, Comet Lovejoy (C/2014 Q2) exceeded expectations when it brightened to visual magnitudes in January. The long-period comet made its closest approach to the Earth on January 7th. The comet's green-hue coma was apparent to visitors looking



through the McCarthy Observa-tory's telescopes during its January open house. Photographic images captured a long, wispy blue ion tail.

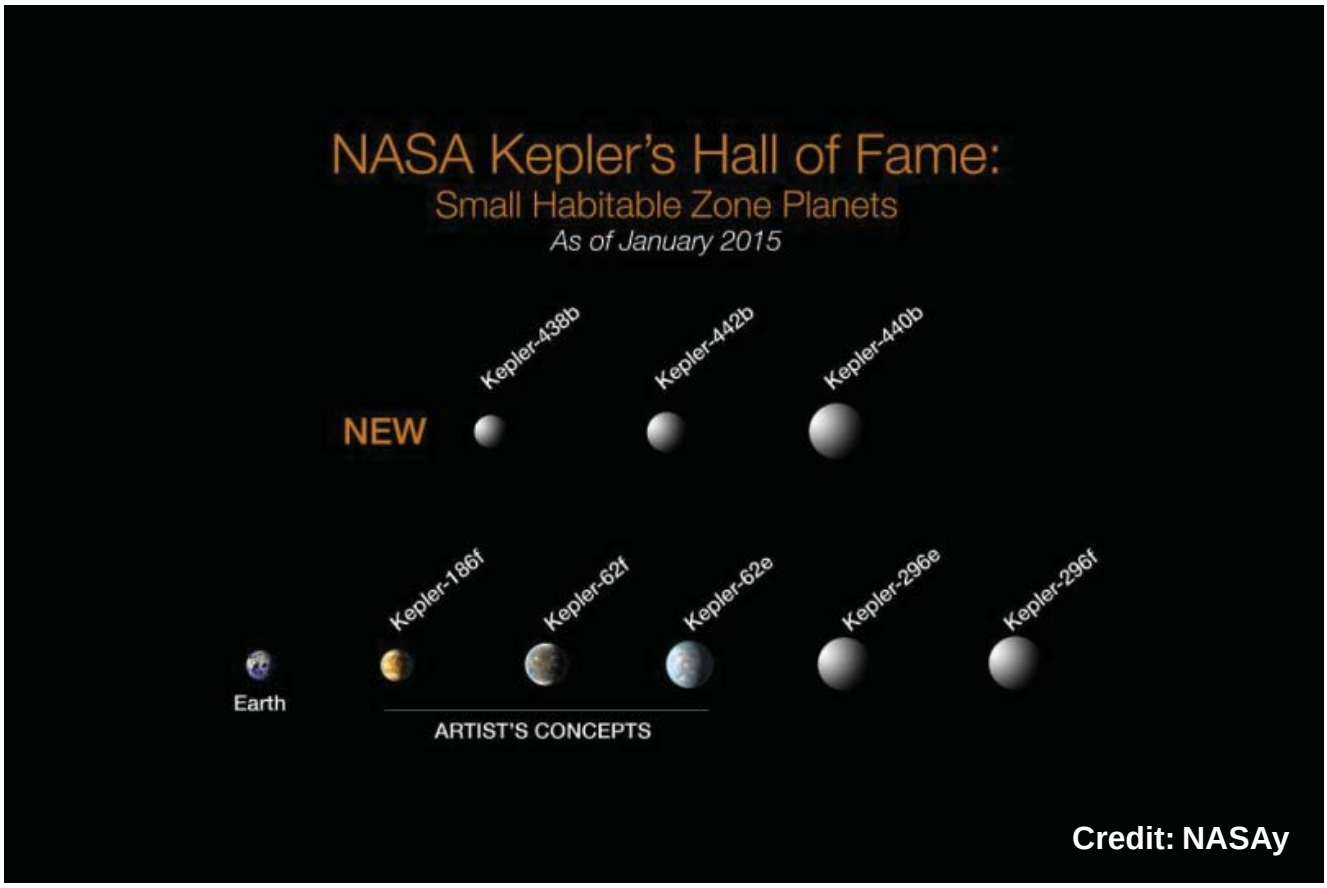
As shown in the orbit diagram produced by JPL's Small-Body Database, the comet approached the inner solar system from below the ecliptic plane (dark blue line). Lovejoy will be closest to the Sun on January 30th before returning to the realm of the outer solar system. Its orbital period of approximately 11,500 years was modified during its journey through the inner solar system as the comet reacted to the subtle gravitational forces of the planets and Sun. Due to this interaction, Lovejoy is expected to return in just 8,000 years.

The image below was captured from the McCarthy Observatory. The green glow is produced by the fluorescing of diatomic carbon by the Sun's ultraviolet rays.

Exoplanet Milestone

In early January, NASA announced the confirmation of eight new exoplanets. The exoplanets were discovered by NASA's Kepler Space Telescope and brought the total count of exoplanets to 1,004 (which has since been added to). There are an additional 4,000 candidates identified from Kepler's survey of 150,000 stars awaiting further study (see image on next page).

Eight of the exoplanets found to date are less than twice the size of Earth and located within their stars' habitable zone (where liquid water can exist over the majority of the stars' lifetime). Two of the new exoplanets, Kepler-438b and Kepler-442b, are likely rocky planets, similar to Earth. Their parent stars are smaller and cooler than our Sun making the habitable zones closer to the stars. Kepler-438b orbits its star once every 35.2 days while Kepler-442b completes its orbit once every 112 days. The stars around which Kepler-438b and Kepler-442b orbit are 475 light years and 1,100 light years, respectively, from Earth in the direction of the constellation Lyra.

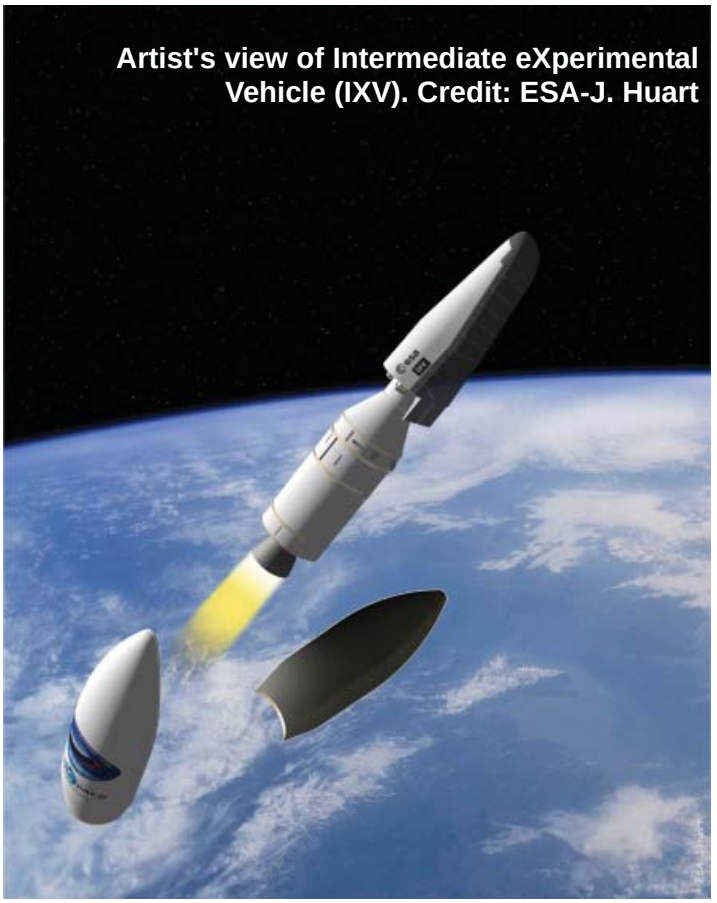


Vega Rising

The test flight of the European Space Agency's reusable spacecraft is scheduled for February 11th, from the Guiana Space Centre in Kourou, French Guiana. The Intermediate Experimental Vehicle (IXV) will be launched on a suborbital trajectory to test the spacecraft's performance at hypersonic and supersonic velocities in a simulation of a return from low-Earth orbit.

The 2 ton IXV vehicle, approximately 16 feet (5 meters) in length, will return to Earth by parachute, splashing down in the Pacific Ocean. The demonstration flight may one day lead to a multipurpose, low-Earth orbit servicing vehicle that can return to a traditional runway.

ESA's 'family' of launch vehicles: Vega, Soyuz at CSG, Ariane 5 GS and Ariane 5 ECA .Source: ESA



Artist's view of Intermediate eXperimental Vehicle (IXV). Credit: ESA-J. Huart

Lost Beagle Found

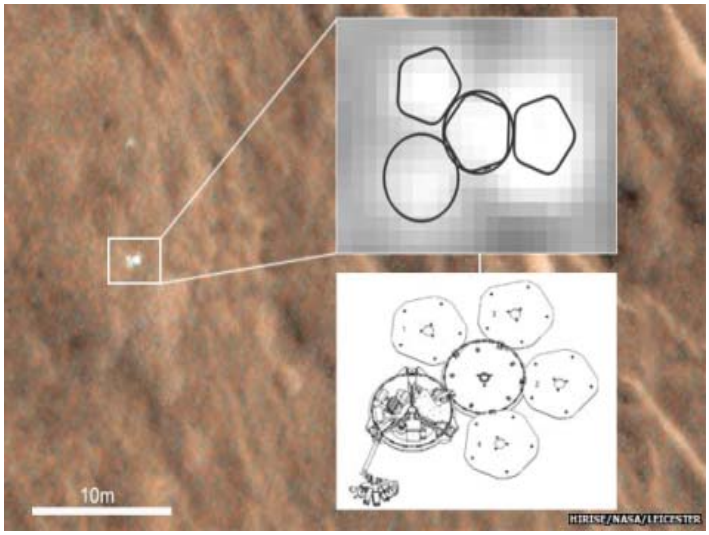
On December 19, 2003, the European Space Agency's Mars Express orbiter released the Beagle 2 lander into the Martian atmosphere. The lander was presumably lost or destroyed after it failed to establish contact with orbiting spacecraft. Despite numerous attempts, no signals were ever detected from the lander.

The British conceived and built Beagle lander was designed to search for signs of life on Mars. It had the appearance of the large pocket watch, approximately 3 feet (1 meter) in diameter. Upon landing, the cover was designed to open and unfurl four disk-shaped solar arrays. The compact lander was equipped with a robotic arm, mobile surface penetrator /sampling drill, cameras, and a suite of instruments including a microscope and a gas analysis package to measure carbon and methane, as markers for life. The photo (below) was taken at a quarry in the UK during pre-flight testing and shows the solar panels and the robotic arm deployed.

Beagle's target landing site was Isidis Planitia, an ancient impact basin near the Martian equator, approximately 1,800 miles west of where the Mar Science Laboratory, Curiosity, is operating. Since Beagle went missing, images sent back by various orbiting spacecraft were scrutinized for clues to what happened to the lander. Unfortunately, the image resolution was not available to find an object only a few feet (meters) across, lying on the surface. That changed with the arrival of the Mars Reconnaissance Orbiter (MRO) in 2006.

MRO is capable of taking highly detailed images of surface features with its High Resolution Imaging Science Experiment (HiRISE) camera. The camera is used in a systematic survey of water modified terrain and for signs of subsurface water and mineral deposits. HiRISE uses a 20-inch (0.5 meter) f/24 telescope to record details as small as 3 feet (1 meter) across.

In searching MRO images of the targeted landing ellipse (an area encompassing 105 x 62 miles



or 170 x 100 km) within Isidis Planitia, Michael Croon, a former member of Mars Express team spotted some promising reflections only three miles (5 km) from the center of the ellipse. Images from subsequent MRO passes over the site appear to confirm that the Beagle lander survived reentry and landed intact. While the Beagle's size is at the limit of detection of the HiRISE camera, image enhancement techniques suggests that two of the solar panels failed to fully deploy. Failed or partial deployment would have blocked the spacecraft's communications antenna, preventing the lander from making contact with orbiting spacecraft, dooming the mission.

Journey to the Center of Jupiter

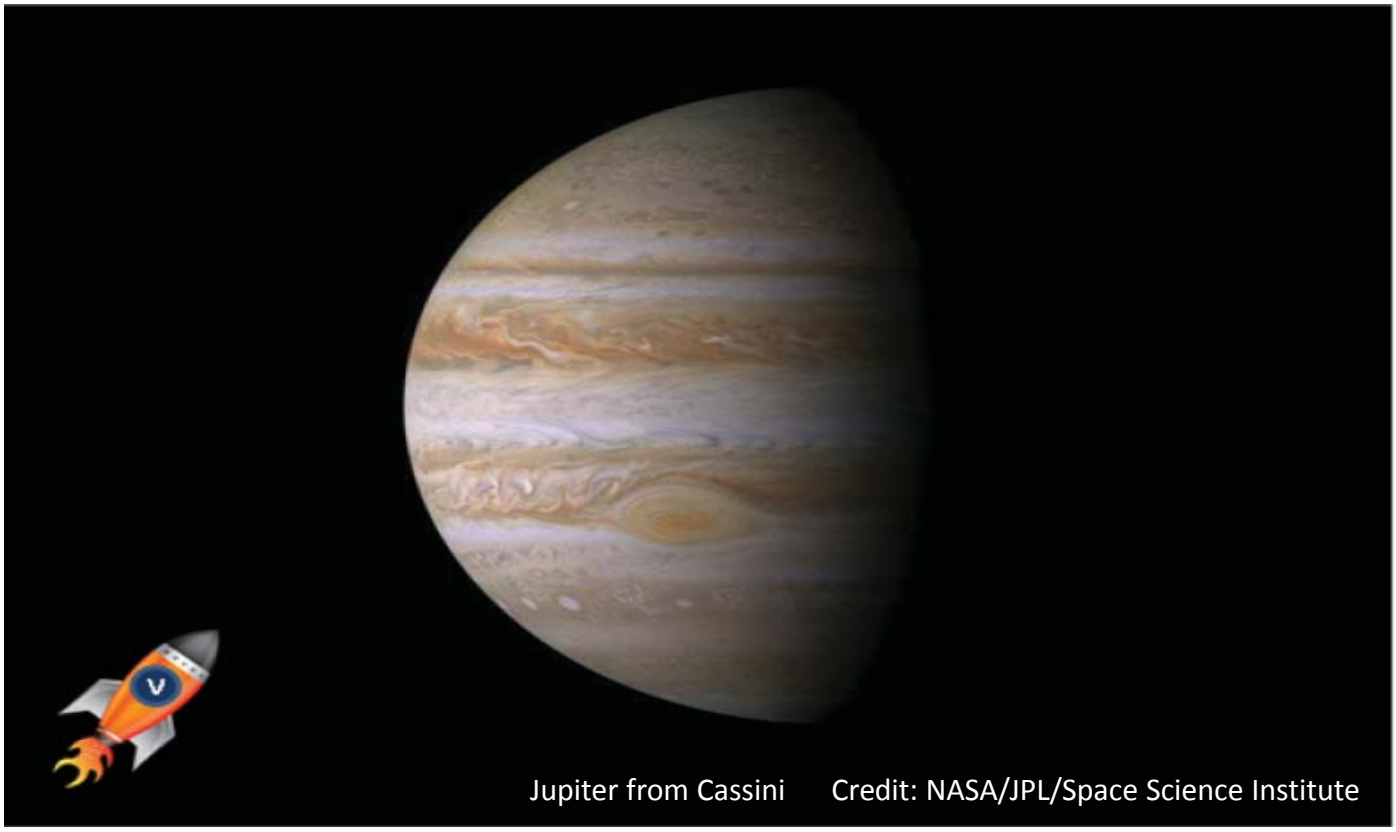
WE ARE CURRENTLY IN the observing season of Jupiter. While the gas giant was closest to Earth in early January, it is now well placed in the early evening sky. The four Galilean moons are clearly visible as companion stars as they travel in synchronous orbits around Jupiter. Prominent on the planet's disk are alternating bands of bright and dark clouds within the gaseous atmosphere.

Cassini was the last spacecraft to visit Jupiter (14 years ago on its way to Saturn), and it will be another 18 months before the Juno spacecraft arrives in July 2016. While robotic spacecraft may one day explore Jupiter's moons, exploring the gas giant is more challenging (the Galileo atmospheric probe was destroyed by Jupiter's crushing atmospheric pressure less than 100 miles below the cloud tops).

But if you could explore the depths of the gas giant, what would you experience? For this imaginary journey, we will travel with a neutrino (˜), a fundamental particle without charge that rarely interacts with matter.

At more than 11 times the diameter of the Earth, Jupiter will command our attention well before our "neutrino transfer vehicle" or NTV arrives. Jupiter's presence is first detected at a distance of almost 2 million miles, with a steady increase in radiation levels. Jupiter's magnetic field has an intrinsic strength 20,000 times greater than Earth's and is saturated with a sea of charged particles. The Sun facing side of the field is shaped and compressed by the solar wind, while the far side extends out past the orbit of Saturn.

Inside the magnetosphere, our NTV encounters several small and irregular moons possible remnants from ancient collisions or captured debris left over from the solar system's formation, before crossing the orbits of the four large, Galilean moons. Visible on the Jupiter facing side of the outer moon Callisto are a series of large concentric ridges surrounding Valhalla, an ancient impact basin. Ganymede is the next moon encountered. Larger than the planet Mercury, its icy surface is masked by large dark regions, impact craters and intersecting ridges and grooves. Closer to Jupiter is the enigmatic world, Europa. Its relatively smooth surface is crisscrossed with a network of cracks in its icy shell. Its youthful appearance and lack of impact craters suggests that the surface has been periodically renewed, possibly by a subsurface ocean that might extend more than 60 miles in depth. The possibility of a vast ocean beneath Europa's surface makes it one of the most likely candidates for extraterrestrial life and, therefore, targets for future missions, such as the Europa Clipper.



Jupiter from Cassini Credit: NASA/JPL/Space Science Institute

Before reaching Jupiter's cloud tops, we pass by Io, the closest of the Galilean moons and the most active. Densest of the four moons, Io's surface is mottled in colors of red, yellow and orange from recent eruptions of its active volcanoes. Io's geological activity is a result of its proximity to Jupiter and Jupiter's tidal forces.

Thirty thousand miles above the outer layers of Jupiter's atmosphere is a faint ring that encircles the planet at its equator. Unlike Saturn's bright ice ring that is easily visible from Earth, Jupiter's dark, dusty ring is more difficult to see and was first detected by the Voyager 1 spacecraft during its flyby of the planet in 1979. Embedded within the ring are two small moons, Adrastea and Metis, which may be the source of the ring's dust.

Inside the ring, the churning, banded atmosphere takes center stage. Jupiter rotates once every 10 hours, causing the clouds and embedded cyclonic storms to rush by our probe. Wind speed at the equator averages 200 miles an hour (mph), although it can reach as high as 400 mph. The cloud layer extends to a depth of 50 to 60 miles (100 km) from the top of the troposphere and is comprised of three different layers with distinct types of clouds. Below the high haze are wispy white clouds of ammonia. Several miles beneath, we find a layer of ammonium hydrosulfide ice and other elemental compounds, exhibiting colors of yellows, reds and browns. At the lowest level, clouds are comprised of water ice and bluish in color. At this point in our journey, the pressure is almost 10 times that on Earth (at sea level).

The temperature and pressure continues to increase the deeper we descend. Hydrogen and helium comprise over 99 percent of Jupiter's atmosphere (with hydrogen being the most abundant) and with the increasing pressure, the gases slowly transition to liquid. Illumination, if any, at this depth is provided by lightning in the layers above.

At a depth of 10,000 miles, the pressure is 3 million times the atmospheric pressure on Earth. Under these conditions the molecular hydrogen ocean begins its transition to a metallic state. A liquid metal ocean extends all the way down to a rocky core, almost 40,000 miles below the cloud tops.

The conditions at the core of Jupiter are extreme, with a pressure 50 million times, or more, than the atmospheric pressure on Earth and a temperature between 60,000 to 70,000° F. With internal heat generated by gravitation energy, Jupiter radiates almost twice as much heat as it receives from the Sun.

As our probe reaches the center of the core, we begin our journey back out through the dark and lifeless oceans of hydrogen, through the overlying layers of clouds and back into the void beyond.

John Glenn and the Flight of Freedom 7

On the morning of February 20, 1962, John Glenn became the first American to orbit the Earth aboard a Mercury space capsule that Glenn named Friendship 7. Originally scheduled for the previous December, the launch was delayed by several technical and mechanical issues, including a fuel leak, and by weather.

Glenn's capsule was placed into orbit by an Atlas rocket, a rocket originally developed as an Intercontinental Ballistic Missile. While the advantages of a multi-stage rocket were well known in the 1950s (dropping off spent stages reduces the fuel required to place the payload into orbit), starting engines in mid-flight had not been perfected. As such, vehicle weight was reduced during flight of the Atlas by dropping off the two outer engines while its center engine continued to burn until orbit was achieved. The Atlas was also unique in that it relied upon a "balloon" design to minimize its weight. This required pressurization of the fuel tanks so that the booster wouldn't collapse in upon itself.

While no longer a balloon design, the Atlas rocket remains an active expendable launcher today, carrying payloads for NASA, the Air Force and other customers.

John Glenn served with the Marine Corps prior to being selected by NASA in the first group of seven astronauts (the Mercury Seven). As a fighter pilot, he flew 59 combat missions in the South Pacific during World War II. Following service in the Korean War (baseball Hall of Fame legend Ted Williams was one of his wingmen), he set a speed record for a transcontinental flight on July 16, 1957 when he flew a Vought F8U Crusader from California non-stop to New York in 3 hours 23 minutes in a test of a new Pratt & Whitney engine (it did require 3 mid-air refuelings).

Glenn's trip around the Earth lasted 4 hours and 55 minutes and 23 seconds, completing 3 orbits be-

Astronaut John Glenn entering the Mercury capsule in preparation for his flight on February 20, 1962

fore splashing down in the Atlantic Ocean southeast of Bermuda. While a public relations success, the flight was not without problems, the most serious of which was an indication that the capsule's heat shield had come loose and its landing bag deployed. Not knowing whether it was a faulty indicator, mission control asked Glenn to leave the retro-pack on during reentry. (The retro-pack consisted of three small rockets that were used to slow the spacecraft down. It was attached to the spacecraft by three straps that extended over the heat shield.) Fortunately, the indicator was faulty and the flaming debris that Glenn saw streaming by his window during reentry was from the retro-pack and not the heat shield.

John Glenn would not return to space for another 36 years. In 1998, at the age of 77, Glenn joined the crew of the space shuttle Discovery for a nine day mission.

February History

Eighty-five years ago on February 18th, a young American astronomer named Clyde Tombaugh discovered the solar system's ninth planet while working at the Lowell Observatory in Flagstaff, Arizona.

Clyde Tombaugh was born on an Illinois farm in February 1906, the eldest of six children. His family moved to a wheat farm in Kansas in 1922. At age 22, with only a high school diploma, Clyde spent most of his time working the family farm. In his spare time he would grind and test telescope mirrors in the farm's underground cellar. In 1928, Clyde sent several of his drawings of Mars and Jupiter from images seen through his homemade telescope to the Lowell Observatory. By chance, the observatory had just acquired a 13-inch telescope and was looking for a dedicated amateur to conduct photographic surveys of the night sky. With only enough money for a one-way ticket, Clyde left Kansas for Arizona in January of 1929. Thirteen months later, and after photographing millions of stars, he would discover Planet X (its designation before being officially named).

Clyde Tombaugh died in 1997. His wife and his family attended the launch of New Horizons. Making the journey to Pluto along with the spacecraft are the ashes of the astronomer.

Venetia Phair, an 11 year old girl from England, suggested the name Pluto for the newly discovered planet. Her grandfather, who was the head librarian at Oxford University, passed the suggestion along to the American astronomers. Venetia, a retired school teacher, passed away in 2009 at the age of 90, but remains the only woman in the world to have named a planet (even if it's only a Dwarf Planet today). Venetia wasn't the only family member to have named a celestial object; her great uncle named the moons of Mars (Phobos and Deimos).

Compared to the size of the parent planet, Pluto has the largest moon in the solar system (the pair is sometimes referred to as a "double planet"). Charon was discovered in 1978 by the American astronomer James Christy and named for the boatman who ferried dead souls across the river Styx to Hades (Pluto's domain). Charon is more than half the size of Pluto. It is also only 12,000 miles from Pluto (compared to 238,000 miles for Earth's moon). As such, in the dark and frozen sky at the edge of our solar system, Charon would appear more than 7½ times larger in Pluto's sky than our moon appears in the Earth's sky.

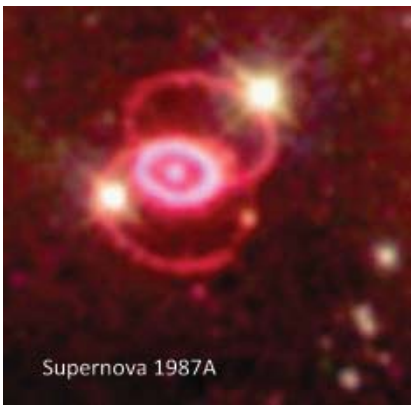
Supernovas

A supernova is an explosion produced when a massive star exhausts its fuel and collapses. These collapsing stars are typically red supergiants at least 8 times more massive than our Sun. If the original star is less than 20 solar masses, the supernova leaves behind a neutron star, approximately 10 to 17 kilometers (6 -10 miles) across, a teaspoon of

which weighs 200-400 million tons. (More massive stars can collapse into black holes.) One of the more famous remnants of a supernova is the Crab Nebula, visible with a moderate telescope in the winter sky in the constellation Taurus.

Many of the supernovas that occur in the Milky Way Galaxy are obscured from our view by gas and dust. On average, one supernova is detected in our galaxy every century (undetected supernovas may occur every 25 to 50 years, based upon our observations of other galaxies). Supernovas can become so bright that they overwhelm their host galaxies for weeks. In the last thousand years, there were four supernovas in the Milky Way that were well documented: a star in the constellation Lupus in the year 1006, one in the constellation Taurus in 1054 (described by Chinese astronomers), one in Cassiopeia in 1572 (observed by Tycho Brahe), and another in Ophiuchus in 1604 (studied by Johannes Kepler).

One of the most scrutinized supernovas occurred within the Large Magellanic Cloud, a satellite galaxy to the Milky Way. In February 1987, a star exploded near the Tarantula nebula some 169,000 light years away. It was the first time that astronomers had detailed observations, not only of the supernova, but of the star before it exploded. The most unusual feature of Supernova 1987A is the circumstellar rings of material seen expanding from the dying star. Since the rings are only moving at a speed of 70,000 to 100,000 miles per hour (much slower than the material ejected in the supernova explosion), scientists theorize that the material was expelled before the supernova when the star was still a red giant.

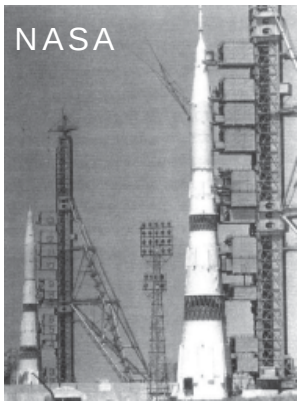


Hubble Heritage Team (NASA/STScI/AURA)

As Dr. Carl Sagan reminded us: "We are star-stuff." Almost all of the elements in our universe were created inside stellar factories (nucleosynthesis). However, elements heavier than iron are only created in the final moments of the collapse of a massive star and detonation of the core. So the next time that you admire your gold jewelry, remember that though it may have come from your favorite jeweler, those gold atoms were created by a nearby supernova.

Soviet Moon Program

February marks the beginning of the end of the Soviet Moon program. While publicly denying its intentions to send cosmonauts to the Moon during the 1960s, Russia was secretly constructing rockets of mammoth proportions (rivaling the Saturn V). On February 21, 1969, the first N1 Moon rocket exploded during its test flight.



The launch of three more N1 rockets would fail before the Soviet government would abandon their manned-Moon program.

The historic photo on the right shows two N1 rockets on the pad at the Soviet Union's launch site at the Baikonur Cosmodrome (also known as Tyuratam) in Kazakhstan. The five stage rockets stood approximately 340 feet high with a first stage powered by 30 individual engines.

February Nights

The days grow longer in February, although the cold seems to linger. With the longer days comes a setting sun that can now be appreciated by that portion of the working population that has spent the last two months driving back and forth to work in the dark.

With the setting Sun comes an opportunity to see an interesting atmospheric phenomenon: Sun pillars. As the Sun sets (or rises) hexagonal shaped ice crystals falling through the cold air can reflect the sunlight and produce dramatic and colorful columns of light. The photo on the right was taken at sunset in February 2002 from Bridgewater, CT.

Jupiter and its Moons

Jupiter reached Opposition on January 5th and is well placed in the evening sky in February. 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 left 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	Io	7:57 pm	12:57 am (2nd)
3rd	Europa	5:22 pm	8:17 pm
8th	Io	9:51 pm	12:08 am (9th)
9th	Callisto	4:11 pm	9:00 pm
10th	Europa	7:59 pm	10:53 pm
17th	Io	6:13 pm	8:31 pm
18th	Europa	10:35 pm	1:30 am (19th)
23rd	Ganymede	4:07 pm	7:45 pm
24th	Io	8:07 pm	10:25 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 7 pm to midnight local time (EST):

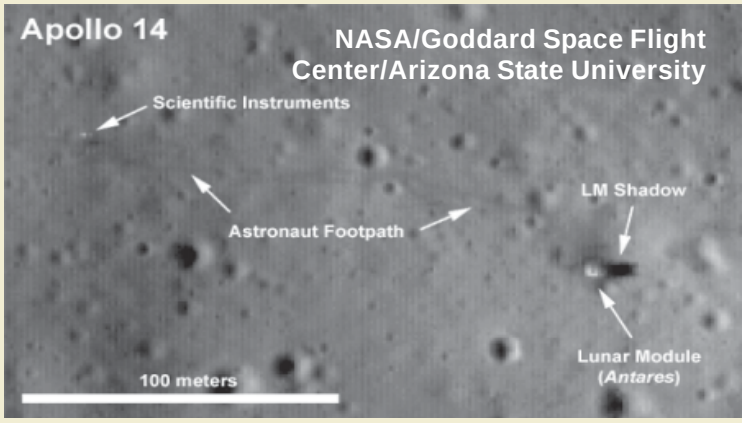
Date	Transit Time	Date	Transit Time
1st	9:39 pm	17th	7:00 pm
4th	7:08 pm	18th	8:38 pm
6th	8:46 pm	20th	10:16 pm
8th	10:24 pm	22nd	11:54 pm
11th	7:53 pm	23rd	7:45 pm
13th	9:31 pm	25th	9:23 pm

Sunrise and Sunset

Sun	Sunrise	Sunset
February 1st (EST)	07:06	17:09
February 15th	06:49	17:27
February 28th	06:30	17:43

Astronomical and Historical Events

1st History: loss of the space shuttle Columbia upon reentry (2003)
1st History: launch of Explorer 1; first artificial satellite by the United States (1958)
2nd History: Soviet space station Salyut 4 reenters the Earth's atmosphere (1977)
3rd Full Moon (Full Snow Moon)
3rd History: Apollo 14, with astronauts Alan Shepard, Stuart Roosa and Edgar Mitchell, lands in the Moon's Fra Mauro region; 3rd manned Moon landing (1971)
3rd History: Soviet spacecraft Luna 9 becomes first spacecraft to soft land on the Moon (1966)
4th History: launch of Lunar Orbiter 3; photographed potential Apollo landing sites (1967)
4th History: Clyde Tombaugh born (1906); discovered the dwarf planet Pluto in 1930
5th History: flyby of Venus by the Mariner 10 spacecraft on its way to Mercury; first U.S. spacecraft to photograph Venus, first to use gravity of one planet to propel itself to another, and the first spacecraft to visit Mercury (1974)
6th Moon at apogee (furthest distance from Earth)



Astronomical and Historical Events (continued)

6th Jupiter at Opposition, rising with the setting Sun and visible all night
6th History: Soviet space station Salyut 7 reenters Earth's atmosphere (1991)
7th History: launch of the Stardust spacecraft for a rendezvous with Comet Wild 2 (1999)
7th History: Astronomical Society of the Pacific founded (1889)
7th History: William Huggins born, pioneered work in astronomical spectroscopy and first to differentiate nebular and galactic spectra (1824)
8th History: discovery of the SAU 094 Mars meteorite in Sayh al Uhaymir, Oman; one of the largest Mars meteorites recovered and the only one with a documented strewn field (2001)
8th History: discovery of GRV 99027 Martian Meteorite on the ice sheet near the Grove Mountain region of Antarctica; the 9.97 gram meteorite was later characterized as a shergottite (2000)
8th History: flyby of Jupiter by the Ulysses spacecraft on its way to study the polar regions of the Sun (1992)
8th History: return of Skylab III crew (astronauts Gerald Carr, William Pogue and Edward Gibson) to Earth after a 3 month stay on the space station (1974)
8th History: Jules Verne born, author and futurist (1828)
10th Scheduled distant flyby of Saturn's moon Rhea by the Cassini spacecraft
10th History: flyby of Venus by the Galileo spacecraft (for a gravity assist) on its way to Jupiter; the encounter provided the first views of mid-level clouds on Venus and confirmed the presence of lightning (1990)
10th History: flyby of Mars by the Soviet Mars 4 spacecraft; failed to enter orbit but did detect night-side ionosphere (1974)
11th Last Quarter Moon
11th Scheduled launch of the ESA's Intermediate eXperminental Vehicle (IXV) from Kourou, French Guiana
11th History: launch of NASA's Solar Dynamics Observatory from Cape Canaveral, Florida; the first mission in the space agency's "Living with a Star" program; five-year mission to study the Sun's energy and its influence on space weather (2010)
11th History: launch of the space shuttle Discovery (STS-82), second Hubble Space Telescope servicing mission; **shuttle tire** on display at the Observatory is from this mission (1997)
11th History: launch of first Japanese satellite: Oshumi (1970)
12th Scheduled flyby of Saturn's largest moon Titan by the Cassini spacecraft
12th History: landing of the Near Earth Asteroid Rendezvous (NEAR) – Shoemaker spacecraft on the asteroid Eros (2001)
12th History: Soviet spacecraft Mars 5 enters orbit around Mars, providing information on surface temperatures, CO_2 concentrations, and detecting a thin ozone layer and water vapor concentrations near the Tharsis region (1974)
12th History: Sikhote Alin meteorite fall in Russia, one of the largest modern falls at 28 tons (1947)
14th Second Saturday Stars – Open House at the McCarthy Observatory
14th History: flyby of Comet Tempel 1 by the Stardust spacecraft (2011)
14th History: NEAR-Shoemaker enters orbit around Eros, one of the largest of the near-Earth asteroids (2000)
14th History: Voyager 1 points its camera back towards the Sun and takes a family portrait, capturing six planets (Venus, Earth, Jupiter, Saturn, Uranus and Neptune) from a distance of approximately 4 billion miles; Mercury was too close to the Sun to be seen and Mars was lost in the scattered sunlight (1990)
14th History: launch of the Solar Maximum Mission (1980) to study the Sun during the peak of the solar cycle; a malfunction less than a year later cut the mission short. However, the satellite was recovered and repaired by the Space Shuttle Challenger in April 1984; operated successfully until burning up in the Earth's atmosphere in December 1989
14th History: launch of Luna 20, Soviet Moon sample return (1972)
14th History: launch of Syncom 1, the first geosynchronous satellite (1963)

Astronomical and Historical Events (continued)

15th Asteroid 8 Flora at Opposition (8.8 Magnitude)
15th History: meteor explodes over the Russian city of Chelybinsk causing hundreds of injuries (2013)
15th History: flyby of the Moon by the Hiten spacecraft; Earth orbiting satellite designed by the Japanese Space Agency to test technologies for lunar and planetary missions (1992)
15th History: Galileo Galilei born (1564)
16th Winter Star Party (through the 22nd), Big Pine Key, Florida
16th Kuiper Belt Object 55565 (2002 AW197) at Opposition (44.878 AU); trans-Neptunian object (TNO) discovered in 2002 by Michael Brown et al., classified as a cubewano
16th History: Gerard Kuiper discovers Uranus' moon Miranda (1948)
17th Scheduled launch of a Russian cargo carrying Progress spacecraft to the International Space Station from the Baikonur Cosmodrome in Kazakhstan
17th History: launch of Ranger 8; Moon impact mission (1965)
17th History: launch of NEAR spacecraft, asteroid orbiter/lander; first of NASA's Discovery missions and the first mission to go into orbit around an asteroid (1996)
17th History: launch of Vanguard 2; designed to measure cloud-cover distribution over Earth (1959)
18th New Moon
18th History: American astronomer Clyde Tombaugh discovers Pluto (1930)
19th Moon at perigee (closest distance from Earth)
19th Kuiper Belt Object 148209 (2000 CR105) at Opposition (59.014 AU)
19th History: Nicolas Copernicus born (1473)
20th History: Clementine spacecraft enters lunar orbit and starts photographic survey; joint project between the Strategic Defense Initiative Organization and NASA, first of a new class of small spacecraft to enable long-duration, deep space missions at low cost using lightweight satellite technology (1994)
20th History: launch of the core module of the Soviet space station Mir (1986)
20th History: launch of Mercury-Atlas 6 and Friendship 7 with astronaut John Glenn; first American in orbit (1962)
21st History: Soviet moon rocket (N-1) explodes during first test flight (1969)
22nd History: launch of Soviet spacecraft Kosmos 110, with dogs Veterok and Ugolyok (1966)
22nd History: Max Wolf discovers asteroids 587 Hypsipyle and 588 Achilles (1906)
23rd History: Supernova 1987A detected in the Large Magellanic Cloud (1987)
24th Mercury at its Greatest Western Elongation (27°) in the morning sky
24th Plutino 90482 Orcus at Opposition; discovered on February 17, 2004; has one large moon - Vanth (47.100 AU)
24th History: launch of the Space Shuttle Discovery (STS-133) on its final mission. The shuttle delivered space parts and critical components to the ISS (2011)
24th History: launch of Mariner 6; Mars flyby mission returned images showing the south polar cap as being composed predominantly of carbon dioxide; refined estimates of the mass, radius and shape of Mars (1969)
24th History: Jocelyn Bell announces discovery of rapidly rotating radio sources, later determined to emanate from neutron stars or pulsars (1968)
24th History: launch of Bumper WAC, first two-stage liquid-propellant rocket and the first human-made object to achieve hypersonic speeds (1949)
25th First Quarter Moon
25th History: flyby of Mars by the Rosetta spacecraft (2007)
25th History: Soviet spacecraft Luna 20 returns lunar soil sample (30 grams) to Earth (1972)
26th History: launch of the first Saturn 1B rocket booster (1966)
28th Kuiper Belt Object 2013 FZ27 at Opposition (47.963 AU)
28th History: flyby of Jupiter by the New Horizons spacecraft bound for Pluto (2007)
28th History: launch of Discoverer 1 (1959); first of a series of satellites which were part of the Corona reconnaissance satellite program and first satellite launched into polar orbit (1959)

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.*

Front Page

A Romulan plasma torpedo? . . . Not exactly. SNR 0519-69.0 is the debris remains from a supernova in the Large Magellanic Cloud, a satellite galaxy 160,000 light years away in the constellation Dorado. The explosion, which became visible on Earth about 400 years ago, is being hotly pursued by light echoes of the cataclysmic event reflected off surrounding interstellar dust.

The image, processed at the Chandra X-ray Observatory, is featured in Chandra's exhibit at the UN sponsored International Year of Light -2015. Image Credit: NASA/CXC/SAO

For more on the International Year of Light, go to *http://www.light2015.org/Home.html.*

Image Credits

Front page design and graphic calendars: Allan Ostergren

Second Saturday Stars poster: Sean Ross, Ross Designs

Cartoon - Jupiter Weather by Bucky Milam, Danbury Area Computer Society

All other non-credited photos were taken by the author: 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

February 14th
7:00 - 9:00 pm

Cosmic PERSPECTIVES

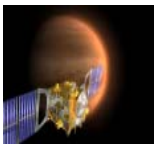
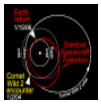
Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

Map

art & design • sean ross • rossgrafix13@yahoo.com

February 2015

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1  Launch of Explorer I (1958) Space Shuttle Columbia breaks up on reentry from orbit (2003) 	**2**  Soviet space station, Salyut 4 reenters Earth's atmosphere (1977)	**3**  Chinese New Year Soviet Luna 9 lands on Moon (1966)   Apollo 14 - 3rd Moon landing- Shepard, Roosa, Mitchell (1971)	**4**  Clyde Tombaugh born (1906)  discoverer of Pluto  Launch of Lunar Orbiter 3, to locate Apollo landing sites (1967)	**5**  Flyby of Venus by Mariner 10 spacecraft en route to Mercury (1974)	**6**  Moon at perigee (closest distance to Earth)  Soviet space station Salyut 7 reenters Earth's atmosphere (1991)	**7** William Huggins born, pioneer of astronomical spectroscopy (1824)   Astronomical Society of the Pacific founded (1889) Launch of Stardust spacecraft for rendezvous with comet Wild 2 (1999) 
8  Jules Verne born (1828) Mars meteorites found - Oman (2001); Antarctica (2000)   Return of Skylab 3 crew after 3 months on space station (1974)	**9**   Astronaut Bernard A. Harris becomes first African-American to perform extra vehicular activity, during shuttle mission STS-63 to Mir spacecraft, flown by first woman shuttle pilot, Eileen Collins (1995)	**10**   Flyby of Venus by Galileo spacecraft on way to Jupiter (1990)  Flyby of Mars by Soviet Mars 4 spacecraft (1974)	**11**  Launch of NASA Solar Dynamics Observatory 2010 Launch of Japanese satellite Oshumi (1970)   A solar eclipse inspires Nat Turner to launch slave revolt in Virginia (1831) Scheduled launch of the ESA's Intermediate eXperimental Vehicle (IXV) from Kourou, French Guiana 	**12**  Moon at apogee (farthest from Earth) NEAR spacecraft lands on asteroid Eros (2001)   Soviet Mars 5 spacecraft in orbit (1974) Sikhote Alin meteorite falls in Russia (1947) 	**13**  John Louis Emil Dreyer born, Danish/Irish astronomer and biographer of Tycho Brahe; continued Herschel's work by publishing catalogue of nebulae and clusters (1852)	**14**  Launch of Syncom 1, first geosynchronous satellite (1963) Launch of Solar Maximum Mission to study Sun during peak of cycle (1980)  Flyby of Comet Tempel 1 by the Stardust spacecraft (2011) 2nd Saturday Stars Open House McCarthy Observatory 
15  Galileo Galilei born (1564) Flyby of Moon by Japan's Hiten spacecraft (1992) 	**16** Winter Star Party (through the 22nd), Big Pine Key, Florida   Gerard Kuiper discovers Uranus' moon, Miranda (1948)	**17** Launch of Ranger 8, Moon impact mission (1965)  Launch of Vanguard 2, to measure Earth cloud cover (1959) Plutino 90482 Orcus discovered - has one moon, Vanth (2004) 	**18** American astronomer Clyde Tombaugh discovers Pluto (1930)	**19** Nicholas Copernicus born (1473)	**20** Launch of Mercury Atlas 6 and Friendship 7 with John Glenn, 1st American in orbit (1962) Launch of core module of Soviet Mir space station (1986)	**21** Soviet Moon rocket (N-1) explodes (1969) Tom Gehrels born , astronomer and co-discoverer of over 4,000 asteroids (1925)
22 Launch of Soviet spacecraft Kosmos 110, with dogs Veterok and Ugolyok (1966)	**23** Supernova 1987A detected in Large Magellanic Cloud (1987)	**24** Launch of Bumper WAC, first two-stage liquid ropellant rocket (1949) Launch of Mariner 6, Mars flyby (1969) Jocelyn Bell's discovery of pulsars (1968) Shuttle Discovery final mission (2011)	**25** Flyby of Mars by Rosetta spacecraft (2007) Soviet spacecraft Luna 20 returns 30-gram soil sample to Earth (1972)	**26** Launch of first Saturn 1B rocket booster (1966)	**27** Bernard Ferdinand Lyot born, French astronomer and inventor of the coronagraph to observe the sun's corona without waiting for an eclipse, (1897)	**28** Launch of Discoverer 1, first of Corona reconnaissance satellite program (1959) Flyby of Jupiter by New Horizons spacecraft bound for Pluto (2007)

Phases of the Moon

Feb 3 Feb 11 Feb 18 Feb 25