

# Galactic Observer

## John J. McCarthy Observatory

Volume 18, No. 2

February 2025

<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory Feb. 12th 7:00-9:00pm Featuring: • Saturn: Cassini Project • Valentine's Day: Love in the Stars • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory February 11th 7:00-9:00pm <b>Lord of the RINGS</b> with <b>SATURN</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory February 10th 7:00-9:00pm <b>Lunar Phases &amp; Eclipses</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory February 9th 7:00-9:00pm <b>2025 Postcards from Mars</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory February 14th 7:00-9:00pm <b>2008 TC3 TWENTY HOURS UNTIL IMPACT</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>
<p><b>Second Saturday Stars</b> FREE Every Month at John J. McCarthy Observatory February 13th 7:00-9:00 pm <b>NASA's New &amp; Future Space Telescopes</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 12th 7:00-9:00 pm <b>DARK ENERGY: The Real Universe?</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 11th 7:00-9:00 pm <b>TERRAFORMING fact &amp; fiction</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 9th 7:00-9:00 pm <b>CRAZY COLOR CURIOSITY</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 8th 7:00-9:00 pm <b>THE GREAT GALACTIC TWINNING</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>
<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 14th 7:00-9:00 pm <b>cosmic PERSPECTIVES</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 13th 7:00-9:00 pm <b>Robotic Exploration of the Solar System</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 11th 7:00-9:00 pm <b>Gravitational WAVES Found!</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 10th 7:00-9:00 pm <b>Exploration of Jupiter by Robotic Spacecraft</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 9th 7:00-9:00 pm <b>NASA's GREAT SPACE OBSERVATORY PROGRAM</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>
<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 8th 7:00-9:00 pm <b>The Real NORTH STAR</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 11th 7:00-9:00 pm <b>Free Star Party</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>20th YEARS OF PROGRAM EXCELLENCE</b> ★ ★ ★</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 10th 7:00-9:00 pm <b>Free Star Party</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>	<p><b>Second Saturday Stars</b> FREE EVENT Every Month at John J. McCarthy Observatory February 8th 7:00-9:00 pm <b>Free Star Party</b> Featuring: • Family Entertainment • Activity Center • Stars &amp; Planets</p>

MCCARTHY OBSERVATORY  
**SECOND SATURDAY STARS**  
 2005 -2025



## February Astronomy Calendar and Space Exploration Almanac



The Jet Propulsion Laboratory's 2024 holiday ornament featuring the Europa Clipper mission. The ornament includes orbit lines for the four Galilean moons, audio waveforms for the word "water" in languages from across the globe, and excerpts from the U.S. Poet Laureate Ada Limón's poem "In Praise of Mystery: A Poem for Europa."

Photo: Bill Cloutier

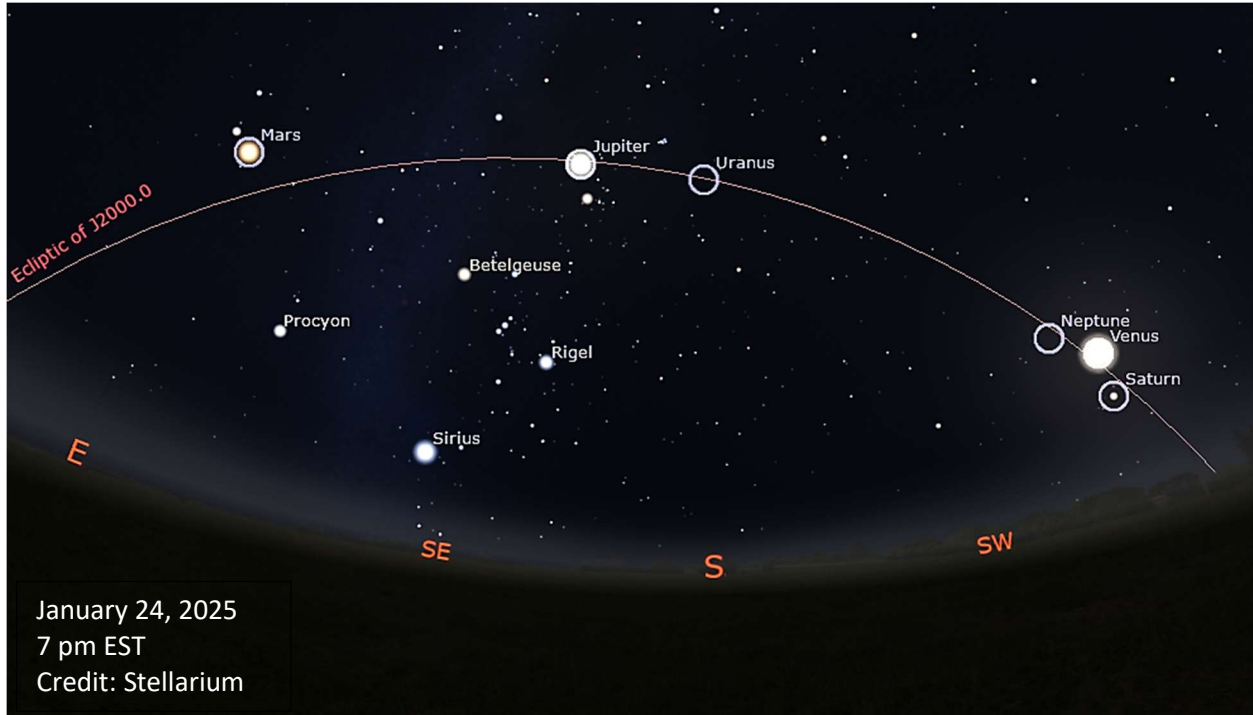
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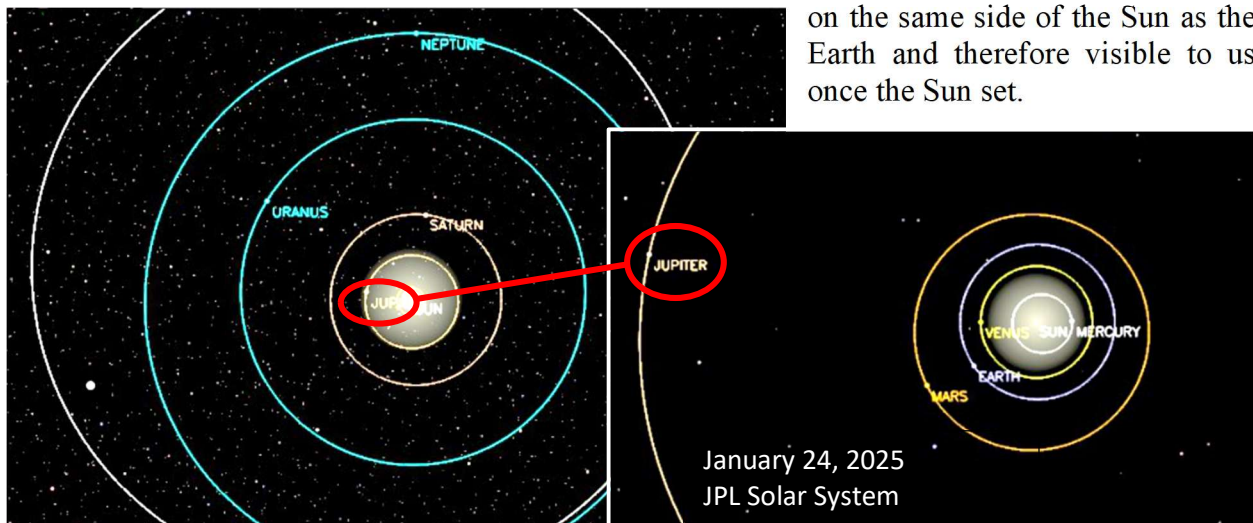
## Misconceptions and Hyperbole

The “Great Planetary Alignment” was an internet sensation in January with embellished tales that convinced many that an opportunity of a lifetime would pass them by unless they viewed the night sky on a particular date. What truly occurred in the sky in January:



It was possible to see four of the classical planets (Saturn, Venus, Jupiter and Mars) without any optical aid if you looked shortly after sunset and before Saturn disappeared below the horizon. With binoculars or a telescope you could also see Neptune and Uranus. The six planets were positioned along an arc from Mars in the east to Saturn in the west. This “arc” is the “plane of the ecliptic,” or the apparent path of the Sun from which the planets never stray far. Its inclination is due to the tilt of Earth’s spin axis and changes with the seasons.

Mars was the only planet in true “alignment” with the Earth in January (on the 16<sup>th</sup>). The other five planets were visible, not because of any extraordinary grand design, but because they were all on the same side of the Sun as the Earth and therefore visible to us once the Sun set.



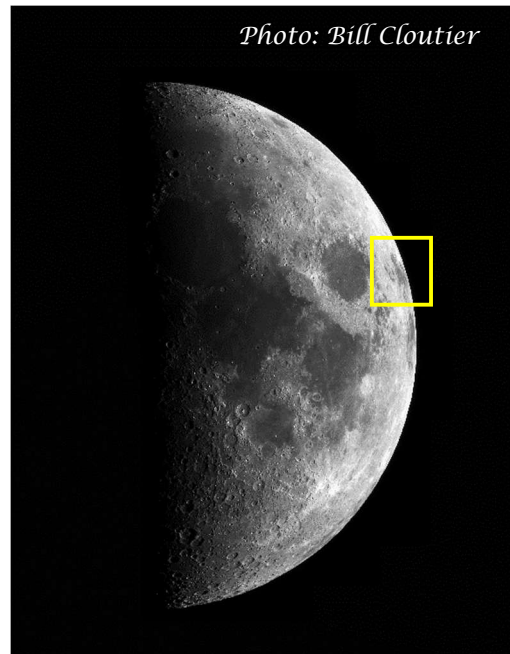


## “Out the Window on Your Left”

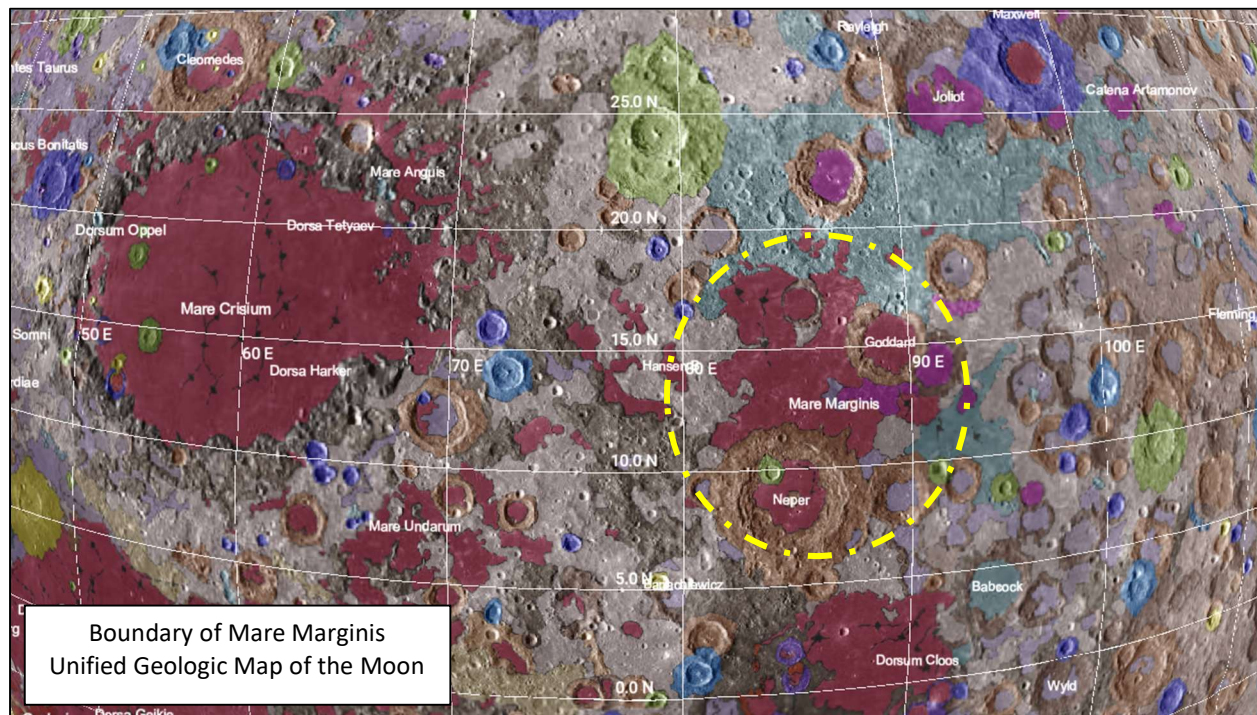
It’s been more than 52 years since Apollo astronaut Gene Cernan left the last boot print on the Moon’s surface. As a nation founded on exploration and the conquest of new frontiers, today’s commitment to return to the Moon has been as fleeting as the funding. But what if the average citizen had the means 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).

Mare Marginis (“Sea of the Edge”) is an irregular basaltic area located on the Moon’s eastern limb, as viewed from Earth. Its center is listed at 86.5° longitude, with portions extending as far east as 93.4°. The lava patch is best seen during times of favorable longitudinal libration (a week or so after the Moon’s closest approach to the Earth when it is possible to view lunar features up to an additional 7° over the eastern limb).

The mare, bounded by the crater Goddard to the northeast and Neper to the south, doesn’t appear to be associated with an impact basin and its basalts (estimated to be between 3.38 to 3.88 billion years old) are relatively thin. Mare Marginis might just be a low-lying region where near-surface lavas erupted and filled in the hollows over an area of about 25,000 square miles (64,900 square km). The mare contains several magnetic anomalies or lunar swirls, like Reiner Gamma, of unknown origin.

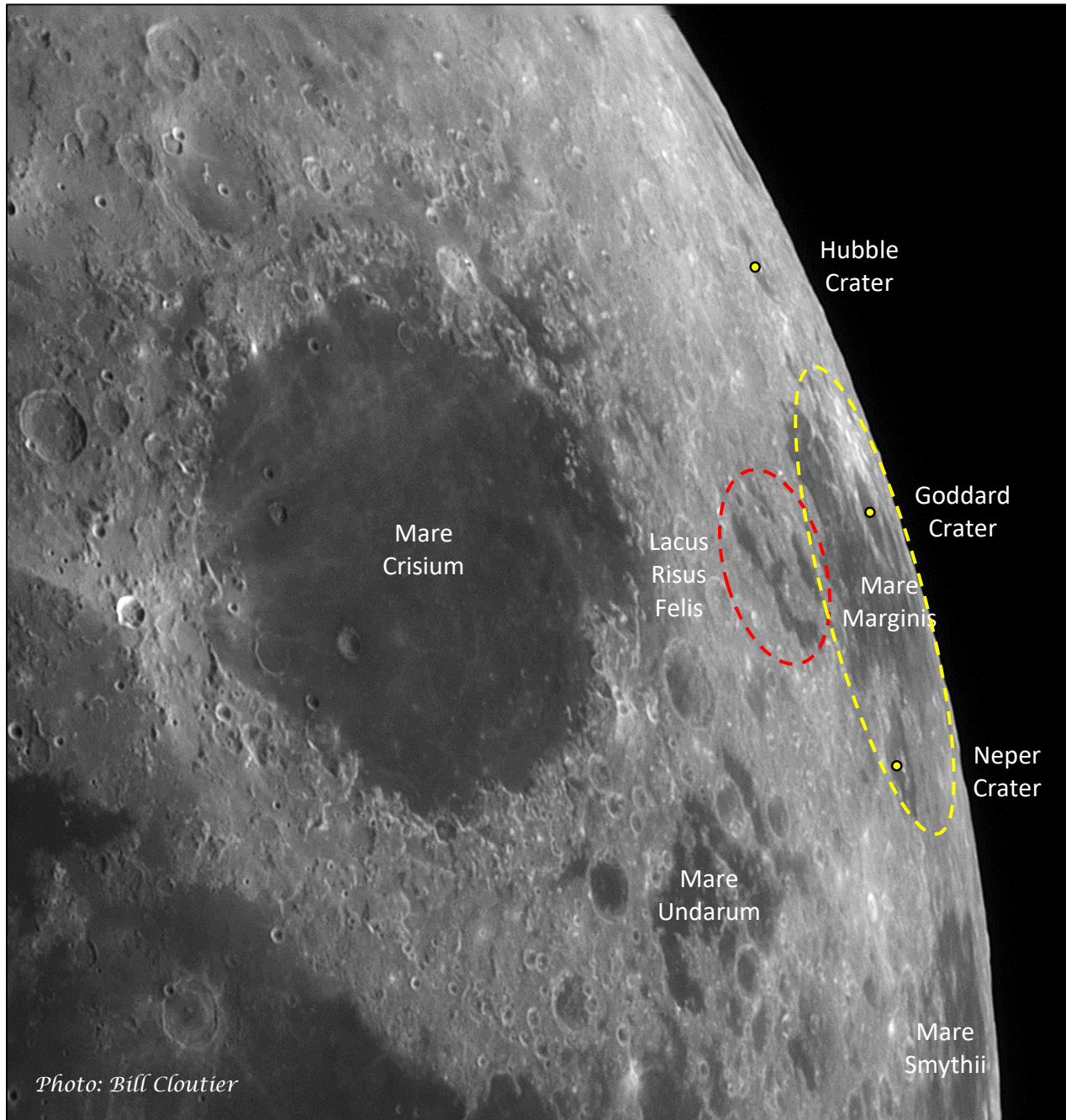


Location of Mare Marginis



Boundary of Mare Marginis  
Unified Geologic Map of the Moon

## Mare Marginis



The lunar seas along the eastern limb of the Moon during a period of favorable libration (features were visible as far east as  $96^\circ$  in longitude). The photograph was captured with a 19<sup>th</sup> century antique refractor with a clear aperture of 4.2 inches.

Charles Wood, a lunar scientist, gave the lava lakes to the west of the mare (circled in red) the informal name of Lacus Risus Felis - the Cat's Smile.



## Twenty Years of Program Excellence



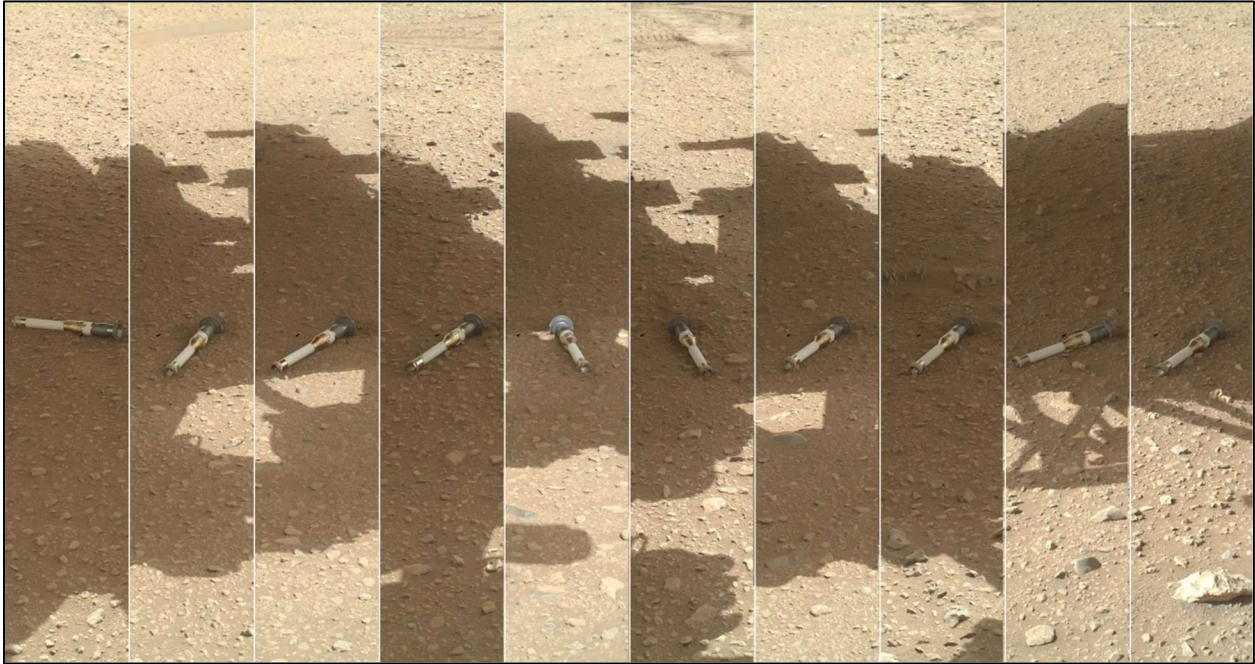
Kicking off the first regularly scheduled community outreach event, from left to right, Rick Birnbaum, Monty Robson, Don Ross, Elaine Green and Bill Cloutier  
New Milford Times, February 4, 2005

Twenty years ago on February 12, 2005, the McCarthy Observatory hosted the first of what would become a long-standing institution. Held every month on the second Saturday (thwarted only by a few blizzards and a pandemic), it is aptly named “Second Saturday Stars.” The concept was first proposed by Elaine Green, who along with her co-coordinator Dr. Parker Moreland, have guided and mentored the program from its humble beginnings to the highly anticipated happening that it has become. Elaine can be found out in front of the Observatory each month, welcoming visitors in all kinds of weather, dispensing information on what the facility has to offer, providing assistance for locating objects of interest in the night sky, crowd herding, and keeping speakers on schedule.

The monthly event features a short talk on a timely topic highlighting the latest developments in astronomy and/or space exploration. The first program offered on that brisk February night featured NASA’s Cassini - Saturnian exploration mission and a sky appreciation segment. The talks are presented by the Observatory’s volunteers, local students, and/or subject matter experts from NASA or other scientific institutions (either onsite or remote). Foremost, the talks are designed to align with the Observatory’s mission to promote science literacy. They do, however, range from the highly technical to more entertaining and with lighter subject matter for all audiences.

When the weather cooperates, visitors can see a myriad of astronomical objects through the Observatory’s flagship telescope located under the dome or through the many other telescopes of various designs and sizes set up on the south-facing observing deck, and even in the parking lot in front of the facility. Second Saturday Stars also provides an opportunity for the public to meet the knowledgeable group of volunteers, from all walks of life, that operate and maintain the observatory. Through their efforts, the McCarthy Observatory has become a regional resource for science-based learning, environmental sustainability, and world-recognized for its contributions to planetary-protection.

## Mars Sample Return Decision Deferred



The ten titanium tubes containing samples collected by NASA's Perseverance rover and cached at the Three Forks sample depot near the front of the ancient river delta remnant in Jezero Crater. The remaining samples of soil and rock will remain with the rover.

Credit: NASA/JPL-Caltech/MSSS

After soliciting proposals from industry and the NASA community on how best to retrieve the samples collected by the Perseverance rover faster and cheaper, the outgoing NASA administrator Bill Nelson announced that a final decision would be not be forthcoming until the latter half of 2026. Uncertainty as to the level of support and funding that could be expected from the newly elected administration was a consideration in the deferral.

From the 11 studies reviewed by the Mars Sample Return Strategic Review team, NASA has identified two landing architectures, or strategic plans, worthy of further development. The first option relies on previously flown entry, descent, and landing system designs. For example, the rocket-powered sky crane is a proven technology, having been used to land the Curiosity and Perseverance rovers, although it might need to be upgraded for a heavier payload. Presumably, this approach would involve NASA's Jet Propulsion Lab, the architect of two Mars missions.

The second option will exploit new commercial capabilities that are under development. While no specifics were provided, Blue Origin's and SpaceX's new heavy lift boosters were examples of upcoming transport vehicles that could deliver a large payload/heavy lander to the surface of Mars.

NASA has made some decisions, e.g., to replace the landing platform's solar panels with a radioisotope power source so that operations could continue in a dust storm and to clean and package the 30 samples tubes on the surface rather than in orbit to simplify planetary protection requirements. With both options, an ESA Earth Return Orbiter will return the sample container to Earth.



## Mars Occulted by Moon



Although it appears that our celestial companions travel from east to west in the night sky, the Moon actually moves from west to east about  $\frac{1}{2}$  degree, or the equivalent to its width, every hour, or about 12 to 13 degrees every day, as a result of its physical motion along its orbit around the Earth. Our perception that our lunar companion rises in the east and sets in the west is due to the much faster rotation of the Earth.

The Moon's motion is best observed when it passes through a crowded star field (e.g., the Pleiades star cluster) or encounters a bright planet along its travels. On the night of January 13<sup>th</sup>, the Moon passed in front of the planet Mars, just one day after the Red Planet was closest to Earth and therefore at its peak brightness. The planet disappeared from our view for more than an hour before reappearing on the opposite limb of the Moon.



Motion of the Moon over a three minute time span as it begins to occult the planet Mars  
Series captured by Bill Cloutier with the Observatory's 4.25 inch antique refractor

## Over the Top



NASA's Perseverance Mars rover captures its first view of the area beyond the crater rim  
Credit: NASA/JPL-Caltech

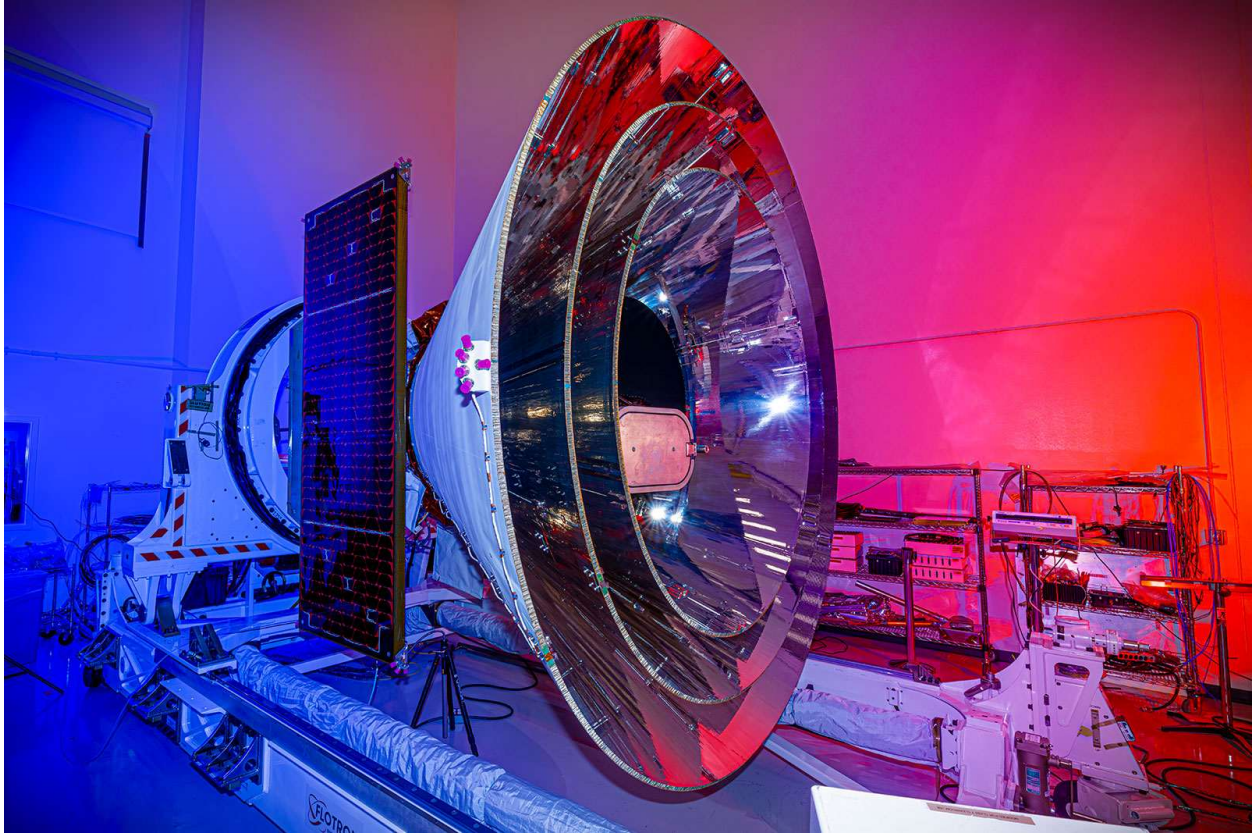
NASA's Perseverance Mars rover has reached the top of Jezero Crater's rim. While stopping along the way to investigate curious rocks and intriguing geology, the climb took about 3½ months as it ascended 1,640 vertical feet (500 vertical meters) while navigating grades as steep as 20 percent. This is the rover's fifth science campaign since landing in the crater four Earth-years ago (the first four were designated by the science team as "Crater Floor," "Fan Front," "Upper Fan," and "Margin Unit").

The fifth, or "Northern Rim campaign," will visit up to four different geologic features during the first year, with Perseverance expected to traverse about 4 miles (6.4 km). Scientists expect to find rocks that date back to the formation of the crater 3.9 billion years ago, including those that partially filled the excavated area, as well as rocks that were blasted out from a much greater depth by the massive impact that created the 28-mile (45-km) diameter crater and formed the rim.

The rim region provides geologists on Earth an opportunity to sample rocks from different Martian eras, possibly including times when the climate on the planet was much different and more hospitable to fostering life. The first stop on the campaign is a layered rocky outcrop called Witch Hazel Hill. Over 33 feet (10 meters) in height, the layers provide a chronology of Martian history with each deeper layer older than the previous. After investigating the outcrop, Perseverance is expected to drive out beyond the rim to the surrounding plain.



## Sky Mapping Mission



NASA's SPHEREx space observatory after completing environmental testing  
Credit: BAE Systems

NASA is targeting a late February launch for its next astrophysics observatory. A SpaceX Falcon 9 rocket will place the Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer, or SPHEREx spacecraft, into a polar orbit from Vandenberg Space Force Base in California. The wide-field, all-aluminum telescope with its three mirrors and six detectors is protected from the light and heat from the Earth and Sun by a series of three nested conical photon shields.

SPHEREx will create a map of the entire sky taking images in every direction in optical, as well as near-infrared light. The observatory will collect data on more than 450 million galaxies along with more than 100 million stars in the Milky Way, more than 600 thousands stars that could host exoplanets, quasars, clusters, asteroids and comets. The data will be used to create a 3-D model of the universe in 102 spectral channels. Over the two-year mission, the telescope will be able to survey the entire sky every six months or four times.

The mission's three key science goals are: 1) to study the inflationary birth of the universe by measuring the distribution of millions of galaxies, 2) search our galaxy for icy compounds including water, carbon dioxide, methanol, carbon monoxide, and other essential building blocks of life to better understand how they are incorporated into planet building, and 3) develop a more complete picture of all the radiating objects and sources in the universe by measuring the collective glow from galaxies, including light from those hidden from our view.

## Blue Ghost to the Moon



Firefly Aerospace has launched its first mission to the Moon. A SpaceX Falcon 9 carried the company's lunar lander into orbit from the Kennedy Space Center on January 15<sup>th</sup>. The lunar lander, called "Blue Ghost" after a rare firefly species found in the southeast region of the United States, is carrying 10 NASA science and technology instruments. This will be Firefly's first CLPS (Commercial Lunar Payload Services) delivery.

Transit time to the Moon is approximately 45 days. Three days into the mission, Blue Ghost successfully fired its thrusters and main engine. The burns raised the spacecraft's orbit around the Earth. The Firefly team will continue to increase the orbit while conducting health checks on the lander's systems. Blue Ghost will orbit Earth for the first 25 days of the mission before heading to the Moon. After completing the four day trip, the lander will orbit the Moon for another 16 days before descending to the surface.

The targeted landing site is in Mare Crisium near a volcanic feature called Mons Latreille. Landing is planned to occur at local sunrise with Blue Ghost expected to support payload operations throughout the lunar day (about 14 Earth-days). As night falls, the lander will capture imagery of the sunset and, while operating for several hours into the night, provide data on the transition to a nocturnal lunar environment.

Blue Ghost wasn't the only payload on the Falcon 9. Also deployed in Earth orbit and destined for the Moon was ispace's second Hakuto-R lunar lander. The lander, called "Resilience," is carrying commercial and cultural payloads along with a micro rover called "Tenacious." They are heading for the far north, near the center of Mare Frigoris, and expected to arrive after Blue Ghost with its low-energy trajectory





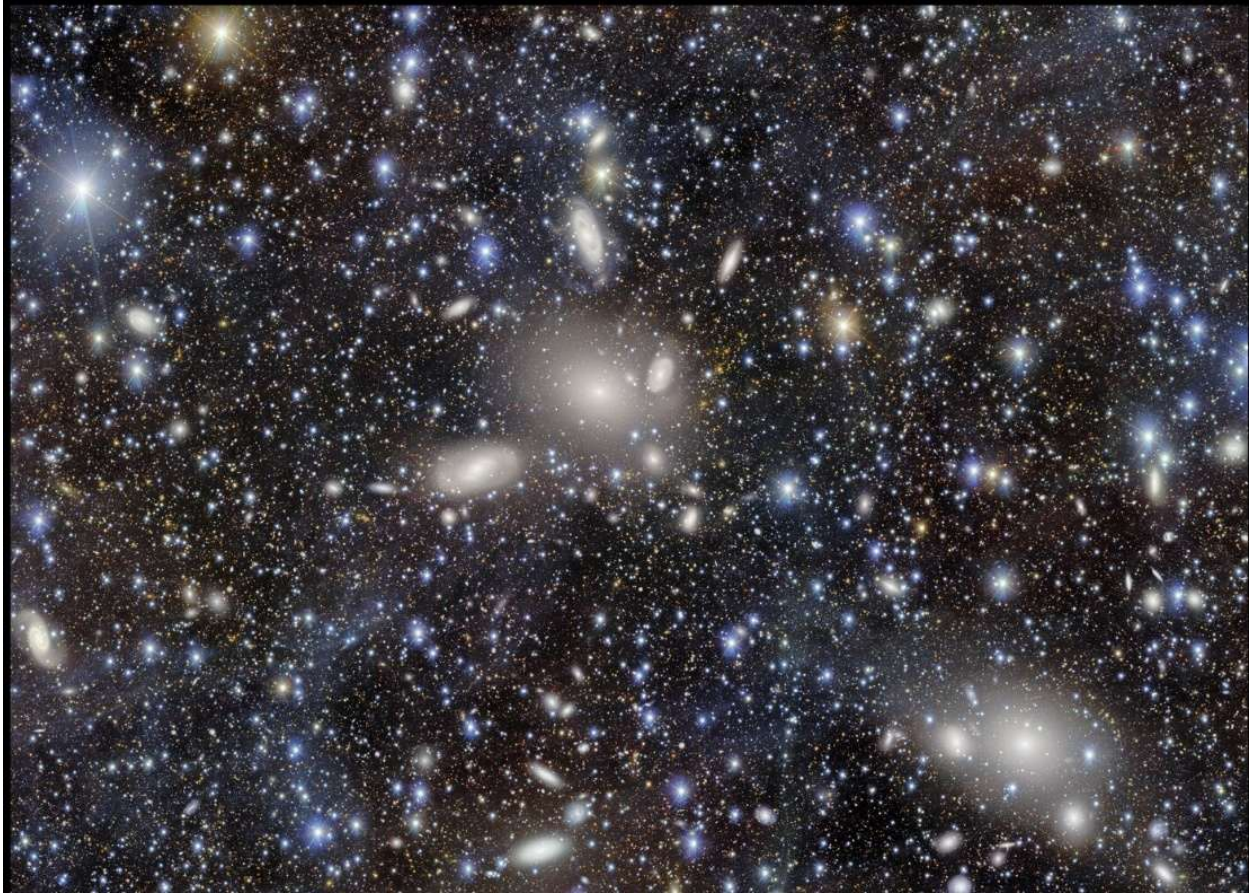
Eight days after launch Firefly's Blue Ghost lunar lander captured this image of the Earth from approximately 4,200 miles ( 6,700 km) above the planet

Credit: Firefly Aerospace

Firefly has been awarded two additional CLPS task orders for payload services to lunar orbit and on the lunar surface. Mission 2, which is tentatively scheduled to launch in 2026, will take the Blue Ghost to the far side of the Moon. The lander will be dropped off by an orbital spacecraft, which will then provide a communications link between Blue Ghost, and its experiments, and Earth. Among the payloads delivered to the surface will be NASA's Lunar Surface Electromagnetic Experiment at Night (LuSEE-Night) telescope - the first operational radio telescope on the Moon. The orbital spacecraft will also deploy the European Space Agency's Lunar Pathfinder satellite into lunar orbit.

Mission 3, which was just awarded, will send Blue Ghost to the enigmatic Gruithuisen Domes in 2028 - volcanic features that appear to be composed of silica-rich volcanic minerals, which could indicate the presence of lunar water and hydrogen. The mission, which is expected to last at least 14 Earth days, will also include the deployment of a small instrumented rover to investigate the composition of the materials found in the surrounding lava flows.

## Dark Energy Camera's Stunning Galaxy Zoo



The Dark Energy Camera's image of the Antlia Cluster

Image credit: Dark Energy Survey/DOE/FNAL/DECam/CTIO/NOIRLab/NSF/AURAImage processing: R. Colombari & M. Zamani (NSF NOIRLab))

The 570-megapixel Department of Energy-fabricated Dark Energy Camera (DECam), mounted on the U.S. National Science Foundation's Víctor M. Blanco 4-meter Telescope at Cerro Tololo Inter-American Observatory in Chile, recently captured a majestic image of the Antlia Cluster (Abell S636). This colossal cluster, containing an array of galaxy types, is located about 130 million light-years from Earth in the direction of the constellation Antlia (the Air Pump). The image (above) captures only a portion of the 230 galaxies that make up the cluster, as well as thousands of background galaxies.

The Antlia Cluster is dominated by two massive elliptical galaxies — NGC 3268 (center) and NGC 3258 (lower right). Along with the large elliptical galaxies are several irregular galaxies and a profusion of lenticular and low-luminosity dwarf galaxies, including ultra-compact dwarfs, compact ellipticals, and blue compact dwarfs. The abundance of galaxy types allows astronomers to trace galactic evolution, while the extraordinary sensitivity of the camera reveals details of the diffuse light from stars ejected from interacting galaxies and super-heated plasma. Massive galactic structures like the Antlia Cluster provide clues about the nature of dark energy (the force thought to drive the accelerated expansion of the universe) and dark (invisible) matter which is believed to comprise the vast majority of the cluster's total mass.



## New Glenn Takes Flight



Blue Origin's new heavy booster successfully took to the sky in the early morning hours of January 16<sup>th</sup>, powered by seven BE-4 liquid methane-fueled rocket engines

Photos: Blue Origin

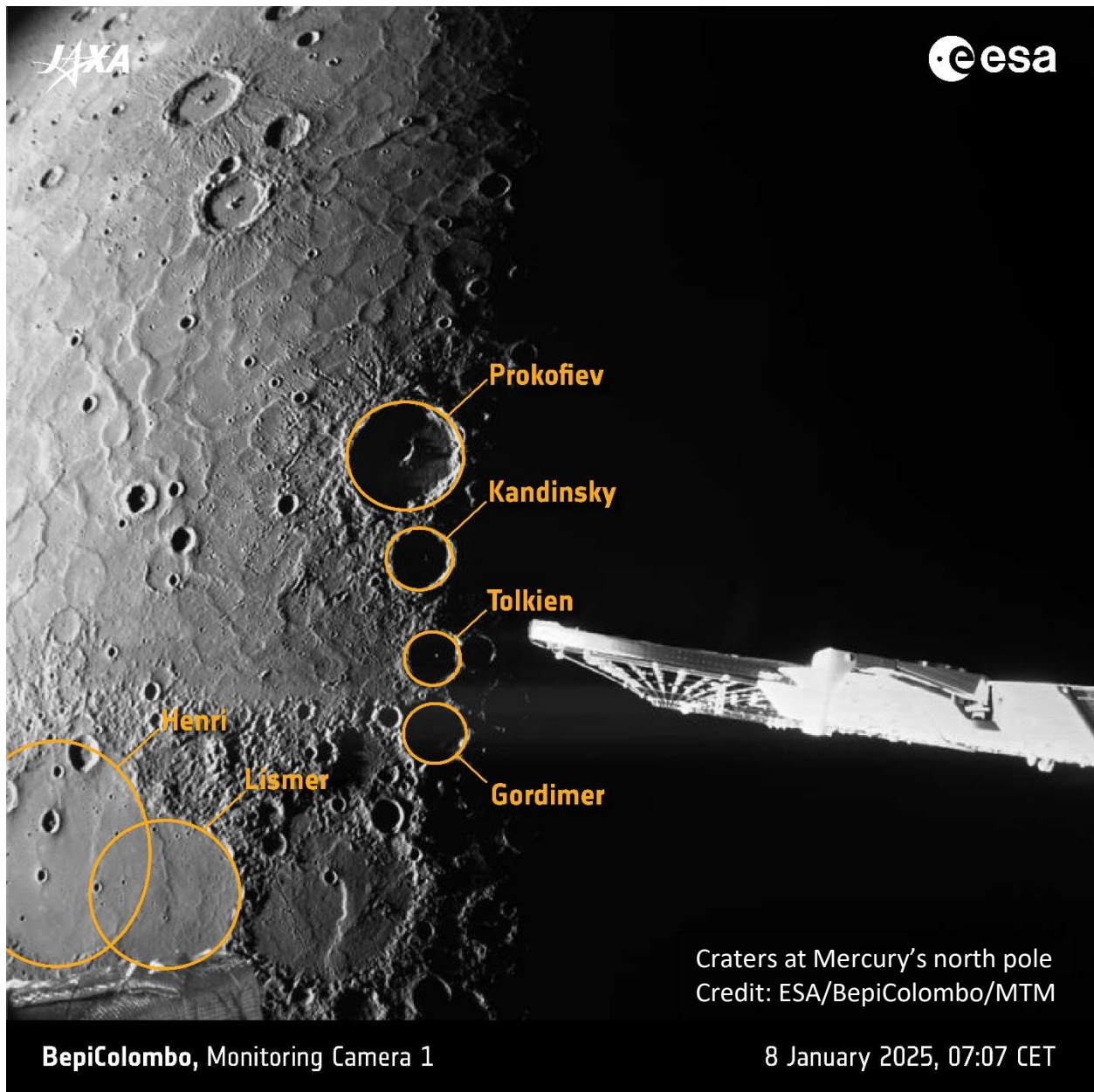


After nearly a decade of development, Blue Origin's first orbital-class rocket successfully achieved orbit on its initial attempt, after launching from Launch Complex-36 at the Cape Canaveral Space Force Station in Florida. Called "New Glenn" after John Glenn, the first American astronaut to orbit the Earth, the booster was the first to use LC-36 in 20 years after a billion dollar investment by the company to rebuild the 1960's facility that once supported Atlas-Centaur launches for NASA and the military.

Following stage separation, the second stage engines propelled the mission's payload into a 12,000 by 1,500 mile (19,300 by 2,400 km) elliptical orbit. While the seven meter (23 foot) fairing was released, the payload, a prototype of Blue Origin's Blue Ring multi-mission space mobility platform, remained fixed in place. New Glenn can carry more than 30,000 pounds (13 metric tons) to geostationary transfer orbit (GTO) and 100,000 pounds (45 metric tons) to low-Earth orbit (LEO).

Blue Origin attempted to recover the 188-foot-tall (57-meter) first stage, however, it was unable to return the booster to a floating landing platform in the Atlantic Ocean. Future flights are expected to carry a prototype of Blue Origin's Blue Moon lunar lander; NASA's ESCAPEDE (Escape and Plasma Acceleration and Dynamics Explorers) probes to investigate Mars' magnetosphere, and Amazon's Project Kuiper internet satellites.

## Mercury's North Pole



ESA/JAXA's BepiColombo spacecraft returned images of the partially illuminated craters at Mercury's north pole and the sunlit Borealis Planitia volcanic plain as it executed its sixth and final flyby of the innermost planet. Despite being so close to the Sun, there is evidence that the permanently shadowed parts of these polar craters contain frozen water.

The flybys, which are used to slow the probe down, set up an orbital insertion in November of 2026 – an eleven-month delay from the original timetable. The late arrival is the result of a faulty thruster on the previous flyby. BepiColombo consists of two individual orbiters: ESA's Mercury Planetary Orbiter (MPO) which will map the planet at different wavelengths, and JAXA's Mercury Magnetospheric Orbiter (MMO) which will investigate the planet's magnetosphere. Separation of the two vehicles will occur once the spacecraft enters a polar orbit. When MMO's orbit is reached, MPO will separate and lower its altitude to conduct its operations closer to the planet.



## Deep Space Network Expands



In the early morning of Dec. 18, 2024, a crane positions the 112-foot-wide (34-meter-wide) steel framework for Deep Space Station 23 reflector dish over the antenna's base structure

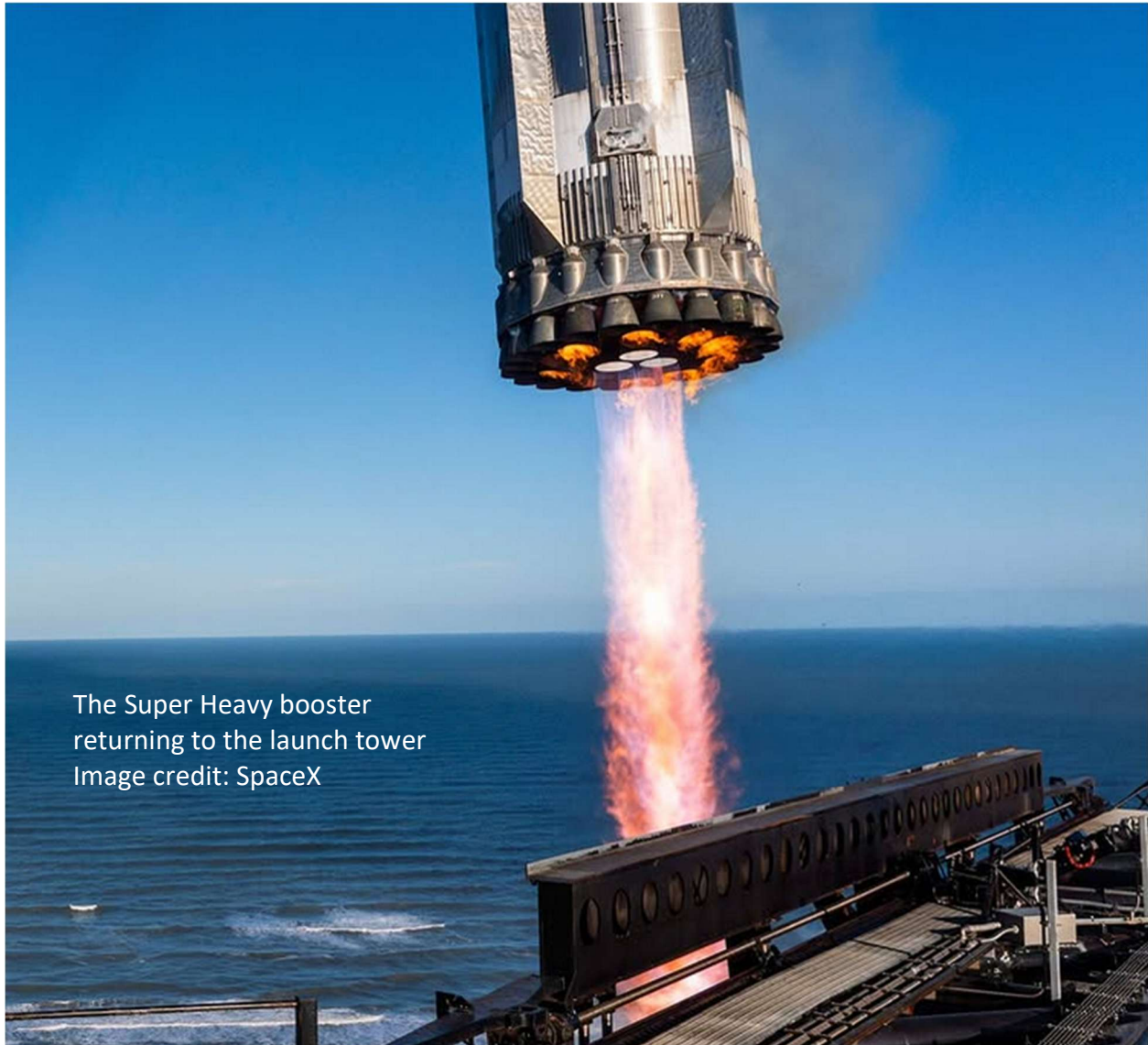
Credit: NASA/JPL-Caltech

NASA's Deep Space Network (DSN) is an array of large radio antennas that allows the agency to track, send commands to, and receive scientific data from distant spacecraft. The DSN is operated by NASA's Jet Propulsion Laboratory (JPL) and is comprised of three facilities located approximately 120 degrees apart in longitude around the world. The strategic placement of the three sites, in Goldstone, California, Madrid, Spain and Canberra, Australia, permits continuous communication with spacecraft as the Earth rotates.

The DSN was officially established in 1963 when the individual sites were connected to JPL's control center. Each site has one massive 70-meter (230-foot) diameter antenna and several smaller ones. However, with the growing number of missions, missions that have continued to operate well past their design life (DSN is still in contact with the Voyager spacecraft launched in 1977), data-rich missions like the James Webb Space Telescope, and shrinking budgets, the system is frequently oversubscribed (up to 40%). With priority given to mission-critical milestones and high-priority missions, forced reductions in contact time for lower priority missions have become necessary. This has had a significant impact on many NASA's science missions and, in some instances, the loss of data.

NASA's Deep Space Network Aperture Enhancement Program, initiated in 2010, was designed to strengthen the network by adding six new 34-meter (112-foot) antennas. However, due to budget cuts, some aspects of the program are over a decade behind schedule. As of the end of 2022, four of six planned antennas had been constructed. Antenna DSS-23 is currently being assembled at the Goldstone site. Once online in 2026, it will be the fifth of six new antennas to be added to the network, following DSS-53 which was added to the Madrid complex in 2022.

## Good News – Bad News



The Super Heavy booster  
returning to the launch tower  
Image credit: SpaceX

On January 16<sup>th</sup>, SpaceX launched their Starship for the seventh time from their Boca Chica, Texas site as the company continues their practice of iterative development where each successive flight builds upon the lessons (and failures) of the previous. The 403.5-foot-tall (123 meters) reusable vehicle is comprised of a 33-engine super heavy booster (first stage) topped by the six-engine Starship (second stage). The mission profile had Starship entering a suborbital trajectory and deploying a dummy payload before a controlled splashdown in the Indian Ocean.

The initial stage of the launch proceeded smoothly with the two vehicles separating after roughly 2-½ minutes. The Starship's six engines carried it forward while the booster relit its engines for a return to the launch pad. As with the 5<sup>th</sup> flight, the booster successfully returned to base about 7 minutes after departure. Unfortunately, around the 7-½ minute mark, Starship's engine performance dropped off. Telemetry was lost about a minute later with debris seen streaking across the sky above the islands of Turks and Caicos just east of Cuba. SpaceX CEO Elon Musk speculated that the loss of the ship was likely the result of a fuel leak in the cavity above the ship engine's firewall.



## Jupiter

Jupiter reached Opposition on December 7<sup>th</sup>. By mid-February, the gas giant shines brightly in the southern sky at the end of twilight. The largest planet in the solar system can be found in the constellation Taurus and to the east of Orion.

## Jovian Moons

Jupiter's four Galilean moons are large enough to be seen with a small telescope. The orbits of the inner three moons are synchronized (orbital resonance) with Europa's orbital period twice Io's period, and Ganymede's orbital period twice that of Europa (e.g., in the time it takes Ganymede to go around Jupiter once, Europa makes two orbits and Io makes four orbits). On nights of good visibility, the shadow(s) of Jupiter's moon(s) can also be seen on the cloud tops as they cross (transit) the planet's disk. Only events that start in the evening are included. A more complete listing can be found in Sky & Telescope's monthly magazine.

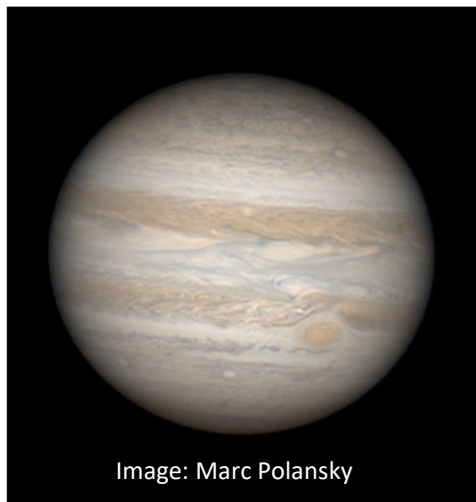


Image: Marc Polansky

## Jovian Moon Transits

Date	Moon	Transit Begins	Transit Ends
31 <sup>st</sup>	Europa	6:57 pm	9:32 pm
1 <sup>st</sup>	Io	7:50 pm	10:02 pm
7 <sup>th</sup>	Europa	9:33 pm	12:08 am (8 <sup>th</sup> )
8 <sup>th</sup>	Io	9:46 pm	11:58 pm
15 <sup>th</sup>	Io	11:42 pm	1:54 am (16 <sup>th</sup> )
17 <sup>th</sup>	Io	6:11 pm	8:23 pm
24 <sup>th</sup>	Io	8:07 pm	10:19 pm

## Great Red Spot Transits

The Great Red Spot is a large, long-lived cyclone in the upper Jovian atmosphere. The Earth-size storm will cross the center line of the planetary disk on the following evenings during the hours between 7 pm to midnight local time.

Date	Transit Time	Date	Transit Time
Jan 31 <sup>st</sup>	9:32 pm	14 <sup>th</sup>	11:07 pm
2 <sup>nd</sup>	11:11 pm	17 <sup>th</sup>	8:37 pm
3 <sup>rd</sup>	7:02 pm	19 <sup>th</sup>	10:16 pm
5 <sup>th</sup>	8:41 pm	21 <sup>st</sup>	11:55 pm
7 <sup>th</sup>	10:19 pm	22 <sup>nd</sup>	7:46 pm
9 <sup>th</sup>	11:58 pm	24 <sup>th</sup>	10:25 pm
10 <sup>th</sup>	7:49 pm	26 <sup>th</sup>	11:04 pm
12 <sup>th</sup>	9:28 pm		

## Remembering Columbia



Columbia crew photo from an undeveloped film canister recovered from the debris. From left (bottom row): Kalpana Chawla, Rick Husband, Laurel Clark and Ilan Ramon. From left (top row): David Brown, William McCool and Michael Anderson. (Image credit: NASA/JSC)

Twenty-one years ago on February 1<sup>st</sup>, the nation's first space shuttle to fly in space broke apart as it returned to Earth, killing all seven crew members aboard. The accident investigation board determined that a large piece of foam fell from the Columbia's external tank during launch, striking the orbiter's left wing. The resulting hole in the carbon-carbon composite insulation allowed hot gases to enter the wing during reentry, resulting in the loss of control and eventual destruction of the vehicle on its 28<sup>th</sup> flight. In the largest ground search in history, volunteers combed an area of east Texas the size of Rhode Island and Delaware for the remains of the shuttle and her crew. Eventually, almost 40 percent of the dry weight of the spacecraft was recovered (84,000 pieces), as well as all of the crew members.

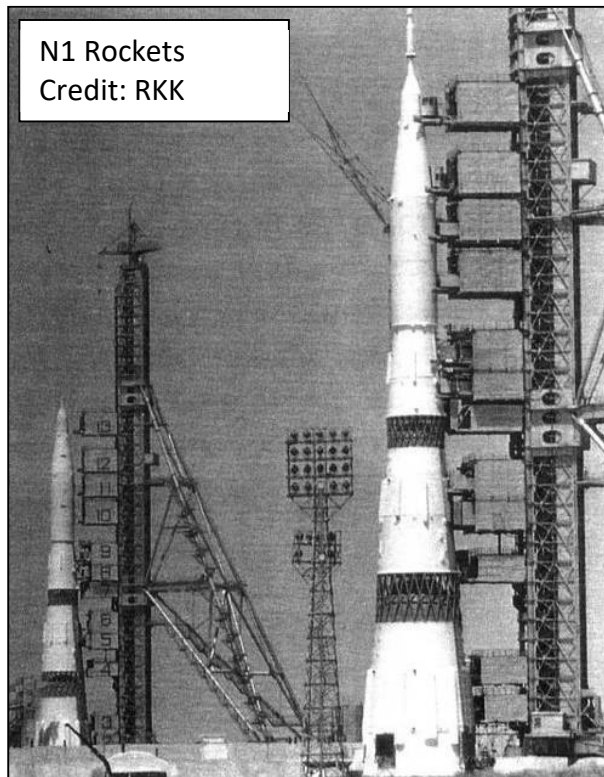
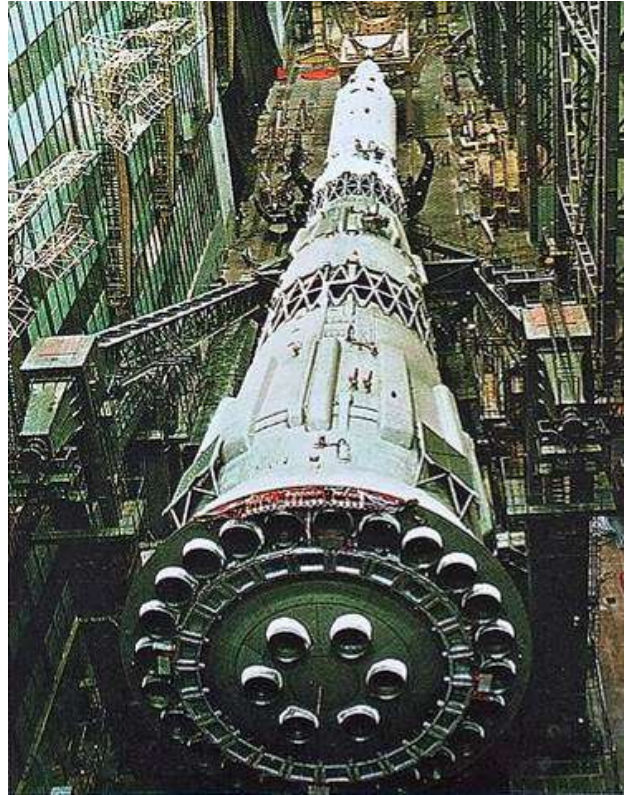
It would be 907 days before another space shuttle flew and, despite all the work to make the vehicle safer, Discovery's external tank shed several large pieces of foam. The largest piece missed the orbiter and the smaller ones caused only minimal damage, based on on-orbit inspections. STS-114, commanded by Eileen Collins, would return safely to Earth at the end of the 14-day mission. Discovery's left main outboard landing gear tire from STS-114 is on display at the Observatory.



## Soviet Moon Program

February 1969 marked the beginning of the end of the Soviet Moon program. While publicly denying its intentions to send cosmonauts to the Moon during the 1960s, the Soviets were secretly constructing rockets of mammoth proportions (rivaling the Saturn V). On February 21, 1969, the N1 moon rocket exploded during its first test flight. The rocket fell back to Earth after a safety system mistakenly shut down all 30 engines when a fire was detected in the first stage less than 70 seconds after liftoff. Three more failures would follow before the Soviet government would abandon their manned-Moon program.

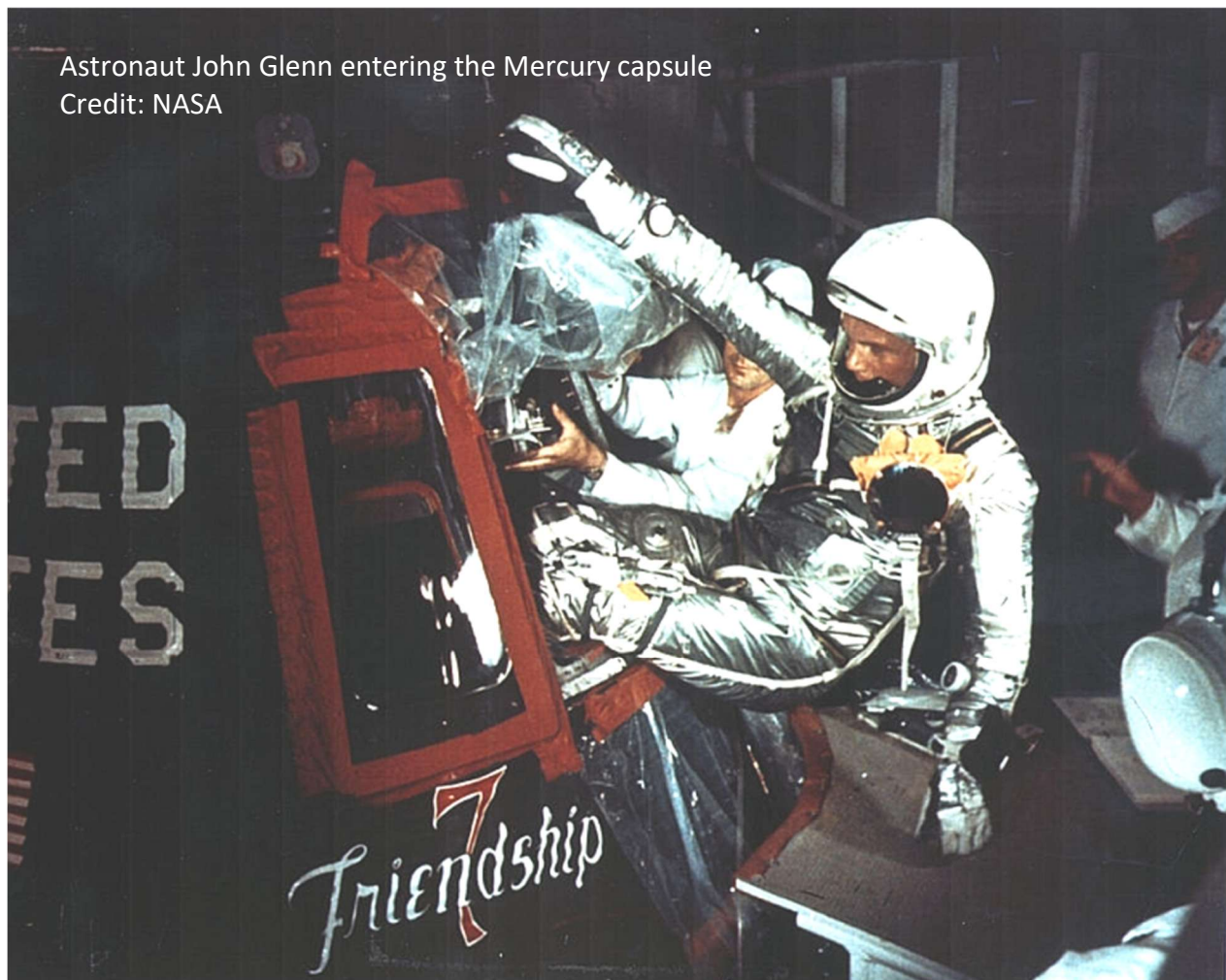
The historic photos on the right shows 1) the N1 under construction with the 30-engine first stage, 2) the Soviet lunar lander and 3) two N1 rockets on pads at the Baikonur Cosmodrome (also known as Tyuratam) in Kazakhstan. The five stage rockets stood approximately 340 feet high.



## 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 served with the Marine Corps prior to being selected by NASA for its manned spaceflight program. 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 before 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. He was the oldest person to fly in space. John Glenn died Thursday, Dec. 8, 2016 at the age of 95. He was the last of the original Mercury 7 astronauts selected by NASA in 1958 for the agency's fledgling manned spaceflight program.

Sunrise and Sunset (from New Milford, CT)

<u>Sun</u>	<u>Sunrise</u>	<u>Sunset</u>
February 1 <sup>st</sup> (EST)	07:05	17:09
February 15 <sup>th</sup>	06:48	17:27
February 28 <sup>th</sup>	06:29	17:43

Astronomical and Historical Events

- 1<sup>st</sup> Moon at perigee (closest distance from Earth)
- 1<sup>st</sup> History: loss of the space shuttle Columbia upon reentry (2003)
- 2<sup>nd</sup> History: Soviet space station Salyut 4 reenters the Earth's atmosphere (1977)
- 3<sup>rd</sup> Closest approach of Apollo class asteroid and Near-Earth Object (NEO) 2018 RE3
- 3<sup>rd</sup> Closest approach of Apollo class asteroid and NEO 2022 AV4
- 3<sup>rd</sup> Closest approach of Aten class asteroid and NEO 2002 CC14
- 3<sup>rd</sup> History: Apollo 14, with astronauts Alan Shepard, Stuart Roosa and Edgar Mitchell, lands in the Moon's Fra Mauro region; 3<sup>rd</sup> manned Moon landing (1971)
- 3<sup>rd</sup> History: Soviet spacecraft Luna 9 becomes first spacecraft to soft land on the Moon (1966)
- 4<sup>th</sup> History: launch of Lunar Orbiter 3; photographed potential Apollo landing sites (1967)
- 4<sup>th</sup> History: Clyde Tombaugh born (1906); discovered the dwarf planet Pluto in 1930
- 5<sup>th</sup> First Quarter Moon
- 5<sup>th</sup> 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)
- 6<sup>th</sup> History: Soviet space station Salyut 7 reenters Earth's atmosphere (1991)
- 6<sup>th</sup> History: Apollo 14 astronaut Alan Shepard attempts to golf on the Moon (1971)
- 7<sup>th</sup> Closest approach of Aten class asteroid and NEO 2016 CO248
- 7<sup>th</sup> Closest approach of Aten class asteroid and NEO 2020 GZ2
- 7<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2022 PK1
- 7<sup>th</sup> History: launch of the Stardust spacecraft for a rendezvous with Comet Wild 2 (1999)
- 7<sup>th</sup> History: Bruce McCandless makes first untethered spacewalk using a jet-powered backpack (1984)
- 7<sup>th</sup> History: Astronomical Society of the Pacific founded (1889)
- 7<sup>th</sup> History: William Huggins born, pioneered work in astronomical spectroscopy and first to differentiate nebular and galactic spectra (1824)
- 8<sup>th</sup> **McCarthy Observatory – Second Saturday Stars**

## Astronomical and Historical Events

- 8<sup>th</sup> History: Allende Meteorite fall (meteorites from the fall were the first extraterrestrial rocks analyzed in the NASA Lunar Receiving Laboratory which had just been completed in September of 1967 to support the Apollo program) (1969)
- 8<sup>th</sup> 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)
- 8<sup>th</sup> 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)
- 8<sup>th</sup> History: flyby of Jupiter by the Ulysses spacecraft on its way to study the polar regions of the Sun (1992)
- 8<sup>th</sup> 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)
- 8<sup>th</sup> History: Jules Verne born, author and futurist (1828)
- 9<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2012 PB20
- 9<sup>th</sup> History: United Arab Emirates Hope (Al-Amal) spacecraft enters orbit around Mars (2021)
- 9<sup>th</sup> History: launch of the ESA's Solar Orbiter on an Atlas 5 rocket from the Cape Canaveral Air Force Station, Florida
- 10<sup>th</sup> History: China's Tianwen-1 enters orbit around Mars (2021)
- 10<sup>th</sup> 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)
- 10<sup>th</sup> History: flyby of Mars by the Soviet Mars 4 spacecraft; failed to enter orbit but did detect night-side ionosphere (1974)
- 10<sup>th</sup> History: MIT, using Millstone Hill radar in Westford, MA, bounces radar off Venus (1958)
- 10<sup>th</sup> History: discovery of Asteroid 624 *Hecktor*, largest Jupiter Trojan, by August Kopff (1907)
- 11<sup>th</sup> 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)
- 11<sup>th</sup> 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)
- 11<sup>th</sup> History: launch of first Japanese satellite: Oshumi (1970)
- 12<sup>th</sup> Full Moon
- 12<sup>th</sup> History: landing of the Near-Earth Asteroid Rendezvous (NEAR) – Shoemaker spacecraft on the asteroid *Eros* (2001)
- 12<sup>th</sup> History: Soviet spacecraft Mars 5 enters orbit around Mars, providing information on surface temperatures, CO<sub>2</sub> concentrations, and detecting a thin ozone layer and water vapor concentrations near the Tharsis region (1974)
- 12<sup>th</sup> History: Sikhote Alin meteorite fall in Russia, one of the largest modern falls at 28 tons (1947)
- 14<sup>th</sup> History: flyby of Comet *Tempel 1* by the Stardust spacecraft (2011)
- 14<sup>th</sup> History: NEAR-Shoemaker enters orbit around *Eros*, one of the largest of the near-Earth asteroids (2000)



## Astronomical and Historical Events (continued)

- 14<sup>th</sup> 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)
- 14<sup>th</sup> 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
- 14<sup>th</sup> History: launch of Luna 20, Soviet Moon sample return (1972)
- 14<sup>th</sup> History: launch of Syncom 1, the first geosynchronous satellite (1963)
- 15<sup>th</sup> Closest approach of Aten class asteroid and NEO 2004 XG
- 15<sup>th</sup> History: launch of the Nova-C lunar lander “Odysseus” built by Intuitive Machines. On February 22<sup>nd</sup>, IM-1 became the first commercial mission to successfully soft-land on the Moon (2024)
- 15<sup>th</sup> History: meteor explodes over the Russian city of Chelyabinsk causing hundreds of minor injuries (2013)
- 15<sup>th</sup> History: discovery of Centaur Object *Chariklo* by Jim Scotti (1997)
- 15<sup>th</sup> 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)
- 15<sup>th</sup> History: Pioneer 10 becomes the first spacecraft to traverse the Main Asteroid Belt (1973)
- 15<sup>th</sup> History: Galileo Galilei born (1564)
- 16<sup>th</sup> Closest approach of Apollo class asteroid, NEO and Potentially Hazardous Asteroid (PHA) 2024 UD26
- 16<sup>th</sup> History: Gerard Kuiper discovers Uranus’ moon *Miranda* (1948)
- 17<sup>th</sup> Moon at apogee (furthest distance from Earth)
- 17<sup>th</sup> History: discovery of the Plutino 90482 *Orcus* with its large moon, Vanth, by American astronomers Michael Brown of Caltech, Chad Trujillo of the Gemini Observatory, and David Rabinowitz of Yale University (2004)
- 17<sup>th</sup> History: Ann Harch discovers *Dactyl*, the first natural satellite of an asteroid (*Ida*) discovered from Galileo Images (1994)
- 17<sup>th</sup> History: launch of Ranger 8; lunar impact mission (1965)
- 17<sup>th</sup> 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)
- 17<sup>th</sup> History: launch of Vanguard 2; designed to measure cloud-cover distribution over Earth (1959)
- 18<sup>th</sup> Closest approach of Aten class asteroid and NEO 2014 CE13
- 18<sup>th</sup> History: landing of the Mars 2020 Perseverance rover in Jezero crater (2021)
- 18<sup>th</sup> History: Mike Brown and Jean-Luc Margot's discovery of *Romulus*, the larger of two moon that orbit Asteroid 87 *Sylvia* (2001)
- 18<sup>th</sup> History: American astronomer Clyde Tombaugh discovers Pluto (1930)
- 19<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2022 DG2
- 19<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2016 AX165
- 19<sup>th</sup> History: Nicolas Copernicus born (1473)
- 20<sup>th</sup> Last Quarter Moon

## Astronomical and Historical Events (continued)

- 20<sup>th</sup> 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)
- 20<sup>th</sup> History: launch of the core module of the Soviet space station Mir (1986)
- 20<sup>th</sup> History: launch of Mercury-Atlas 6 and Friendship 7 with astronaut John Glenn; first American in orbit (1962)
- 21<sup>st</sup> History: launch of Israel's SpaceIL, privately-funded, lunar lander aboard a SpaceX Falcon 9 rocket from the Cape Canaveral Air Force Station, Florida
- 21<sup>st</sup> History: Soviet moon rocket (N-1) explodes during first test flight (1969)
- 22<sup>nd</sup> History: launch of Viking, Sweden's first satellite (1986)
- 22<sup>nd</sup> History: launch of Soviet spacecraft Kosmos 110, with dogs Veterok and Ugolyok (1966)
- 22<sup>nd</sup> History: Max Wolf discovers asteroid 588 *Achilles* – the first Trojan asteroid (1906)
- 23<sup>rd</sup> History: Supernova 1987A detected in the Large Magellanic Cloud (1987)
- 24<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2015 BK509
- 24<sup>th</sup> 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)
- 24<sup>th</sup> 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)
- 24<sup>th</sup> History: Jocelyn Bell announces discovery of rapidly rotating radio sources, later determined to emanate from neutron stars or pulsars (1968)
- 24<sup>th</sup> History: launch of Bumper WAC, first two-stage liquid-propellant rocket and the first human-made object to achieve hypersonic speeds (1949)
- 25<sup>th</sup> Closest approach of Apollo class asteroid and NEO 2023 RW3
- 25<sup>th</sup> History: flyby of Mars by the Rosetta spacecraft (2007)
- 25<sup>th</sup> History: Soviet spacecraft Luna 20 returns lunar soil sample (30 grams) to Earth (1972)
- 26<sup>th</sup> History: launch of the first Saturn 1B rocket booster (1966)
- 26<sup>th</sup> History: original crew of Gemini 9, Elliot See and Charles Bassett killed in plane crash at the McDonnell Aircraft building in St. Louis (1966)
- 27<sup>th</sup> New Moon
- 27<sup>th</sup> History: discovery of Jupiter's moon Herse was by Brett J. Gladman, John J. Kavelaars, Jean-Marc Petit, and Lynne Allen (2003)
- 28<sup>th</sup> History: flyby of Jupiter by the New Horizons spacecraft bound for Pluto (2007)
- 28<sup>th</sup> History: launch of Discoverer 1; first of a series of satellites which were part of the Corona reconnaissance satellite program and first satellite launched into polar orbit (1959)

## Commonly Used Terms

- Apollo: a group of near-Earth asteroids whose orbits also cross Earth's orbit; Apollo asteroids spend most of their time outside Earth orbit.
- Aten: a group of near-Earth asteroids whose orbits also cross Earth's orbit, but unlike Apollos, Atens spend most of their time inside Earth orbit.



### Commonly Used Terms

- Atira: a group of near-Earth asteroids whose orbits are entirely within Earth's orbit
- Centaur: icy planetesimals with characteristics of both asteroids and comets
- Kuiper Belt: region of the solar system beyond the orbit of Neptune (30 AUs to 50 AUs) with a vast population of small bodies orbiting the Sun
- Opposition: celestial bodies on opposite sides of the sky, typically as viewed from Earth
- Plutino: an asteroid-sized body that orbits the Sun in a 2:3 resonance with Neptune
- Trojan: asteroids orbiting in the 4<sup>th</sup> and 5<sup>th</sup> Lagrange points (leading and trailing) of major planets in the Solar System

### References on Distances

- the apparent width of the Moon (and Sun) is approximately one-half a degree ( $\frac{1}{2}^\circ$ ), less than the width of your little finger at arm's length which covers approximately one degree ( $1^\circ$ ); three fingers span approximately five degrees ( $5^\circ$ )
- 1 astronomical unit (AU) is the distance from the Sun to the Earth or approximately 93 million miles

### International Space Station and Starlink Satellites

Visit [www.heavens-above.com](http://www.heavens-above.com) for the times of visibility and detailed star charts for viewing the International Space Station and bright 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](http://www.spaceweather.com)

### NASA's Global Climate Change Resource

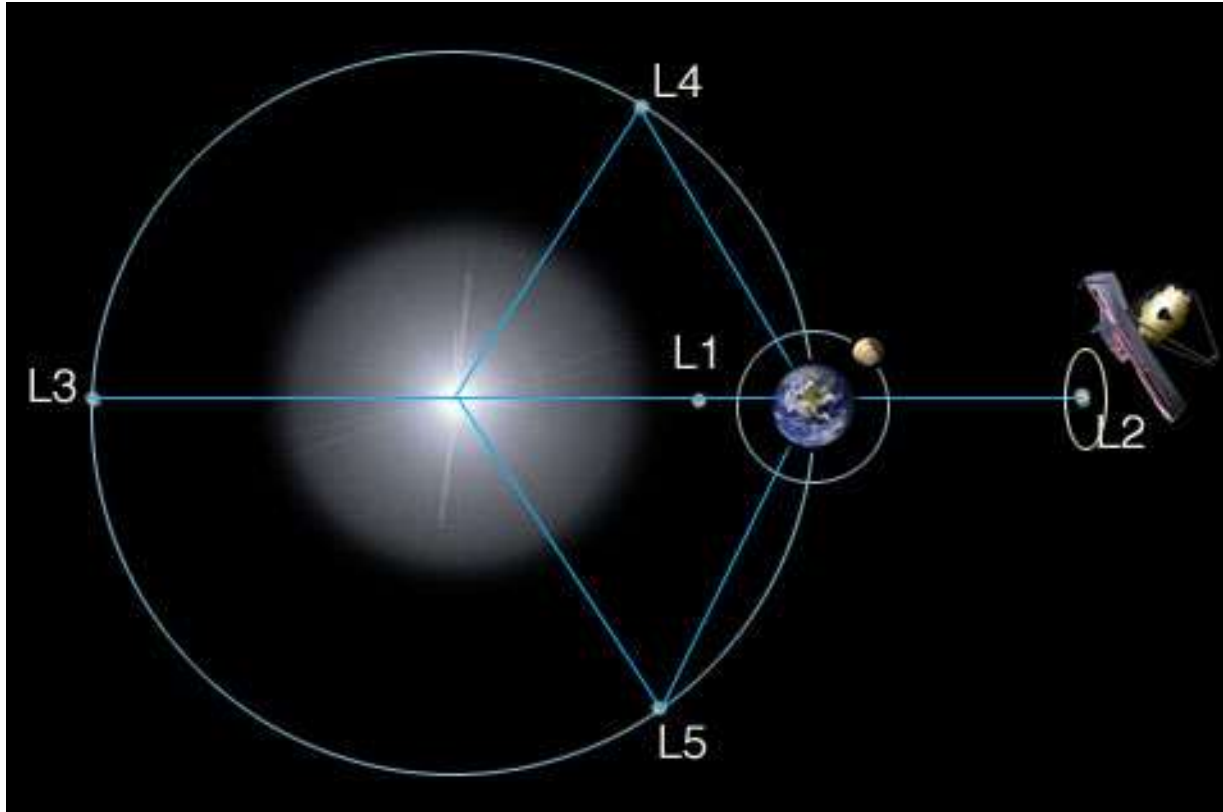
Vital Signs of the Planet: <https://climate.nasa.gov/>

### Mars Mission Websites

- Mars 2020 (Perseverance rover): <https://mars.nasa.gov/mars2020/>
- Mars Science Laboratory (Curiosity rover): <https://mars.nasa.gov/msl/home/>
- Mars Atmosphere and Volatile Evolution (MAVEN): <https://science.nasa.gov/mission/maven/>

## Lagrange Points

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



James Webb Space Telescope

<https://webb.nasa.gov/index.html>

Euclid Space Telescope

[https://www.esa.int/Science\\_Exploration/Space\\_Science/Euclid](https://www.esa.int/Science_Exploration/Space_Science/Euclid)

Gaia Star Surveyor

[https://www.esa.int/Science\\_Exploration/Space\\_Science/Gaia](https://www.esa.int/Science_Exploration/Space_Science/Gaia)



## Contact Information

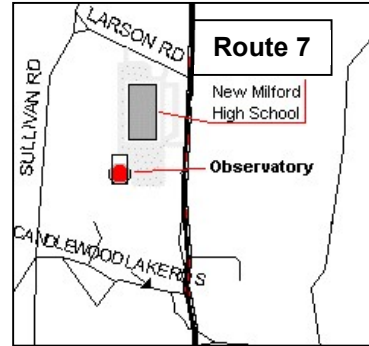
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