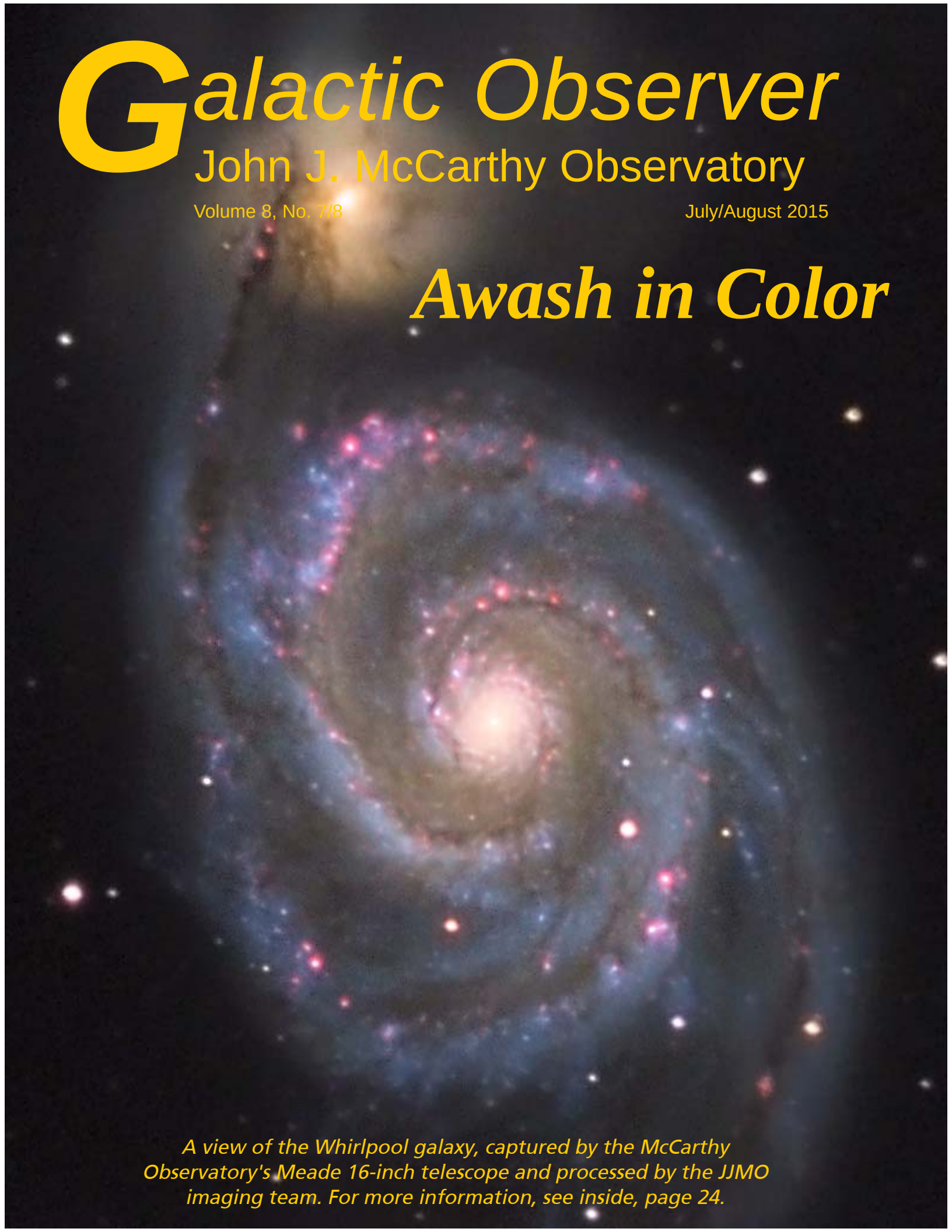
Galactic Observer

John J. McCarthy Observatory

Volume 8, No. 7/8 July/August 2015

Awash in Color



A view of the Whirlpool galaxy, captured by the McCarthy Observatory's Meade 16-inch telescope and processed by the JJMO imaging team. *For more information, see inside, page 24.*

The John J. McCarthy Observatory

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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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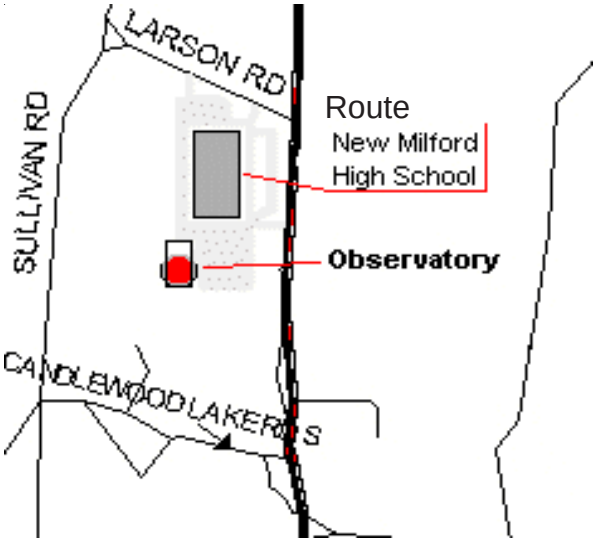
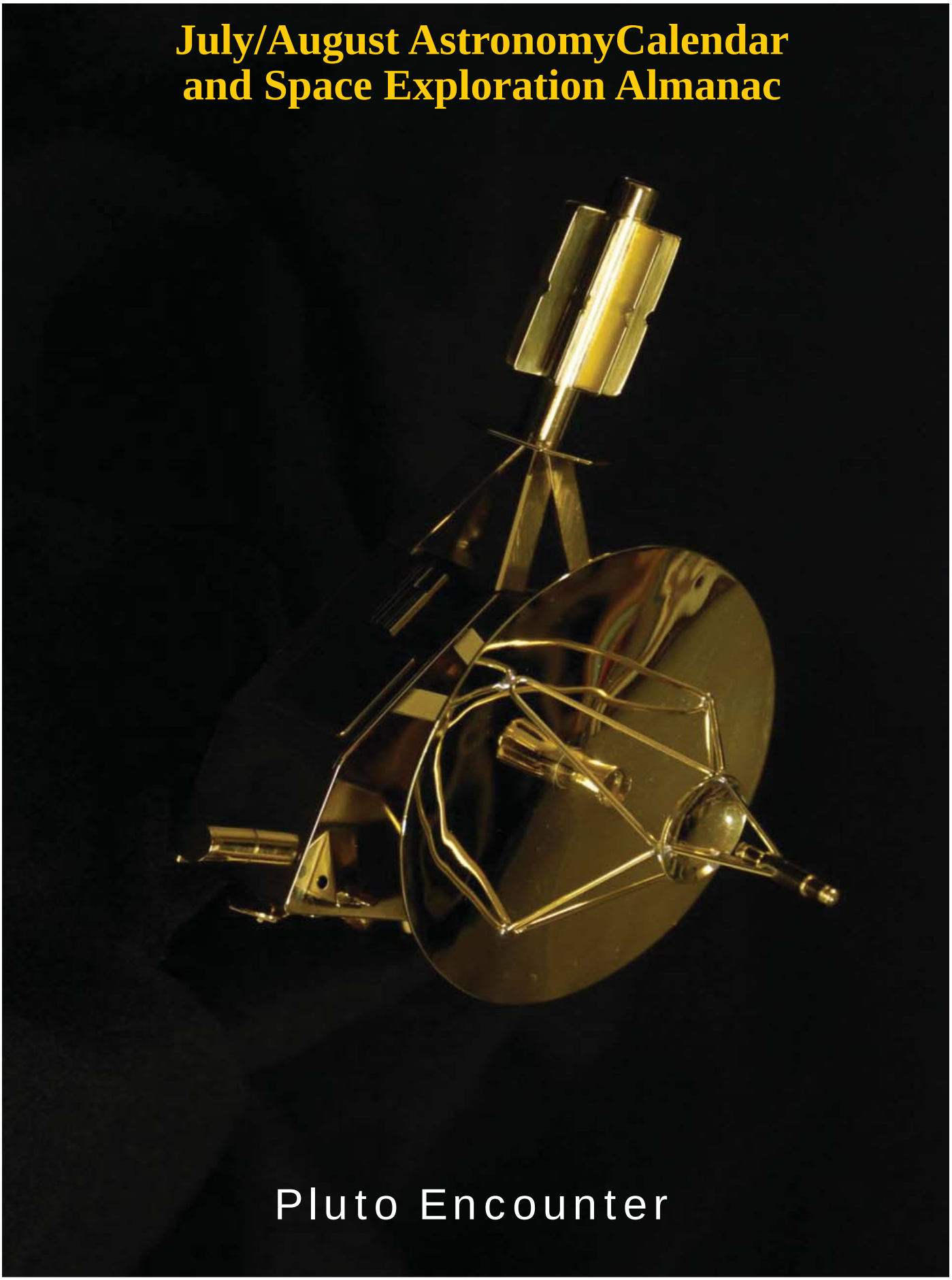


In This Issue

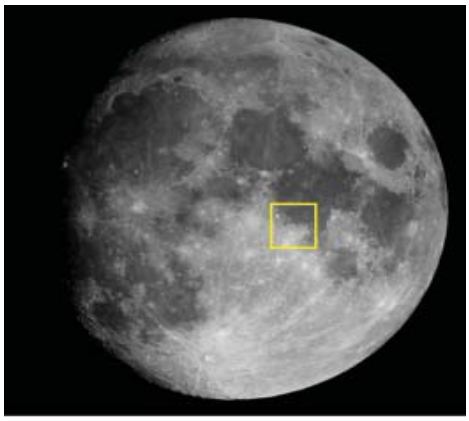
July/August AstronomyCalendar and Space Exploration Almanac



Pluto Encounter

"Out the Window on Your Left"

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



Lunar "seas" and "oceans" are actually expansive, low-lying plains formed by ancient lava flows

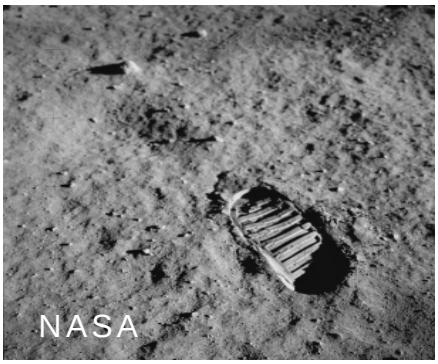
The onboard computer was carrying the Lunar Module (LM) towards a large crater surrounded by a field of boulders. At 500 feet above the lunar surface, Neil Armstrong took manual control of the LM, slowing its controlled descent while searching for an area clear of obstacles. The Sun was climbing into the pitch black sky, just 12.5 degrees above the horizon. The low Sun cast long shadows that accented the rugged terrain. At 250 feet, Buzz Aldrin spotted the LM's shadow on the lunar landscape below. Dropping lower, Armstrong flew over the primary landing site and past West Crater to a level area just beyond the boulder field. At 100 feet, Buzz Aldrin called out "5%," signaling that only 5% of the fuel remained and triggering the 90 second abort clock back at Mission Control in Houston. Less than a minute later, the sensory probes hanging from the LM's footpads touched the surface and the contact light came on inside the cabin. Armstrong shut down the descent engine and the LM settled to the surface, touching down 4:17:39 P.M. (EDT) on Sunday, July 20, 1969. A few seconds later Armstrong called out "Houston - Tranquility Base here. The Eagle has landed."

It had all begun eight years earlier. With only 15 minutes of manned flight experience (the suborbital flight of astronaut Alan Shepard), President Kennedy went before Congress on May 25, 1961 and asked for funding for an ambitious program of lunar exploration: "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth." Four months later, the President told the crowd at Rice University "We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."

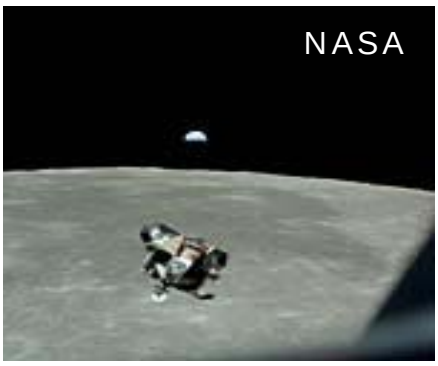
Every month, approximately seven days after a New Moon, the Sun rises upon the undisturbed footprints left behind at Tranquility Base.

Astronaut Edwin E. Aldrin Jr., lunar module pilot, descends the steps of the Lunar Module

Armstrong and Aldrin raise the U.S. flag on the lunar surface



Boot prints on the Lunar Ssurface



LunarModule approaches Command Module for docking

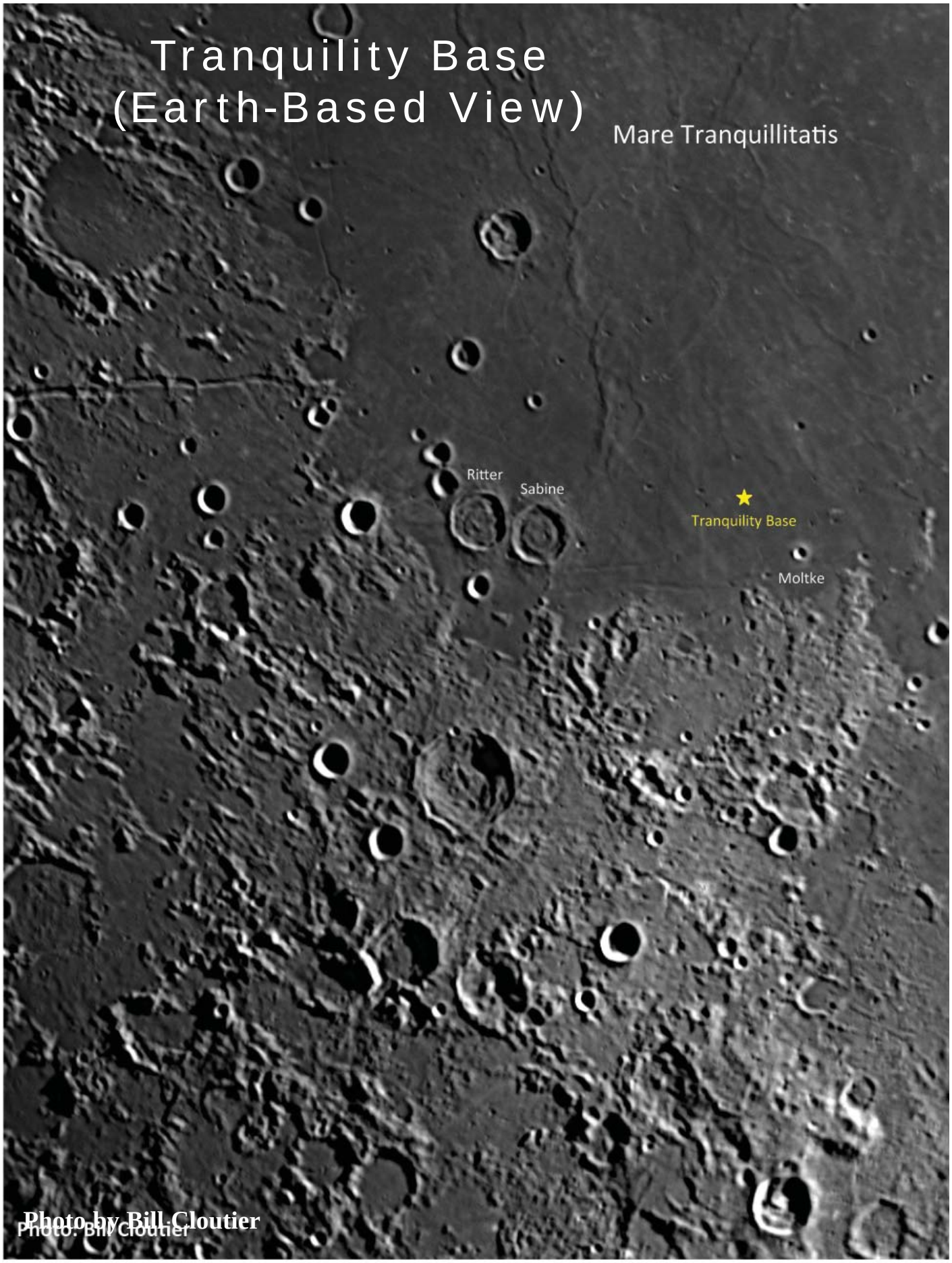
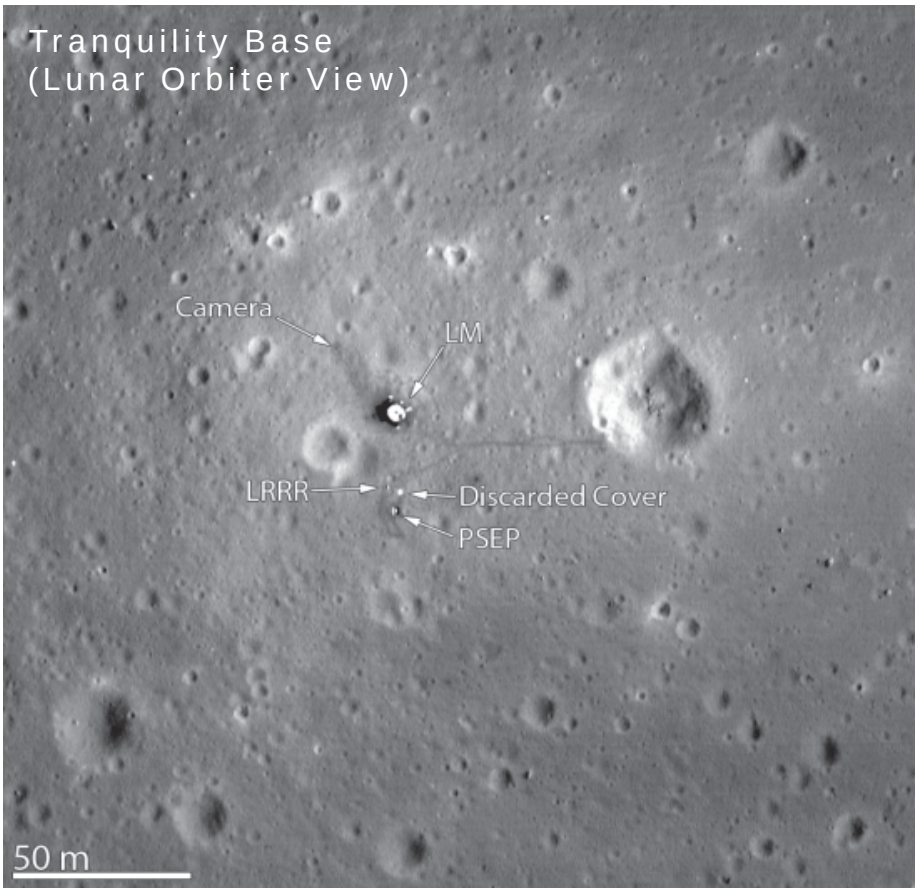


Photo by Bill Cloutier

NASA's Lunar Reconnaissance Orbiter (LRO) imaged the Apollo 11 landing site in 2012 from an altitude of 15 miles (24 km). From that distance, the spacecraft's camera was able to resolve the descent stage of the Lunar Module (LM), the Lunar Laser Ranging RetroReflector (LRRR) (still in use today) and its discarded cover, and the Passive Seismic Experiment Package (PSEP).

The LRO image also shows the astronauts' whereabouts during the two and one-half hours spent on the surface (dark tracks). Armstrong ventured the furthest from the LM when he made a quick inspection of a small crater (Little West) 164 feet (50 meters) to the east (right) of the LM.

For comparison, the total area explored during this first visit to the Moon could fit within the infield of a modern ballpark, except for Armstrong's excursion to Little West (the outfield).



LRO Image of Tranquility Base
Credit: NASA/GSF C/Arizona State University

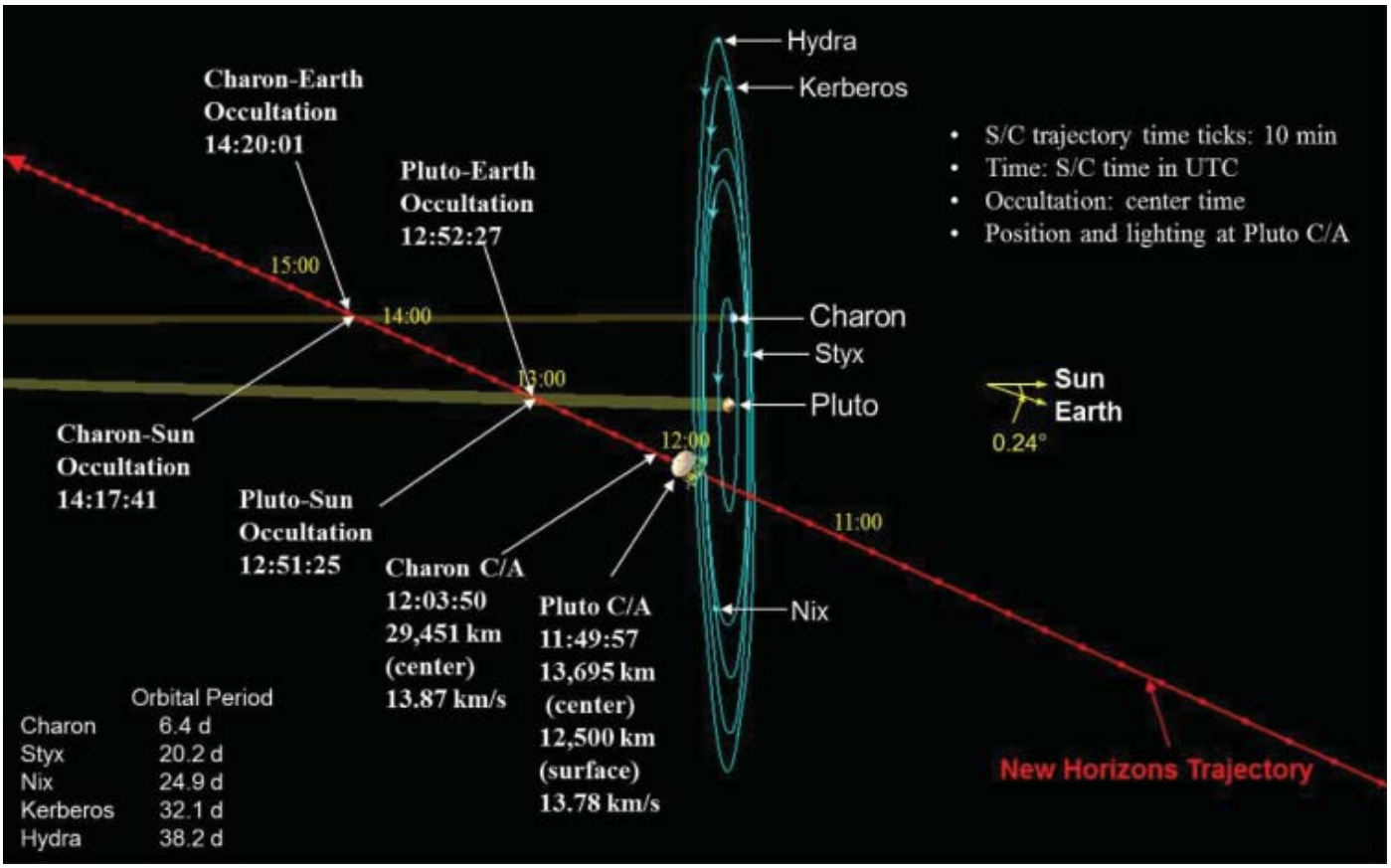
Pluto Encounter

Simulated view of Pluto and Charon 30 minutes before closest approach JPL's Solar System Simulator http://space.jpl.nasa.gov/

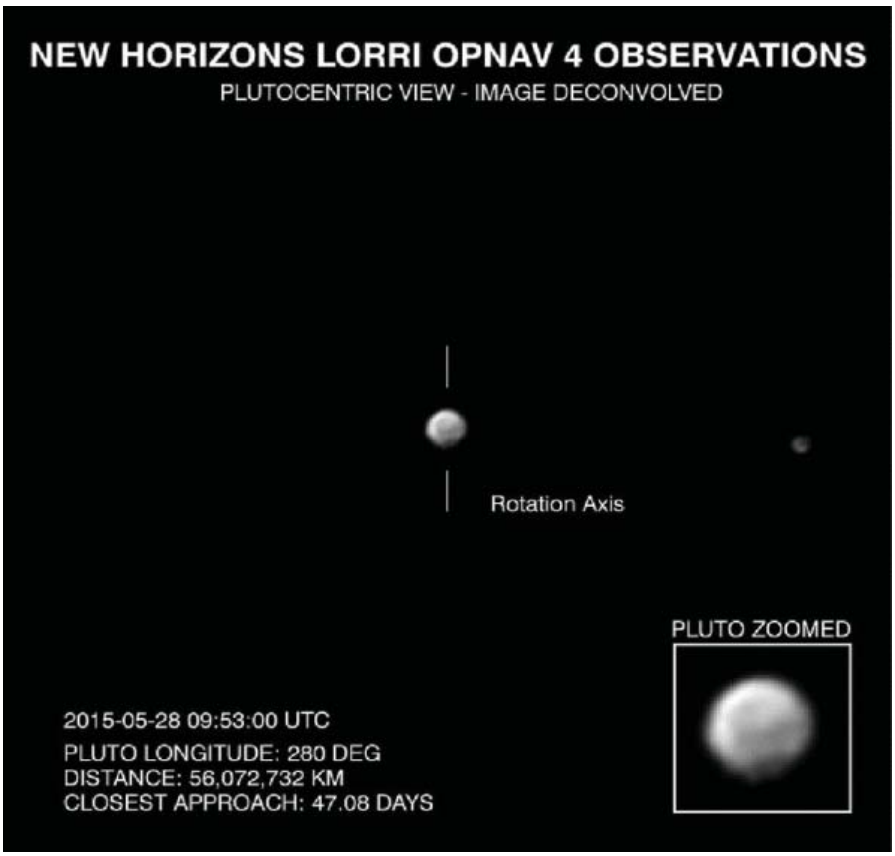
After nine and one-half years, the New Horizons spacecraft will make a high-speed pass of the dwarf planet Pluto on July 14th. At its closest approach, the spacecraft will be approximately 7,750 miles (12,500 km) from Pluto and 17,900 miles (28,800 km) from its largest moon Charon.

Observations made on May 29-30 and on June 5 by New Horizons' Long Range Reconnaissance Imager did not detect any rings, new moons, or other hazards that would require a change in the spacecraft's current trajectory. The New Horizons team has until July 4th to modify the spacecraft's course or, as a last resort, use the spacecraft's high-gain antenna as a debris shield (although this could reduce the science gathered during close approach).

Computer modeling of Pluto and its five moons, done by Mark Showalter of the SETI Institute in Mountain View, California and Doug Hamilton of the University of Maryland at College Park, found the rotation of Pluto and Charon around a common center of gravity has a chaotic effect on the other three, smaller moons. Specifically, the smaller moons wobble and tumble due to the shifting gravitational fields of the two larger bodies.



July 14th Timeline: NASA/JHUAPL



Credits: NASA/Johns Hopkins University Applied Physics Laboratory/SWRI

Space Shuttle Legacy

The dramatic success of the Apollo program was also responsible for its demise. Once Kennedy's challenge had been met and the Soviet Union bested, Congress quickly lost interest in funding NASA's ambitious and expansive exploration programs, including an expedition to Mars, development of a nuclear rocket, construction of a space station and deep space bases, and a space shuttle to service orbiting facilities.

Less than six months after Neil Armstrong had stepped onto the Moon, NASA began to cancel future missions due to draconian budget cuts. Apollo 20 was cancelled in January 1970, followed by two additional cancelations by the following September. One by one, cancelation of the other programs followed.

If not for the political support of the Air Force, the shuttle would have met the same fate. The Air Force, after having several of its own space programs canceled in the 1960s, including Dyna-Soar and the Manned Orbiting Laboratory, was interested in a low-cost means of launching reconnaissance satellites and military hardware. Air Force support on Capitol Hill, however, did not come without a cost. The price of their support was the redesign of the shuttle from a straight wing to a delta wing for greater cross-range capability (for example, to execute a one-orbit mission from Vandenberg Air Force Base, polar orbit and short-duration capture missions (capturing Soviet satellites in flight). The change in flight profile and wing configuration would significantly increase the reentry temperature - and therefore the demands on the shuttle's thermal protection system - which would one day have disastrous consequences.

The space shuttle that flew was a compromise, designed to meet Air Force requirements and the Office of Management and Budget's constraints. It was likely a much different (and more expensive) vehicle than if NASA had been allowed to pursue its fully reusable, potential hot-metal, straight-wing, initial design.

The space shuttle (or orbiter) is only one component of the Space Transportation System (STS). The three main engines of the reusable orbiter, carrying crew and cargo into orbit, are powered by 143,000 gallons of liquid oxygen and 385,000 gallons of liquid hydrogen contained within an expendable external tank during the first 8½ minutes of flight. Two solid rocket boosters (recoverable) provide an additional 2.6 million pounds of thrust during the first two minutes of flight. The solid rockets return to Earth (ocean) by parachute. The orbiter returns in an unpowered glide to a runway landing.

Photo by Bill Cloutier

Space Shuttles on Display

Six orbiters were built at Rockwell International's facility in Palmdale, California. The first, Enterprise, was used for atmospheric testing, the other five for travel to, and for long-duration stays in, low-Earth orbit. Between April 12, 1981 and July 21, 2011, the five space-worthy orbiters (Columbia, Challenger, Discovery, Atlantis and Endeavour) completed a total of 135 missions, carried 355 men and women, flew over 500 million miles, and spent more than 1,300 days in orbit.

The orbiters rendezvoused with Russia's Mir space station nine times, the International Space Station more than 35 times, and the Hubble Space Telescope five times. They carried to orbit satel-

lites, space station components, space telescopes, laboratories and laboratory experiments, and spacecraft to explore the solar system.

Unfortunately, the STS never delivered as lower-cost transportation system. The greater concern, however, was the loss of two shuttles and crew. The loss of the Columbia upon reentry on February 1, 2003 prompted a comprehensive reevaluation of the program. The Columbia Accident Investigation Board concluded that: "*Because of the risks inherent in the original design of the Space Shuttle, because that design was based in many aspects on now-obsolete technologies, and because the Shuttle is now an aging system but still developmental in character, it is in the nation's interest to replace the Shuttle as soon as possible as the primary means for transporting humans to and from Earth orbit*." Shortly after the release of the Board's findings, President Bush announced the remaining space shuttle fleet would be retired once the construction of the International Space Station was complete.

The landing of Atlantis on July 21, 2011 signaled the end of the shuttle program and the beginning of the effort to prepare the orbiters for a new life on public display. Toxic fuels were drained, hazardous materials and toxic chemicals neutralized, pyrotechnics disarmed, the main engines removed and preserved for future use and the shuttle's control systems placed in a safe configuration.

The Smithsonian requested the Discovery as the oldest and most traveled orbiter for display at its National Air and Space Museum, Udvar-Hazy Center in Virginia. The Enterprise, which had been on display at the Udyar-Hazy Center, was moved to the Intrepid Sea, Air & Space Museum in New York City.

NASA awarded Endeavour to the California Science Museum in Los Angeles, close to the Palmdale facility where it was built. Atlantis stayed close to home and put on display at the Kennedy Space Center.

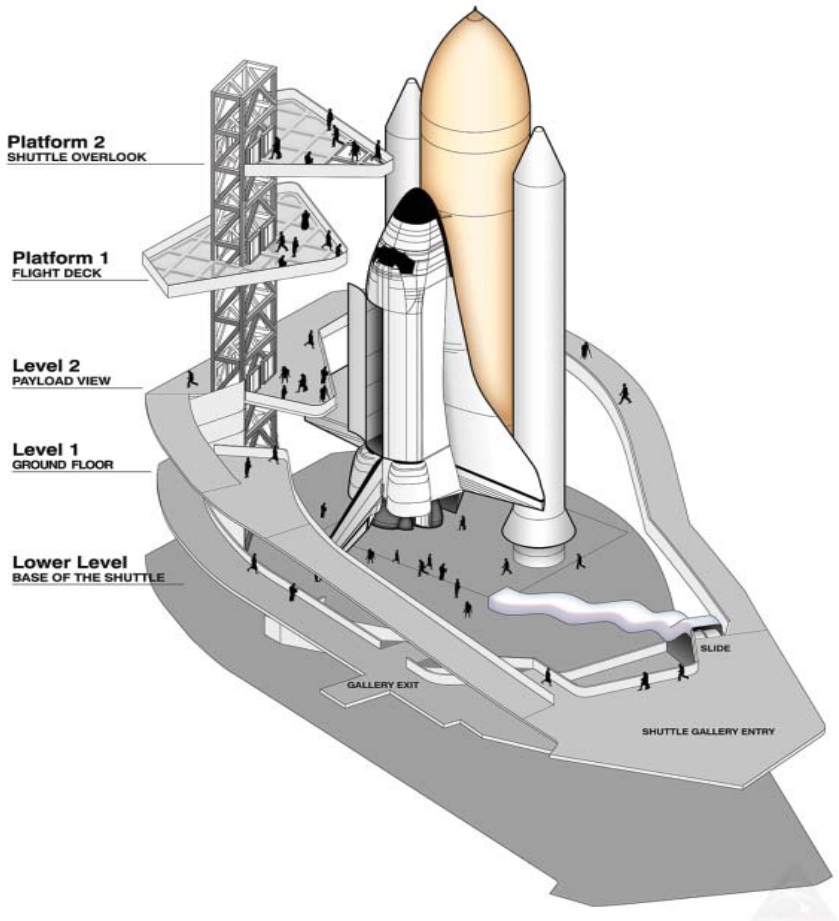
Enterprise

The Enterprise, designated Orbital Vehicle (OV)-101, was a test vehicle. It was not intended for spaceflight but provided critical test data on the orbiter's handling within the atmosphere, needed for a successful return from flight. It flew several captured flights (attached to the top of a Boeing 474) and five free flights at the Edwards Air Force Base. The orbiter was originally to be named Constitution; however, a write-in campaign by viewers of the Star Trek television show persuaded the administration to christen OV-101: Enterprise.

Once the Smithsonian acquired Discovery, the Enterprise was transported by barge to the Intrepid Sea, Air & Space museum where it went on display on July 19, 2012.

Discovery

Discovery was NASA's third orbiter (OV-103) and flew more missions than any of the other orbiters - 39 flights between 1984 and 2011. It was the workhorse of the fleet and the orbiter that flew the "return-to-flight" missions after the Challenger and Columbia accidents. Discovery delivered the Hubble Space Telescope to orbit and flew two of the follow-on ser-



Concept drawing by ZGF Architects LLP of the California Science Center's future Endeavour exhibit (California Science Center)

Enterprise

Discovery

vicing missions in 1997 and 1999. The orbiter made two flights to the Russian space station Mir and 13 flights to the International Space Station. The name Discovery was chosen to honor historic sailing ships of the past.

Discovery was delivered to the Smithsonian (near Dulles Airport) in April 2012 mounted atop NASA's Shuttle Carrier Aircraft, a modified Boeing 747 jumbo jet. It is displayed in a landing configuration with its gear deployed.

Endeavour

Endeavour (OV-105) was the last orbiter to join the fleet, built to replace the Challenger. Its maiden flight was on May 7, 1992 - the first of 25 missions. Endeavor carried the "corrective optics" in the first servicing mission to the Hubble Space Telescope. The orbiter also delivered the first U.S. component, the Unity Module, to the International Space Station. The orbiter is named after the British HMS Endeavour, the ship commanded by Captain James Cook on his first expedition to Australia and New Zealand between 1769 and 1771.

The California Science Center was selected to display the Endeavour, based, in part, on its proximity to Palmdale. The orbiter was delivered to the Los Angeles International Airport by the Shuttle Carrier Aircraft on September 21, 2012. Three weeks later, the orbiter was towed 12 miles through the streets of Los Angeles to the museum. Endeavor is on temporary display until a permanent home can be constructed. It is currently mounted in an elevated horizontal position, allowing visitors to walk beneath the orbiter. The orbiter will eventually be displayed in a vertical, launch configuration with an

external fuel tank and solid rocket boosters.

The California Science Center also acquired two solid rocket boosters from the Kennedy Space Center in 2012 (currently in storage at NASA's Armstrong Flight Research Center). The museum had planned to use a replica for the external tank, since the tanks used for flight were not recovered.

Over the 30-year program, 136 flight-qualified tanks were constructed at NASA's Michoud Assembly Facility in Louisiana. By happenstance, one tank was never used (it was too heavy to be used for ISS construction). Instead, the tank became a test article and even considered for future use on the Space Launch System. It was recently decided not to repurpose the tank, making it available to the California Science Center. Later this year (or early next year), the tank will be transported from Louisiana by barge, through the Panama Canal to Los Angeles. It will then follow the same route through the streets as Endeavor to the museum. Once the new 188,000 square foot addition to the California Science Center is complete (the Samuel Oschin Air and Space Center), the tank will be joined with the orbiter and solid rocket boosters and lifted into place. The exhibit is scheduled to open in 2018.

When complete, this will be the only stack of actual flight hardware from the Space Shuttle program on display.

Atlantis

Atlantis was NASA's fourth orbiter (OV-104), named after the two-masted boat that served as the primary research vessel for the Woods Hole Oceanographic Institute from 1930 to 1966. It benefited from the lessons learned in the construction of its predecessors, being completed

Photo by Bill Cloutier

Discovery

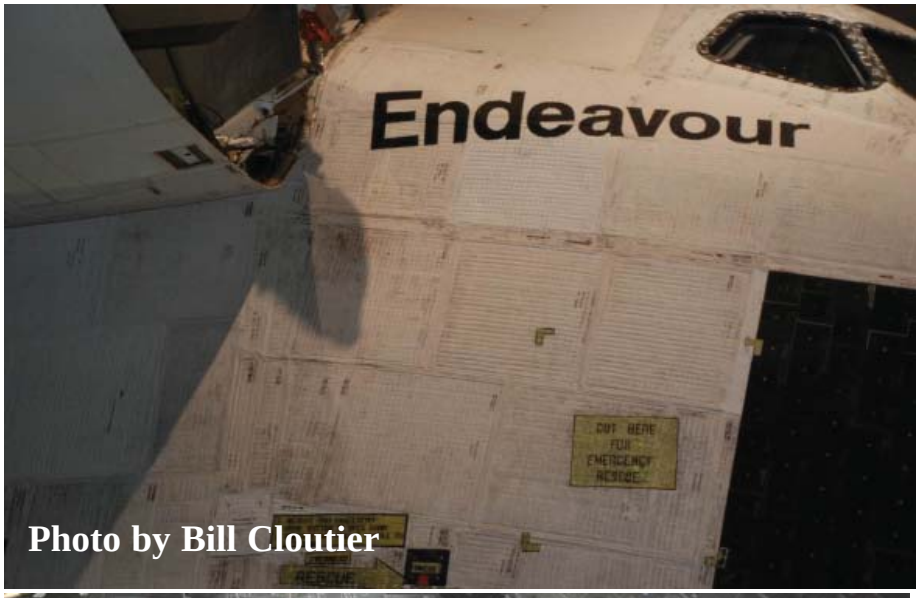


Photo by Bill Cloutier

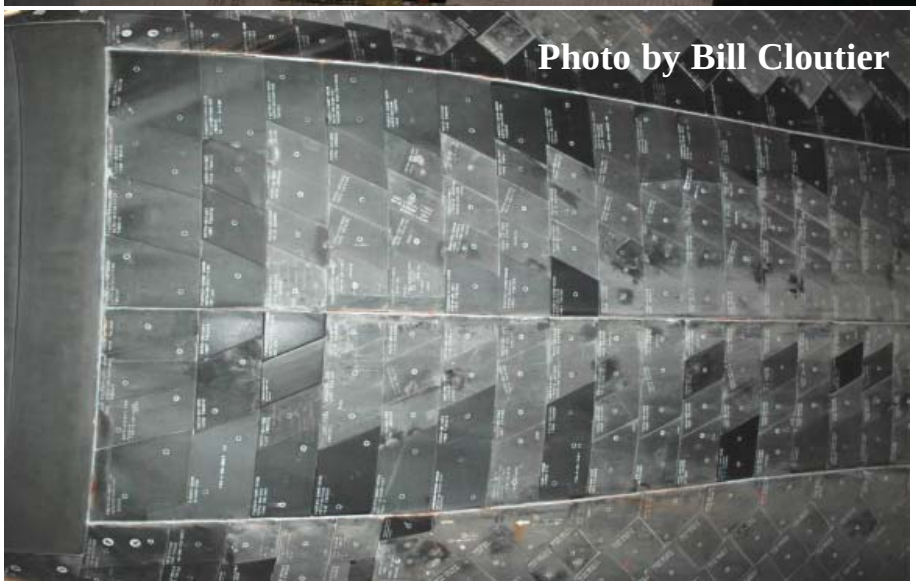


Photo by Bill Cloutier

Endeavour

in half the hours spent on Columbia and weighing in at 3.5 tons lighter (allowing it to carry more payload).

Atlantis was the first orbiter to dock with the Russian Mir space station. It carried to orbit planetary probes that would explore Venus (Magellan) and Jupiter (Galileo) and the Compton Gamma Ray Observatory. Atlantis delivered the U.S. laboratory module Destiny and the Joint Airlock Quest to the International Space Station, as well as sections of the Integrated Truss Structure (the structural backbone of the ISS).

Atlantis is on display at the Kennedy Space Center's Visitor Center. It is displayed as in flight, with payload doors open and its Canadarm (robotic arm) extended.

Lost Orbiters

Columbia

Columbia (OV-102) was NASA's first space-worthy orbiter. It lifted off on its maiden voyage on April 12, 1981, piloted by mission commander (and former Gemini and Apollo astronaut) John Young and pilot Robert Crippen. The orbiter was named for the first American ship to circumnavigate the globe in 1790 as well as the Apollo 11 command module. Among its many accomplishments, Columbia carried the Chandra X-ray Observatory into orbit in July 1999.

The orbiter and crew were lost during reentry on February 1, 2003 when hot gases entered a hole in the orbiter's left wing. The hole had been created by a small piece of foam shed by the external tank on takeoff. The hot gases melted the airframe, causing the vehicle to break up in the atmosphere.

Challenger

Challenger (OV-099) was originally built as a test vehicle. In 1979, Rockwell International received a contract to convert the orbiter for space flight (NASA believed Challenger to be a less complex conversion than Enterprise). Challenger arrived at the Kennedy Space Center in 1982, joining the Columbia.

The orbiter was named after the British Naval research vessel HMS Challenger that sailed the Atlantic and Pacific oceans during the 1870s.

Challenger made her maiden voyage on April 4, 1983. That mission included the first spacewalk from an orbiter, as well as the deployment of the first satellite in the Tracking and Data Relay Satellite System (TDRSS) constellation. Several spacelabs were carried into orbit in Challenger's payload bay. Sally Ride, the first American woman in space, rode to orbit aboard the Challenger.

Challenger was the first orbiter to be launched at night and the first to land at the Kennedy Space Center (prior missions had landed at either the Edwards Air Force Base in California or at White Sands, New Mexico).

The orbiter and crew (including high school teacher Sharon Christa McAuliffe) were lost when a seal failed in the right rocket booster. The open joint allowed burning fuel to escape from the rocket booster and breech the external tank. Seventy-three seconds after liftoff, the orbiter was destroyed in an explosion from the failure of the hydrogen and oxygen fuel inner tanks.

Planning Your Visit

Space Shuttle	Enterprise	Discovery	Endeavour	Atlantis
Location	Intrepid Sea, Air & Space Museum, NYC	Smithsonian Udvar-Hazy Center, Chantilly, Virginia	California Science Center,[1] Los Angeles	Kennedy Space Center, Florida
General Admission[2]				
Adult	$31.00	Free	Free [3]	$50.00
Seniors	$27.00	Free	Free [3]	$46.00
College Students	$27.00	Free	Free [3]	-
Veterans	$24.00	Free	Free [3]	-
Youth	$24.00	Free	Free [3]	-
Child	$17.00	Free	Free [3]	$40.00
Child (under 3)	Free	Free	Free [3]	-
Retired Military	Free	Free	Free [3]	-
Active Duty	Free	Free	Free [3]	$46.00
Museum Members	Free	Free	Free [3]	-
Parking	-	$15.00	$10.00	$10.00
Summer Hours (M-F)	10:00 am - 5:00 pm	10:00 am - 6:30 pm	10:00 am - 5:00 pm	9:00 am - 6:00 pm
Summer Hours (Weekends)	10:00 am - 6:00 pm	10:00 am - 6:30 pm	10:00 am - 5:00 pm	9:00 am - 6:00 pm

[1] Endeavour is on temporary display while its permanent home is under construction

[2] Best available information and subject to change. Does not include special attractions, tours or access to traveling exhibits

[3] $2 timed reservation is required on weekends, holidays, and the high attendance periods

Reference Websites for Additional Information:

Enterprise http://www.intrepidmuseum.org/
Discovery https://airandspace.si.edu/visit/udvar-hazy-center/
Endeavour http://californiasciencecenter.org/
Atlantis https://www.kennedyspacecenter.com/

Moving on Down

The Dawn spacecraft continues to adjust its orbit around the dwarf planet Ceres, moving closer with each burn of its ion thrusters. In July, the spacecraft will begin a downward spiral to the third of four mapping altitudes, 900 miles (1,450 km) above the cratered surface. The spacecraft will spend more than two months mapping Ceres at this altitude (between August 4th and October 15th) before descending to its final orbit 230 miles (375 km) above the surface in December (where it will remain until mission end).

On June 6th, from its second mapping orbit at an altitude of 2,700 miles (4,400 km), Dawn captured this image of the cratered surface, including the mysterious bright spots on the crater floor. Scientists are still puzzled by the nature of these spots, and are considering explanations that include salt and/or ice.

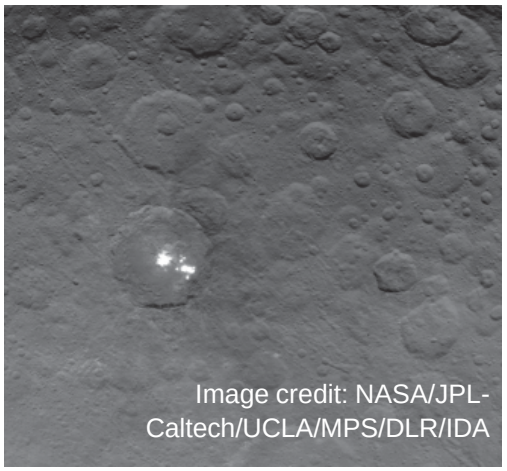
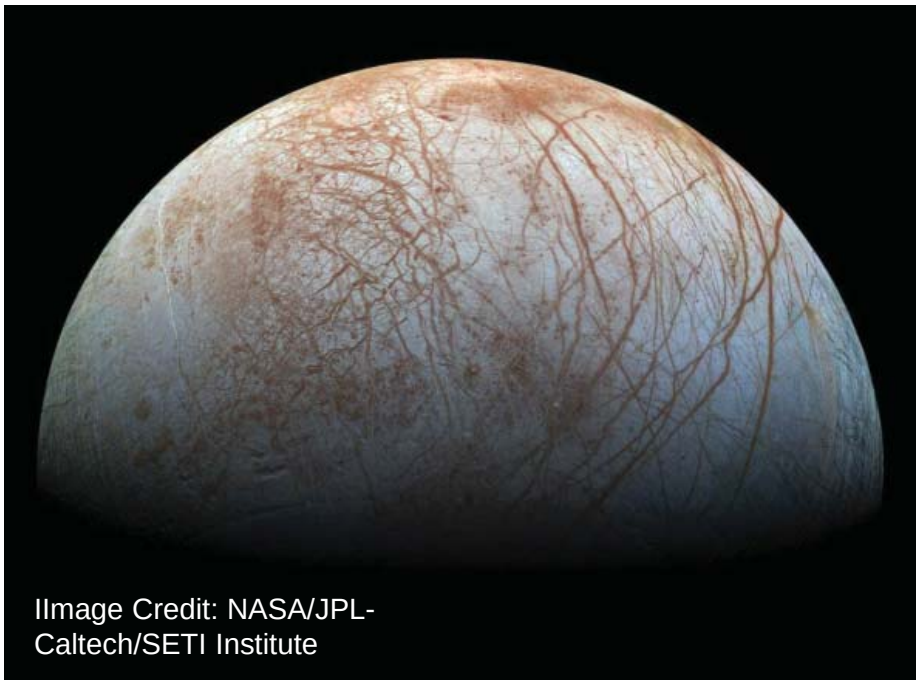


Image credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Mission Europa: Progress Report

A robotic mission to Jupiter's moon Europa continues to move forward, with NASA recently announcing the selection of nine instruments that will be carried by the space-craft's science platform. While the instruments are not specifically designed to detect life, they will be able to assess the habitability of the icy world. Mission scientists are hoping that the suite of instruments will provide the information needed to characterize the subsurface ocean (depth and salinity), the overlying icy crust (thickness and activity), the darker material seen on the surface, and the plumes detected by the Hubble Space Telescope.

The instruments selected for the mission include a magnetometer to measure the moon's magnetic field, a spectrometer for mapping organic compounds, ice penetrating radar, a thermal imaging system and an ultraviolet spectrograph for analysis of any icy plumes. Depending upon Congressional funding, NASA hopes to be able to launch the mission in the 2020s. Arrival time at Jupiter will depend upon the availability of several heavy lift rocket boosters currently under development.



IImage Credit: NASA/JPL-Caltech/SETI Institute

The Europa spacecraft will be solar powered - similar to the Juno spacecraft which is en route to Jupiter (2016 arrival). It will use the gravity of Jupiter and its moons to adjust the spacecraft's elongated orbit and execute at least 45 close flybys of Europa while minimizing the time spent within Jupiter radiation belts.

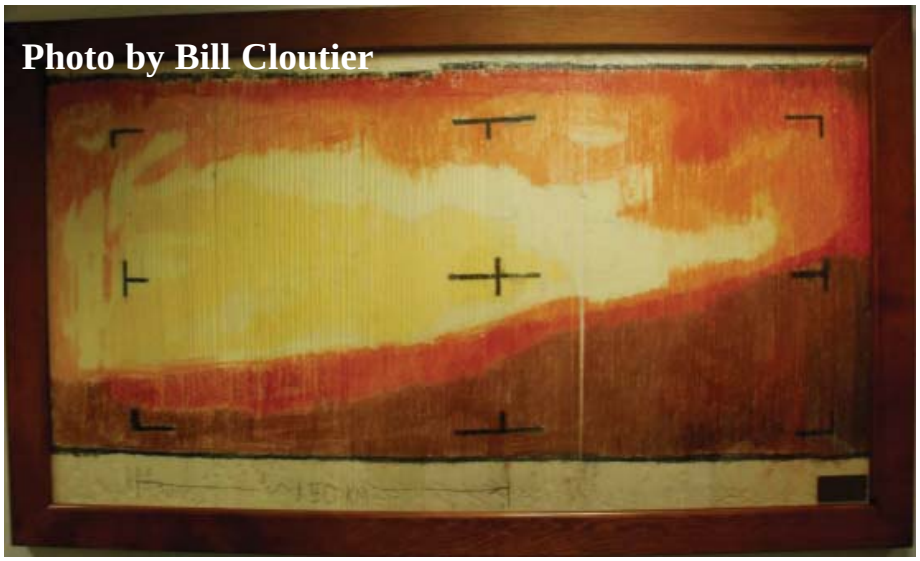
Mariner 4 – The First Photograph

In a nondescript hallway at NASA's Jet Propulsion Laboratory (JPL) hangs a framed picture that could pass for modern art or a preschool art project. A closer inspection reveals its composition: 3-inch wide strips of ticker tape arranged in columns and containing streams of seemingly random numbers, colored like a paint-by-numbers picture.

The picture is actually the first television image of Mars (in pastels), as transmitted from a small tape recorder on the Mariner 4 spacecraft as it flew past Mars on July 14, 1965. The digital data transmitted from the recorder was converted into numbers and printed on strips of paper at JPL (JPL built the Mariner 4 spacecraft and its unsuccessful twin, Mariner 3). JPL personnel, anxious to see if the tape recorder was working (it was a spare recorder that flew

on Mariner 4), stapled the strips to the wall and hand colored the numbers with pastels purchased from a local art store based upon the brightness of the individual pixels.

The resulting picture shows the limb of Mars, with brown representing space. The completed picture was eventually cut out of the wall, framed and presented to then JPL director, William H. Pickering. Mariner 4 transmitted a total of 22 black and white photographs during its encounter with Mars, passing as close as 6,118 miles (9,846 km) to the Red Planet. The images revealed a barren and cratered planet - much to the disappointment of those hoping for a more hospitable environment.



Saturn's Icy Moons

The Cassini spacecraft is currently in an orbit around Saturn that facilitates flybys of the planet's icy moons. On April 11, 2015, the spacecraft's narrow-angle camera captured Dione and Rhea in the same field of view. The moon in the foreground is Dione at 698 miles (1,123 km) in diameter. The moon in the background is Rhea (949 miles or 1,527 km in diameter). Dione appears larger because it was much closer to the camera. While eerily hypnotic, the image serves a more practical purpose in confirming the spacecraft's course and direction.

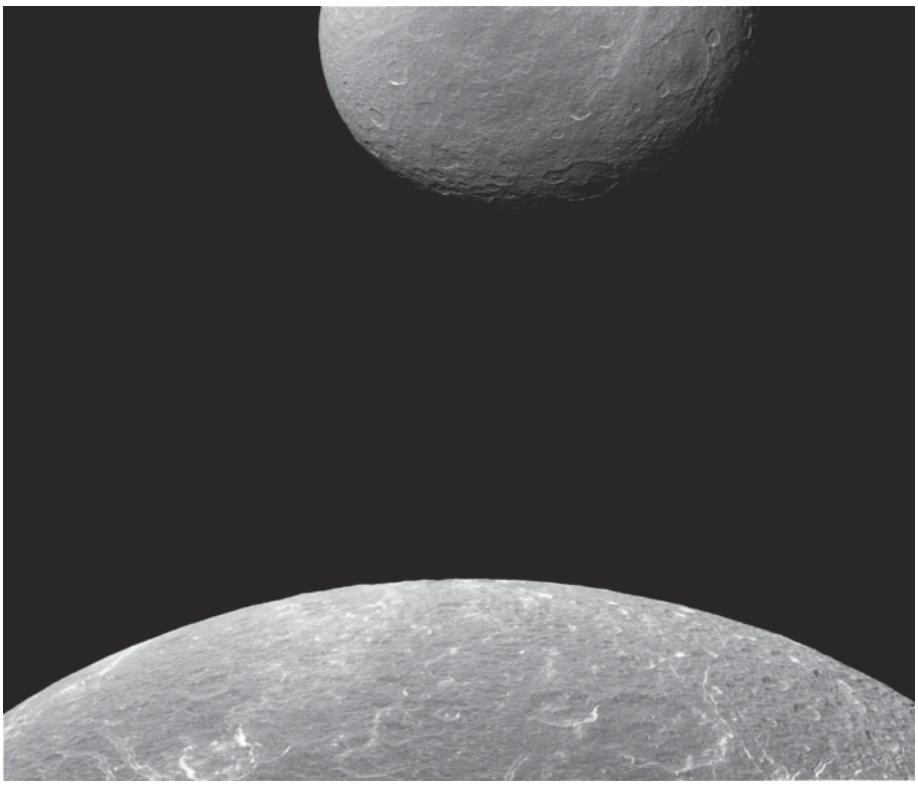


Image credit: NASA/JPL-Caltech/Space Science Institute

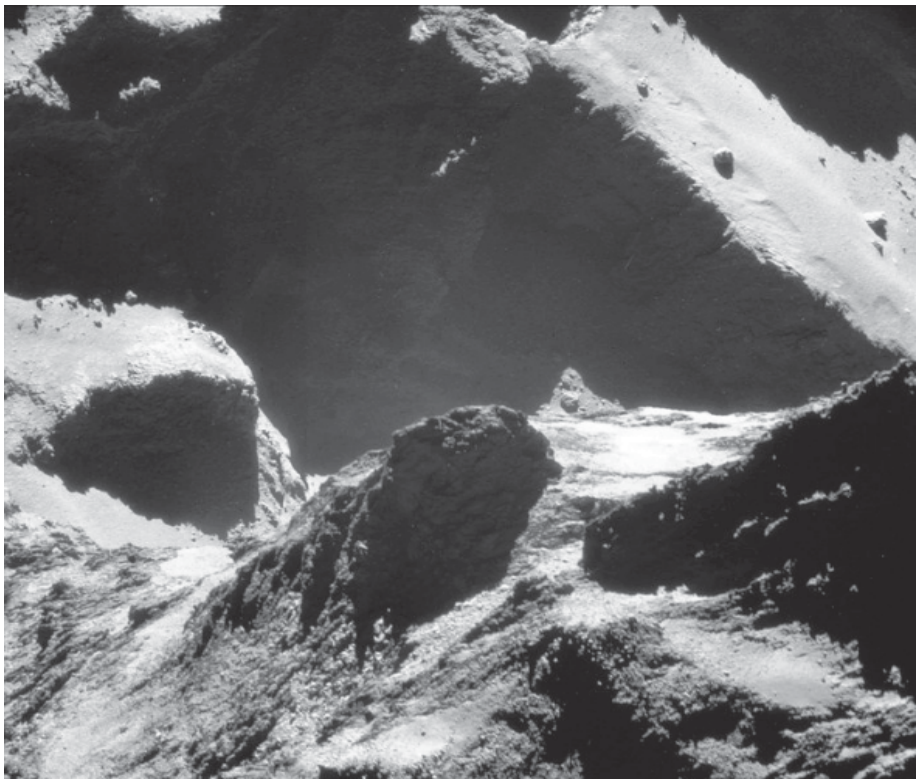
Cassini obtained the image from a distance of approximately 68,000 miles (110,000 km) from Dione. Rhea was approximately 300,000 miles (500,000 km) from Cassini at the time.

Philae Awakens

On August 6, 2014, the European Space Agency's Rosetta spacecraft rendezvoused with 67P/Churyumov-Gerasimenko, a short period comet. The spacecraft has traveled with the comet for the past year on the comet's journey around the Sun. The comet will reach perihelion (closest distance to the Sun) in August 2015 before heading back out beyond the orbit of Jupiter.

On November 12, 2014, Rosetta released a small lander (Philae) onto the surface of the

comet. Philae operated for three days on battery power after settling down in a heavily shadowed outcropping (the lander's solar panels were unable to recharge its batteries). However, on June 13, 2015, after 211 days of hibernation, mission controllers received a signal from the lander. Philae's internal temperature and power level indicate that the landing area is now receiving some sunlight. With communications reestablished, Rosetta should be able to pinpoint Philea's location and scientists are hopeful that the lander can continue its scientific mission.



Comet 67P/Churyumov-Gerasimenko Copyright: ESA/Rosetta/ NAVCAM, CC BY-SA IGO 3.0

Colonizing Mars – Technology Development

The heaviest payload delivered to the Martian surface has been the one-ton Curiosity rover. The rover landed safely in Gale Crater using a large (fifty-foot diameter) parachute and a rocket-powered sky crane to slow its descent. While innovative, a more capable delivery system is needed if NASA plans to deliver even larger payloads to the Martian surface - for example, to support human exploration.

Workers prepare the LDSD for its second test flight in the high bay clean room of the Jet Propulsion Laboratory's Spacecraft Assembly Facility

Larger parachutes are under development; however, the velocity at which they can be opened is still the limiting factor. With the average density of the Martian atmosphere only 1% of Earth's atmosphere, NASA is investigating new methods to decelerate the payload to velocities where parachutes can successfully operate.

The Low-Density Supersonic Decelerator (LDSD) is NASA's saucer-shaped test vehicle for evaluating technologies to increase the drag and slow the entry of a vehicle entering the Martian atmosphere. Two test flights have been completed with the vehicle equipped with a Supersonic Inflatable Aerodynamic Decelerator, or SIAD, and 100-foot (30.5-meter) diameter parachute. LDSD tests are conducted at an altitude of 180,000 feet (55,000 meters) to mimic the density of the Martian atmosphere and at Mach 4 (super-

sonic velocity). The vehicle is carried to the test altitude by a large scientific balloon (first 120,000 feet or 37,000 meters) and a solid-fueled rocket motor.

The SIAD is a balloon-like collar that, once inflated, increases the surface area (and drag) of the vehicle as it enters the atmosphere. With the SIAD inflated, the vehicle can be slowed from Mach 3.5 or greater to Mach 2 or lower. A 20-foot (6-meter) diameter and 26-foot (8-meter) diameter SIAD are under development. NASA is also developing a 100-foot- (30.5-meter-) diameter parachute, called the Supersonic Ringsail parachute. The parachute should be able to slow the vehicle to subsonic velocities. Together, the new technologies may make it possible to land payloads 2 to 3 times heavier than currently possible.

In two test flights, the 20-foot diameter SIAD has been successfully deployed. The supersonic parachutes, in both instances, failed on deployment and initial inflation; however, all other test objectives were achieved.

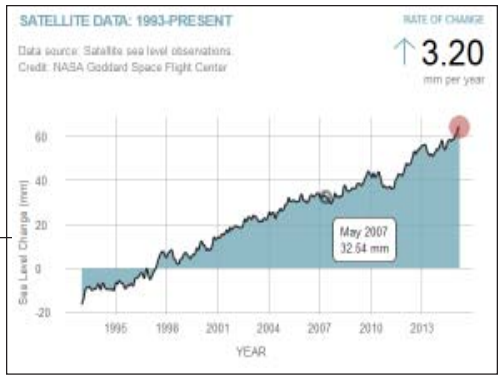
LDSD being readied for second launch at the Pacific Missile Range Facility on the island of Kauai in Hawaii. Source: NASA

Jason 3

The Jason 3 spacecraft arrived at the Vandenberg Air Force Base in California on June 18, 2015 in preparation for an August 8th launch aboard a SpaceX Falcon 9 rocket. The mission is the fourth in a series of U.S.-European satellites designed to measure the surface topography of the Earth's oceans (beginning with the TOPEX/Poseidon satellite mission in 1992). Jason 3 will replace the Jason 2 spacecraft launched in 2008.

The Falcon 9 rocket will deliver the 1,146 pound (510 kg) satellite into a near-polar orbit, 830 miles (1,336 km) above Earth. Jason 3 will provide data on ocean roughness, sea level and wave heights around the world. The data is used in forecasting severe weather (including hurricanes), monitoring surface wave heights, predicting the severity of El Niño and La Niña events, monitoring tides and currents (and storm surges), and recording global sea level change.

Since 1993, altimetry data from the Jason satellites has shown a 3 millimeter per year rise in sea level. The rate is nearly twice as fast as measured in the previous century (sea level rise is due to a combination of melting land ice and warmer temperatures that cause sea water to expand). The Jason 3 radar altimeter has an accuracy of 1.3 inches (3.3 centimeters).



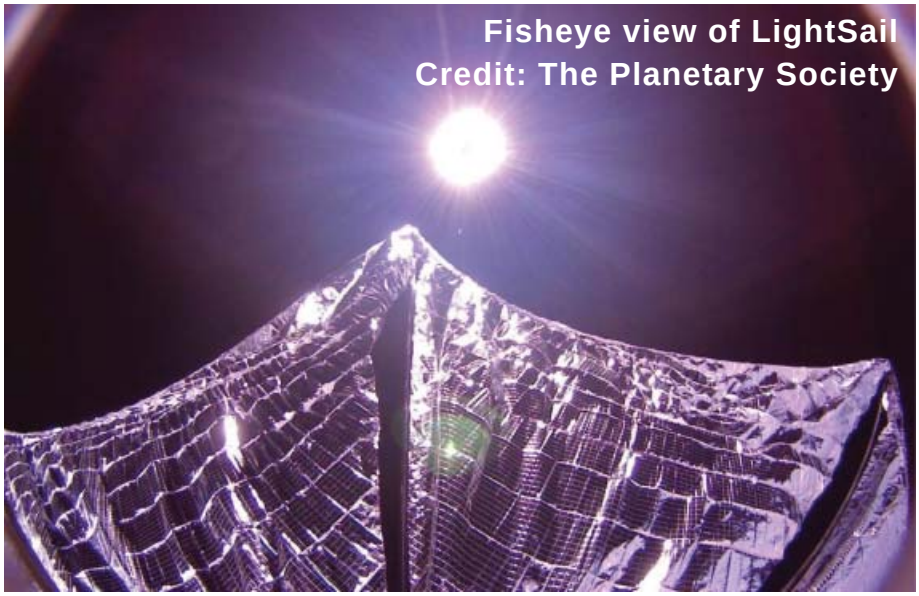
LightSail

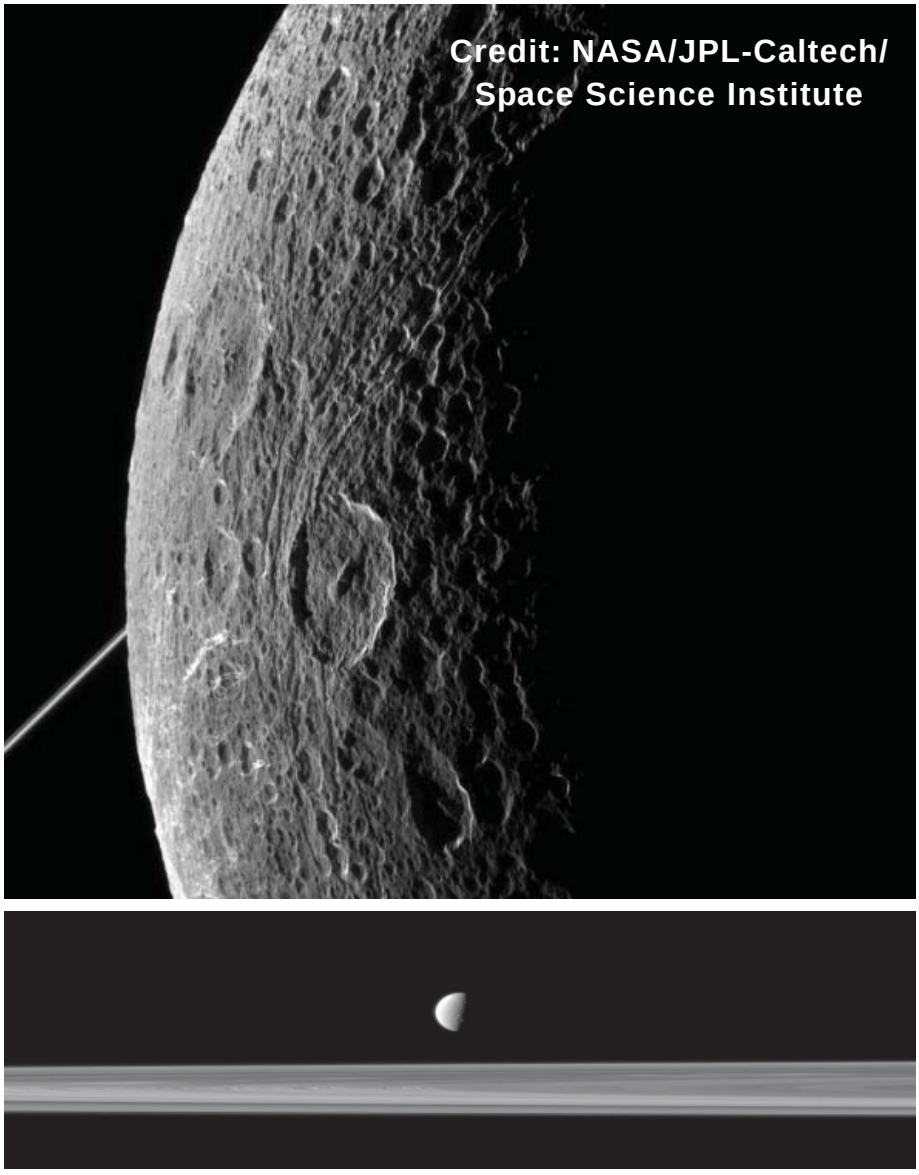
The Planetary Society completed its first test flight of its citizen-funded solar sail. The 344 square foot (32 square meters) Mylar sail was successfully deployed on June 7th from a three-unit CubeSat that was carried into orbit on an Atlas V rocket (along with the Air Force's secret space plane). The mission ended shortly after deployment due to the atmospheric drag at the sail's low altitude.

The successful test flight paves the way for a second flight

Artist's view of the future Jason-3 satellite
Credit: Cnes/Nasa/Eumetsat/NOAA

in 2016. Riding to orbit with a small satellite developed by the Georgia Institute of Technology, SpaceX's new Falcon Heavy will deliver the sail to an altitude of 450 miles (720 km). At that altitude, the Planetary Society plans to sail through space propelled only by the energy and momentum of the Sun's photons. Approximately $4.2 million of the total program cost of $5.45 million have been raised through public outreach and social media efforts such as Kickstarter campaigns.





Ringside view of Dion taken by Cassini in 2011. Source: NASA

Dione

The battered surface of Saturn's moon Dione is captured by the Cassini spacecraft during a close flyby on June 16, 2015. The spacecraft passed within 321 miles (516 km) of the moon's surface. Saturn's rings (bright line) can be seen in the background.

Dione was discovered by Giovanni Cassini on March 21, 1684. The moon has a diameter of 698 miles (1,123 km) and orbits Saturn once every 2.7 days. Dione's distance from Saturn is approximately that of Earth's moon (approximately 234,000 miles or 377,400 km). The moon is tidally locked, with one face always facing Saturn. Dione, in turn, has tidally locked two smaller moons, Helene and Polydeuces, with Helene positioned 60 degrees ahead of Dione and Polydeuces 60 degrees behind Dione. Dione is also in resonance (exerting mutual gravitational influence) with the moons Mimas and Enceladus

Dione orbits within the bounds of Saturn's E-ring, a broad expanse of microscopic particles. The particles, originating from the icy geysers on Enceladus, bombard Dione. The moon's density suggests a composition of rock (dense core) and ice.

Summer Activities

Summer is a great time to enjoy the night sky. Some suggestions for this summer:

1. Attend a star party. Star parties are gatherings of amateur astronomers where the general public is invited to share the wonders of the night skies with skilled observers and through telescopes of every size and shape. A calendar of dates and locations across the United States is available at www.skyandtelescope.com. Closer to home, the McCarthy Observatory hosts a star party on the second Saturday of each month. Please join us on July 11th and August 8th with your family and friends for a memorable evening under the stars.

2. Take in a meteor shower. With no telescope required, this naked-eye activity can be enjoyed in a lawn chair and a warm blanket. While an occasional meteor can be spotted at anytime, August 12th is the night to catch the Perseids meteor shower. A meteor shower occurs when the Earth passes through a cloud of debris usually left behind by a comet. Comet Swift-Tuttle is the source of the small grains of dust that create the Perseid shower. As one of the most famous showers, the Perseids meteor shower usually delivers an impressive display. Expect dark skies this year, as moonlight will not be a problem.

3. Locate the Summer Milky Way. Our solar system resides in one of the outer arms of a very large, rotating pinwheel of 200-300 billion stars called the Milky Way Galaxy. During the summer, we can see the inner arms of the pinwheel in the direction of the galactic core. Unfortunately, a dark sky is required, as excessive lighting is ruining the natural inky black of the celestial sphere. However, it can be seen from parts of New Milford, late at night and once the moon has set. If you have never seen the Milky Way:

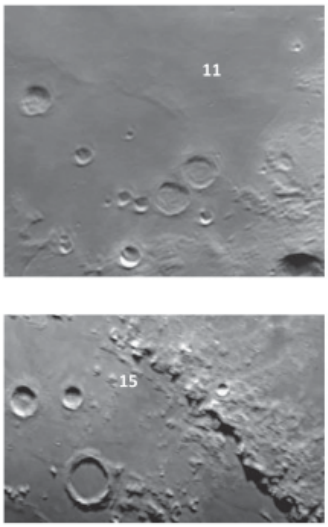
   - Locate the Big Dipper (the most prominent asterism in the northern sky). The last two stars in the bowl of the Dipper point to the North Star.
   - Imagine a line extended from the two Dipper stars, through the North Star and an equal distance beyond. You should now be between the constellations Cepheus and Cassiopeia. Cassiopeia is shaped like a W or and is the starting point for our journey down the Milky Way.
   - The Milky Way flows from Cassiopeia south to Cygnus (the Swan or Northern Cross). Cygnus can be recognized by its brightest star Deneb (at the tail) and the three bright stars that form the wing.
   - Continuing south, the bright star Altair provides the next navigation aid, directing us to Sagittarius, an asterism shaped like a teapot. On a dark night, the star clouds of the Milky Way appear like steam from the spout of the teapot. The spout is also in the general direction of the center of our galaxy (26,000 light years away).

"Teapot" asterism in Sagittarius and star clouds of the Milky Way

   From a good observing site, you should see a band of cloudiness through this area of the sky. Through binoculars, the "clouds" can be resolved into bright areas populated by stars and darker areas with few or no stars. The darker patches are regions of gas and dust that obscure our view of the galactic center.

4. Find the Apollo landing sites. July marks the anniversaries of two moon landings. Apollo 11 landed on the southwestern shore of the Sea of Tranquility on July 20, 1969. Apollo 15 landed in the foothills of the Apennine Mountains on July 30, 1971. The southwestern shore of the Sea of Tranquility is visible 5 days after a New Moon. The Sun rises on the Apennine Mountains around the First Quarter Moon.

Sea of Tranquility and Apollo 11 landing site



Apennines Mountains and Apollo 15 landing site

Astronomical and Historical Events

July

1st Full Moon (sometimes called the Full Buck, Thunder or Hay Moon)
1st Venus passes 0.4° from Jupiter
1st History: opening of the Smithsonian National Air & Space Museum (1976)
1st History: NASA officially activates the Launch Operations Center on Merritt Island, Florida; later renamed the Kennedy Space Center (1962)
1st History: 100 inch diameter mirror for the Hooker Telescope arrives on Mt. Wilson (1917)
1st History: discovery of asteroid *6 Hebe* by Karl Hencke (1847)
2nd History: launch of European Space Agency's Giotto spacecraft to Comet Halley (1985)
3rd Scheduled launch of a Russian Progress cargo-carrying spacecraft to the International Space Station from the Baikonur Cosmodrome in Kazakhstan
3rd History: launch of the ill-fated Nozomi spacecraft to Mars by Japan (1998)
3rd History: launch of the Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX) by a Scout rocket (1992)
4th History: impact of Comet Tempel 1 by Deep Impact's impactor (2005)
4th History: Pathfinder spacecraft, with rover Sojourner, lands on Mars (1997)
4th History: Chinese astronomers record a "guest star" (supernova) in the constellation Taurus; visible for 23 days and 653 nights (1054); the remnant (Crab Nebula) later catalogued by Charles Messier as Messier 1 or M1
5th Distant flyby of Saturn's moons *Pan* and *Telesto* by the Cassini spacecraft
5th Moon at Perigee (closest distance to Earth)
6th Earth at Aphelion, furthest distance from Sun (1.017 AU)
6th History: discovery of Jupiter's moon *Lysithea* by Seth Nicholson (1938)
6th History: Isaac Newton's "Principia" published (1687)
7th Flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
7th Centaur Object 944 Hidalgo at Opposition (6.892 AU)
7th Dwarf Planet 134340 Pluto at Opposition (31.888 AU), rising with the setting Sun and visible (with a telescope) all night
7th History: launch of the Mars Exploration Rover B (Opportunity) (2003)
8th Last Quarter Moon
8th History: launch of the Space Shuttle Atlantis (STS-135) to the International Space Station; final space shuttle flight to low Earth orbit (2011)
9th History: closest pass of Jupiter's cloud tops by the Voyager 2 spacecraft (1979)
10th History: flyby of asteroid *21 Lutetia* by the European Space Agency's Rosetta spacecraft (2010).
10th History: launch of Telstar 1, prototype communication satellite designed and built by Bell Telephone Laboratories (1962)
10th History: Alvan Graham Clark born, optician and telescope maker (1832)
11th Second Saturday Stars – Open House at the McCarthy Observatory
11th History: launch of the Soviet Gamma Observatory (1990)
11th History: Skylab re-enters into the Earth's atmosphere (1979)
12th History: launch of Soviet Mars orbiter Phobos 2 (1988)
13th History: Soviet Union launches Luna 15, a lunar lander and sample return mission, in an attempt to upstage Apollo 11; crashed during landing (1969)
13th History: Langley Research Center's birthday (1917)
14th Flyby of dwarf plant Pluto by the New Horizons spacecraft
14th History: flyby and first close-up view of Mars by the Mariner 4 spacecraft (1965)
15th New Moon
15th History: the Dawn spacecraft enters orbit around the asteroid 4 *Vesta* (2011)
16th History: over twenty fragments of comet Shoemaker-Levy 9, with diameters estimated at up to 2 kilometers, collide with Jupiter between July 16th and the 22nd (1994); the comet had been discovered a year earlier by astronomers Carolyn and Eugene Shoemaker and David Levy
16th History: launch of Badr-A, first Pakistan satellite (1990)
16th History: launch of Apollo 11, with astronauts Neil Armstrong, Edwin "Buzz" Aldrin and Michael Collins, first manned lunar landing (1969)
16th History: first launch of a Proton rocket by the Soviet Union (1965)
17th History: docking (and crew handshake) of an Apollo spacecraft with astronauts Thomas Stafford, Vance Brand, and "Deke" Stayton with a Soyuz spacecraft with cosmonauts Alexei Leonov and Valeri Kubasov (the Apollo-Soyuz Test Project (ASTP)) (1975)

Astronomical and Historical Events (continued)

17th History: William Bond and John Adams Whipple take the first photograph of a star (Vega) at the Harvard College Observatory (1850)
18th History: launch of Rohini 1, India's first satellite (1980)
18th History: launch of Gemini X, with astronauts John Young and Michael Collins (1966)
18th History: launch of Soviet Zond 3 spacecraft; first successful flyby of Moon; transmitted photographs that included the far side (1965)
18th History: Allan Sandage born, astronomer specializing in observational cosmology (1926)
19th Centaur Object 37117 *Narcissus* at Opposition (6.594 AU)
19th History: launch of the Explorer 35 spacecraft into an elliptical lunar orbit; designed to study interplanetary plasma, magnetic field, energetic particles, and solar X-rays (1967)
20th History: discovery of Jupiter's moon *Callirrhoe* (2000)
20th History: Gus Grissom's Mercury capsule (Liberty Bell 7) retrieved from the Atlantic Ocean floor at a depth of 15,000 feet, 38 years after it had sunk after splashdown (1999)
20th History: Viking 1 lands on Mars (1976)
20th History: Apollo 11 lands on Moon at 4:17 pm EDT; first step onto the lunar surface at 10:56 pm (1969)
21st Moon at Apogee (furthest distance from Earth)
21st History: launch of the Soviet Mars mission Mars 4 (1973)
21st History: launch of Mercury-Redstone 4 with astronaut Virgil (Gus) Grissom; second suborbital flight by the United States (1961)
21st History: discovery of Jupiter's moon *Sinope* by Seth Nicholson (1914)
22nd Scheduled launch of a Russian Soyuz spacecraft with the next Expedition crew to the International Space Station from the Baikonur Cosmodrome in Kazakhstan
22nd History: landing of Soviet spacecraft Venera 8 on Venus (1972)
23rd Dwarf planet Ceres closest approach to Earth (1.939 AU)
23rd History: launch of Space Shuttle Columbia (STS-93) and the Chandra X-ray Observatory (1999); first mission commanded by a woman, Eileen Collins
23rd History: discovery of Comet Hale-Bopp by Alan Hale and Tom Bopp (1995)
23rd History: discovery of Neptune's rings (1984)
23rd History: launch of Landsat 1 into a near-polar orbit to obtain information on Earth's resources, environmental pollution, and meteorological phenomena (1972)
24th First Quarter Moon
24th History: first rocket launch from Cape Canaveral (Bumper/V-2 rocket) in 1950
25th Distant flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
25th History: Svetlana Savitskaya becomes the first woman to walk in space (1984)
25th History: launch of Soviet Mars orbiter Mars 5 (1973)
26th History: launch of the Space Shuttle Discovery (STS-114) "Return to Flight," 907 days after the loss of Space Shuttle Columbia (2005)
26th History: launch of Apollo 15 with astronauts David Scott, James Irwin and Alfred Worden; fourth lunar landing (1971)
26th History: launch of Syncom 2, first geosynchronous satellite (1963)
27th Distant flyby of Saturn's moons *Dione* and *Enceladus* by the Cassini spacecraft
28th History: launch of Skylab-3 astronauts Alan Bean, Jack Lousma and Owen Garriott (1973)
28th History: launch of Ranger 7; Moon impact mission (1964)
29th South Delta-Aquarids Meteor Shower peak
29th History: deorbit and destruction of the Salyut 6 space station; first of the Soviet's second-generation space station design (1982)
29th History: Deep Space 1 flyby of asteroid *Braille* (1999)
30th History: the Cassini spacecraft arrives at Saturn after a seven year journey (2004)
30th History: launch of the Wilkinson Microwave Anisotropy Probe (WMAP); mapped the Cosmic Microwave Background radiation and determined the age of the universe to be 13.73 billion years old to within one percent (2001)
30th History: Apollo 15 lands on Moon at 6:16 pm EDT (1971)
30th History: discovery of Jupiter's moon *Carme* by Seth Nicholson (1938)
30th History: Galileo observes Saturn's rings (1610)
31st Full Moon (second full moon occurring within a calendar month, sometimes called a Blue Moon)
31st History: impact of the Lunar Prospector (1999)
31st History: flyby of Mars by Mariner 6 (1969)

Astronomical and Historical Events for July (continued)

August

1st Peak of the Alpha Capricornids meteor shower
1st History: discovery of Martian meteorite (shergottite class) SAU 051 in Oman (2000)
1st History: launch of Lunar Orbiter 5, the last of the Lunar Orbiter series; photographed potential Apollo and Surveyor landing sites and captured the first image of a nearly full Earth from space (1967)
1st History: Maria Mitchell born, first woman to be elected as an astronomer to the American Academy of Arts and Sciences (1818)
2nd Moon at Perigee (closest distance to Earth)
2nd Kuiper Belt Object 2008 OG19 at Opposition (37.588 AU)
3rd History: launch of the MESSENGER spacecraft to Mercury (2004)
4th History: launch of the Phoenix polar lander spacecraft to Mars (2007)
5th History: launch of the Juno spacecraft to Jupiter (2011)
5th History: flyby of Mars by the Mariner 7 spacecraft (1969)
5th History: astronaut Neil Armstrong born (1930)
6th Last Quarter Moon
6th Southern Iota Aquarids Meteor Shower Peak
6th History: the Rosetta spacecraft and her robotic lander companion Philae arrive in orbit around Comet 67P/Churyumov–Gerasimenko after a 10-year journey (2014)
6th History: landing of the Mars Science Laboratory (MSL or Curiosity) at the base of Mount Sharp inside Gale Crater (2012)
6th History: launch of Vostok 2 and cosmonaut Gherman Titov; second man in Space (1961)
6th History: Chinese astronomers first observe supernova in Cassiopeia; remained visible for more than 6 months (1181)
7th History: Brett Gladman, et al's discovery of Saturn moons *Ymir*, *Paaliaq* and *Kiviuq* (2000)
7th History: announcement of possible microfossils found in Martian meteorite ALH84001 (1996)
7th History: Viking 2 arrives at Mars (1976)
8th Second Saturday Stars – Open House at the McCarthy Observatory
8th Scheduled launch of the Jason 3 ocean altimetry satellite from the Vandenberg Air Force Base
8th History: launch of Genesis spacecraft, solar particle sample return mission (2001)
8th History: launch of Pioneer Venus 2 (1978)
8th History: launch of the Soviet Zond 7 Moon probe (1969)
9th History: launch of the Soviet Luna 24 spacecraft, third attempt (and only successful attempt) to recover a sample from Mare Crisium (1976)
10th History: launch of Mars Reconnaissance Orbiter to Mars (2005)
10th History: launch of Kitsat A, first South Korean satellite (1992)
10th History: the Magellan spacecraft enters orbit around Venus; radar mapped 98% of the planet over the following two years (1990)
10th History: launch of the Lunar Orbiter 1 spacecraft; photographed smooth areas of the lunar surface for assessing future landing sites and captured iconic image of the Earth rising above the lunar surface (1966)
11th History: Asaph Hall discovers Martian moon *Deimos* (1877)
12th Peak of the Perseids meteor shower
12th History: launch of the High Energy Astronomical Observatory (HEAO-1) to monitor x-ray sources (1977)
12th History: Soviet spacecraft Vostok 4 launched one day after Vostok 3 - first time multiple manned spacecraft in orbit, although they did not rendezvous (1962)
12th History: launch of Echo 1, the first experimental communications satellite (1960)
13th History: discovery of Mars' south polar cap by Christiaan Huygens (1642)
13th History: discovery of long-period variable star Mira, (Omicron Ceti) by David Fabricius (1596)
14th New Moon
14th Asteroid *21 Lutetia* at Opposition (9.0 Magnitude)
14th 80th Convention of Amateur Telescope Makers (Stellafane), Springfield, Vermont (through the 15th), see https://stellafane.org/convention/2015/index.html
16th Scheduled launch of the cargo-carrying Japanese H-2 Transfer Vehicle from the Tanegashima Space Center to the International Space Station
16th History: launch of Explorer 12 spacecraft, measured cosmic-ray particles, solar wind protons, and magnetospheric and interplanetary magnetic fields (1961)

Astronomical and Historical Events for July (continued)

17th Moon at Apogee (furthest distance from Earth)
17th Scheduled launch of Japanese H-2 Transfer Vehicle, unmanned cargo vehicle, to the International Space Station from the Tanegashima Space Center, Japan
17th Flyby of Saturn's moon *Dione* by the Cassini spacecraft
17th Distant flyby of Saturn's moon *Tethys* by the Cassini spacecraft
17th History: launch of Venera 7; Soviet Venus lander (1970)
17th History: launch of Pioneer 7 (1966)
17th History: Asaph Hall discovers Martian moon *Phobos* (1877)
18th Distant flyby of Saturn's moons *Enceladus*, *Methone*, *Titan* and *Helene* by the Cassini spacecraft
18th History: launch of Suisei; Japan's Comet Halley mission (1985)
19th History: launch of first Philippine communications satellite Agila 2 (also known as Mabuhay 1 or ABS 5) (1997)
19th History: launch of Soviet Sputnik 5 spacecraft with dogs Belka and Strelka (1960)
19th History: discovery of S Andromedae (SN 1885A), supernova in the Andromeda Galaxy and the first discovered outside the Milky Way Galaxy; discovered by Irish amateur astronomer Isaac Ward in Belfast on the 19th and independently the following day by Ernst Hartwig at Dorpat (Tartu) Observatory in Estonia (1885)
19th History: Orville Wright born (1871)
19th History: John Flamsteed born; English astronomer known for his accurate astronomical observations and first Astronomer Royal (1646)
20th History: launch of Voyager 2 to the outer planets (1977)
20th History: launch of Mars orbiter/lander Viking 1 (1975)
20th History: Ernst Hartwig's discovery of S Andromedae Supernova (1885)
21st History: launch of the Orbiting Astronomical Observatory-3, Copernicus, with a UV telescope and X-ray detector (1972)
21st History: launch of Gemini V with astronauts Gordon Cooper and Charles Conrad (1965)
22nd First Quarter Moon
23rd Comet 67P/Churyumov-Gerasimenko closest approach to Earth (1.768 AU)
24th Kuiper Belt Object 2004 NT33 at Opposition (37.935 AU)
24th History: Pluto reclassified as a Dwarf Planet (2006)
24th History: launch of the Soviet Luna 11 spacecraft to analyze the Moon's chemical composition, study gravitational anomalies and measure radiation levels (1966)
25th Northern Iota Aquarids Meteor Shower Peak
25th Centaur Object 7066 Nessus at Opposition (25.578 AU)
25th Kuiper Belt Object 307982 (2004 PG115) at Opposition (36.736 AU)
25th History: flyby of Neptune by the Voyager 2 spacecraft (1989)
25th History: launch of the Spitzer Space Telescope (2003)
25th History: launch of the Advanced Composition Explorer spacecraft to study energetic particles from the solar wind, the interplanetary medium, and other sources (1997)
26th History: flyby of the planet Saturn by the Voyager 2 spacecraft (1981)
27th Kuiper Belt Object 225088 (2007 OR10) at Opposition (86.355 AU)
27th History: launch of the Mariner 2 spacecraft to Venus; first successful planetary encounter (1962)
28th History: flyby of the asteroids *Ida* and *Dactyl* by the Galileo spacecraft (1993)
28th History: discovery of Saturn's moon *Enceladus* by William Herschel (1789)
29th Full Moon (sometimes called Sturgeon, Green Corn or Grain Moon)
29th Plutino 175113 (2004 PF115) at Opposition (40.524 AU)
29th History: discovery of a bright nova in the constellation Cygnus (Nova Cygni 1975); visible to the unaided eye for about a week (1975)
30th Moon at Perigee (closest distance to Earth)
30th Kuiper Belt Object 120178 (2003 OP32) at Opposition (41.065 AU)
30th Kuiper Belt Object 2003 QX113 at Opposition (58.828 AU)
30th History: discovery of first Kuiper Belt Object (1992 QB1) by David Jewitt and Jane Luu
30th History: launch of Japanese satellite Yohkoh (Sunbeam) to observe phenomena taking place on the Sun (1991)
30th History: launch of STS-8 and astronaut Guy Bluford; first African-American in space and first night launch and landing by a shuttle (1983)

Sunrise and Sunset

Sun	Sunrise	Sunset
July 1st (EDT)	05:23	20:32
July 15th	05:32	20:26
July 31st	05:47	20:12
August 1st	05:48	20:11
August 15th	06:02	19:54
August 31st	06:18	19:29

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.*

Image Credits

Front page design and graphic calendar: Allan Ostergren

Cover image: Whirlpool galaxy, processed by JJMO imaging team, Marc Polansky and Carly KleinStern. The Whirlpool image is a combination of color images from a Canon 6D DSLR camera, Luminance/detail and hydrogen-alpha images from the SBIG ST-10XME CCD camera. All images were taken through the Meade 16" telescope - the DSLR images were at f/10, and the CCD images at f/5.

The image is a composite including of 75 minutes of hydrogen alpha filter exposure and 80 minutes of luminance filter exposure with the CCD camera, and 78 minutes of color images from the DSLR. All images were calibrated, aligned, stacked, and pre-processed in PixInsight, and finishing touches done in Photoshop.

Page 3: Scale model of the New Horizons spacecraft by Master Craftsman Don Ross. Photo by Bill Cloutier

Second Saturday Stars poster: Sean Ross, Ross Designs

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

July 11th

8:00 - 10:00 pm

THE JUPITER SYSTEM

- Refreshments
- Family Entertainment
- Activity Center
- Stars & Planets
- Rain or shine

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

July 2015

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1  Smithsonian Air & Space Museum birthday (1976)  100-inch mirror for Hooker telescope arrives at Mt Wilson (1917)  NASA officially activates the Launch Operations Center on Merritt Island, Florida; later renamed the Kennedy Space Center (1962)	2  Launch of European Space Agency' Giotto spacecraft to Comet Halley (1985)	3  Launch of ill-fated Japanese Nozomi spacecraft to Mars (1998)  Launch of the Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX) by a Scout rocket (1992)	4  Crab nebula viewed by Chinese astronomers (1054)  Mars Pathfinder landing (1997)  Henrietta Leavitt born; measured distances to far galaxies (1868)  Probe of comet Tempel 1 by Deep Impact impactor (2005)
Moon at Perigee (closest distance to Earth) 5   A. E. (Andrew Ellicott) Douglass ,an American astronomer who discovered a correlation between tree rings and the sunspot cycle. (1867)	6  Isaac Newton's *Principia* published (1687)  Discovery of Jupiter's moon Lysithea by Seth Nicholson (1938)	7  Launch of Mars Exploration Rover B *Opportunity* (2003)	8  Launch of the Space Shuttle Atlantis (STS-135) to the International Space Station; final space shuttle flight to low Earth orbit (2011)	9  Close pass of Jupiter's cloud tops by Voyager 2 spacecraft (1979)	10  Alvan Graham Clark born, telescope maker (1832)  Flyby of Asteroid 21 Lutetia by European Space Agency's Rosetta spacecraft (2010)  launch of Telstar 1, prototype communication satellite designed and built by Bell Telephone Laboratories (1962)	11  Launch of Soviet Gamma Observatory (1990)  Skylab re-enters into the Earth's atmosphere (1979)  2nd Saturday Stars Open House McCarthy Observatory
12  Soviet Mars orbiter Phobos 2 launched (1988)	13  Langley Research Center Birthday (1917)  Soviet spacecraft Luna 15 launched, lander to crash on Moon (1969)	14  First close-up view of Mars by Mariner 4 Spacecraft (1965)	15  Launch of Apoll0 18 and Soyuz 19 in joint U.S./ Soviet mission (1975)  The Dawn spacecraft enters orbit around the asteroid 4 Vesta (2011)	16  Apollo 11 Moon mission Armstrong, Aldrin, Collins (1969)  Schoemaker/ Levy Comet fragments impact Jupiter (July 16-22, 1994)  first photo of a star other than our Sun (Vega) by Harvard University (1850)	17  Monsignor Georges Lemaître born; Belgian priest and astronomer was first to propose expanding universe and Big Bang theory (1894)  Docking and handshakes of Apollo 18 and Soyuz 19 crews (1975)	18  Allan Standage born, cosmologist (1926)  Rohini I, India's 1st satellite, failed at launch (1980)  Launch of Zond 5, 1st successful Moon flyby (1965) Gemini X with John Young and Michael Collins (1966) 
19  Launch of Explorer 35 spacecraft into an elliptical lunar orbit, to study interplanetary plasma, magnetic field, energetic particles, and solar X-rays (1967)  Edward Charles Pickering born - Harvard astronomer and physicist who discovered the first spectroscopic binary stars, later used to measure cosmic distances. (1846)	20 Apollo 11 lands on Moon (1969) Viking I lands on Mars (1976) Gus Grissom's capsule Liberty Bell raised after 30 years on ocean floor (1999)	21 Moon at Apogee (furthest distance from Earth) Launch of Soviet Mars 4 mission (1973) Virgil (Gus) Grissom, 2nd U.S. suborbital flight (1961)	22 Landing of Soviet spacecraft Venera 8 on Venus (1972)	23 Alan Hale and Tom Bopp announce discovery of comet Hale-Bopp (1995) Launch of Shuttle Columbia and Chandra X-ray Observatory; first mission commanded by a woman, Eileen Collins (1999) Launch of Landsat 1 into a near-polar orbit to study Earth's resources and meteorological phenomena (1972)	24 Bumper V-2, first rocket launch from Cape Canaveral (1950) 78th Convention of Amateur Telescope Makers (Stellafane), Springfield, Vt (through the 27th),	25 Svetlana Savitskaya becomes first woman to walk in space (1984) Launch of Soviet orbiter Mars 5 (1973)
26 Shuttle Discovery (STS-114) "return to flight" (2005) Launch of Syncom 2, first geosynchronous satellite (1963) launch of Apollo 15, fourth lunar landing (1971)	27 Sir George Biddell Airy born - an English mathematician and Astronomer Royal who worked on planetary orbits, measuring the mean density of the Earth, and establishing Greenwich as the prime meridian (1801)	28 Launch of Ranger 7, Moon impact mission (1964) Launch of Skylab 3 (Bean, Pogue, Garriott) (1973)	29 South Delta-Aquarids meteor shower peak Deep Space I encounter with asteroid Braille (1999) President Eisenhower signs Public Law 85-568, creating the National Aeronautics and Space Administration (1958)	30 Launch of the Wilkinson Microwave Anisotropy Probe WMAP); mapped the Cosmic Microwave Background radiation and determined the age of the universe (2001) Galileo observes Saturn's rings (1610)	31 Impact of the Lunar Prospector (1999) Mariner 6 Mars flyby (1969)	

August 2015

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Phases of the Moon
July 2015

1 Launch of Lunar Orbiter 5, the last of the Lunar Orbiter series (1967)

Maria Mitchell born, first woman elected as an astronomer to the American Academy of Arts and Sciences (1818)

Discovery of Martian meteorite SAU 051 in Oman (2000)

Moon at Perigee (closest distance to Earth)

2

Valery Fyodorovich Bykovsky born: Soviet cosmonaut flew three manned space mission space flights, spending five days in orbit aboard Vostok 5 in 1963 - a record for a solo flight. (1934)

3

Launch of MESSENGER spacecraft to Mercury (2004)

4

Launch of Phoenix Spacecraft to Mars (2007)

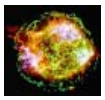
5 Astronaut Neil Armstrong born (1930)

Launch of the Juno spacecraft to Jupiter (2011)

Flyby of Mars by the Mariner 7 spacecraft (1969)

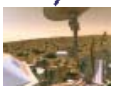
6 Gherman Titov, 2nd man in space (1961)

Cassiopeia Supernova observed by Chinese (1181)



Landing of Mars Science Lab (MSL or Curiosity) inside Gale Crater (2012)

7



Viking 2 on Mars (1976)

Martian meteorite found to contain possible life (1996)

8 Launch of Genesis Spacraft (2001)

Launch of Pioneer Venus 2 (1978)

Launch of Soviet Zond 7 moon probe (1969)

2nd Saturday Stars Open House McCarthy Observatory

9

Launch of Soviet Luna 24 spacecraft, third (and only successful attempt) to recover a sample from Mare Crisium (1976)

10

Launch of Mars Reconnaissance Orbiter (2005)

Magellan spacecraft orbits Venus (1990)

11

Asaph Hall discovers Martian Moon Deimos(1877)

12 Perseid meteor showers at peak

Launch of the High Energy Astronomical Observatory (HEAO-1) to monitor x-ray sources (1977)

Launch of Echo 1A, communications satellite in 2ND attempt (1960)

13

Discovery of long-period variable star Mira, Omicron Ceti by David Fabricius (1596)

Discovery of Mars' south polar cap by Christiaan Huygens (1642)

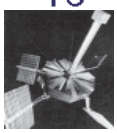
14

Educator astronaut Barbara Morgan leads a Q&A session with children in Boise, Idaho from the space shuttle Endeavour, fulfilling legacy of Christa McAuliffe, who died in the 1986 Challenger disaster (2007)

15

President Reagan announced his support for the construction of an orbiter to replace Challenger (1986)

16



Launch of Explorer 12 spacecraft, measured cosmic-ray particles, solar wind protons, and magnetospheric and interplanetary magnetic fields (1961)

Moon at Apogee (furthest distance from Earth)

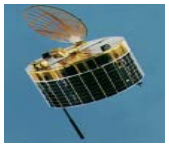
17

launch of Venera 7; Soviet Venus lander (1970)

Asaph Hall discovers Martian Moon Phobos (1877)

Launch of Pioneer 7 (1966)

18



Launch of Suisei, Japan's Comet Halley mission (1985)

19 Launch of Sputnik 5, with dogs Belka and Strejka (1960)

Birth of Orville Wright (1871)

Sir John Flamsteed born, English astronomer (1646)

Dmitri Ivanovich Mendeleev rises to 11,500 feet (3.5 km) to observe an eclipse in Russia (1887)

20

Launch of Mars orbiter/ lander Viking 1 (1975)

Launch of Voyager 2 to outer planets (1977)

21

Launch of Gemini V with astronauts Gordon Cooper and Charles Conrad (1965)

Launch of the Orbiting Astronomical Observatory-3, Copernicus, with a UV telescope and X-ray detector (1972)

22

Neptune was found to have a continuous ring system by the Voyager 2 spacecraf (1989)

23

Lunar Orbiter 1 takes first photograph of Earth from Moon (1966)

24

Pluto reclassified as a dwarf planet (2006)

Launch of the Soviet Luna 11 spacecraft to analyze the Moon's chemistry, gravitation and radiation levels (1966)

25

flyby of Neptune by the Voyager 2 spacecraft (1989)

Meteor shower (Northern Iota Aquarids peak)

26

Flyby of Saturn by Voyager 2 spacecraft (1981)

27

launch of the Mariner 2 spacecraft to Venus; first successful planetary encounter (1962)

28 Discovery of Saturn's moon Enceladus by William Herschel (1789)

Flyby of asteroids Ida and Dactyl by the Galileo spacecraft (1993)

29

Discovery of Nova Cygni in the constellation Cygnus (1975)

Moon at Perigee

30

Discovery of first Kuiper Belt object, 1992 QB1, by David Jewet and Jane Luu

Launch of STS-8 and astronaut Guy Bluford, 1st African-American in space (1983)

First recorded occurrence - comet Howard Koomen-Michels impacts sun (energy of 1 million hydrogen bombs) (1979)

31

US Naval Observatory authorized by an act of Congress (1842)

Phases of the Moon - August 2015