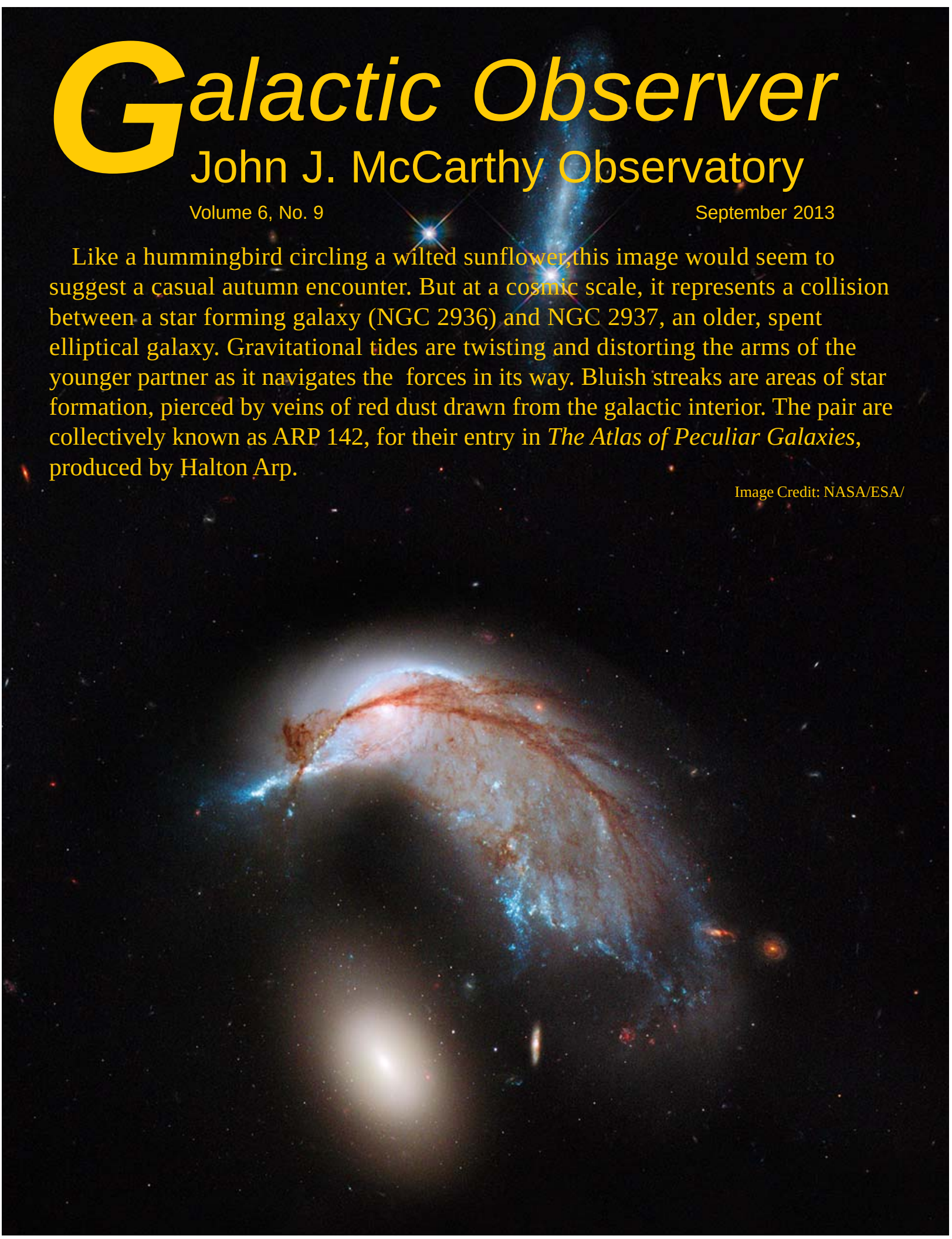
Galactic Observer

John J. McCarthy Observatory

Volume 6, No. 9 September 2013

Like a hummingbird circling a wilted sunflower,this image would seem to suggest a casual autumn encounter. But at a cosmic scale, it represents a collision between a star forming galaxy (NGC 2936) and NGC 2937, an older, spent elliptical galaxy. Gravitational tides are twisting and distorting the arms of the younger partner as it navigates the forces in its way. Bluish streaks are areas of star formation, pierced by veins of red dust drawn from the galactic interior. The pair are collectively known as ARP 142, for their entry in *The Atlas of Peculiar Galaxies*, produced by Halton Arp.

Image Credit: NASA/ESA/



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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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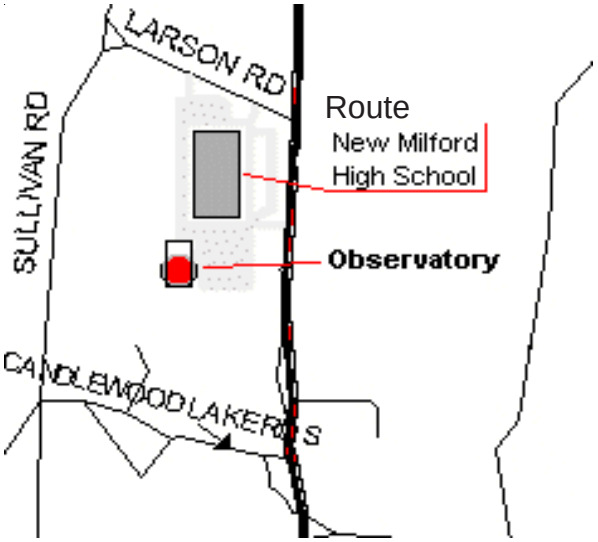
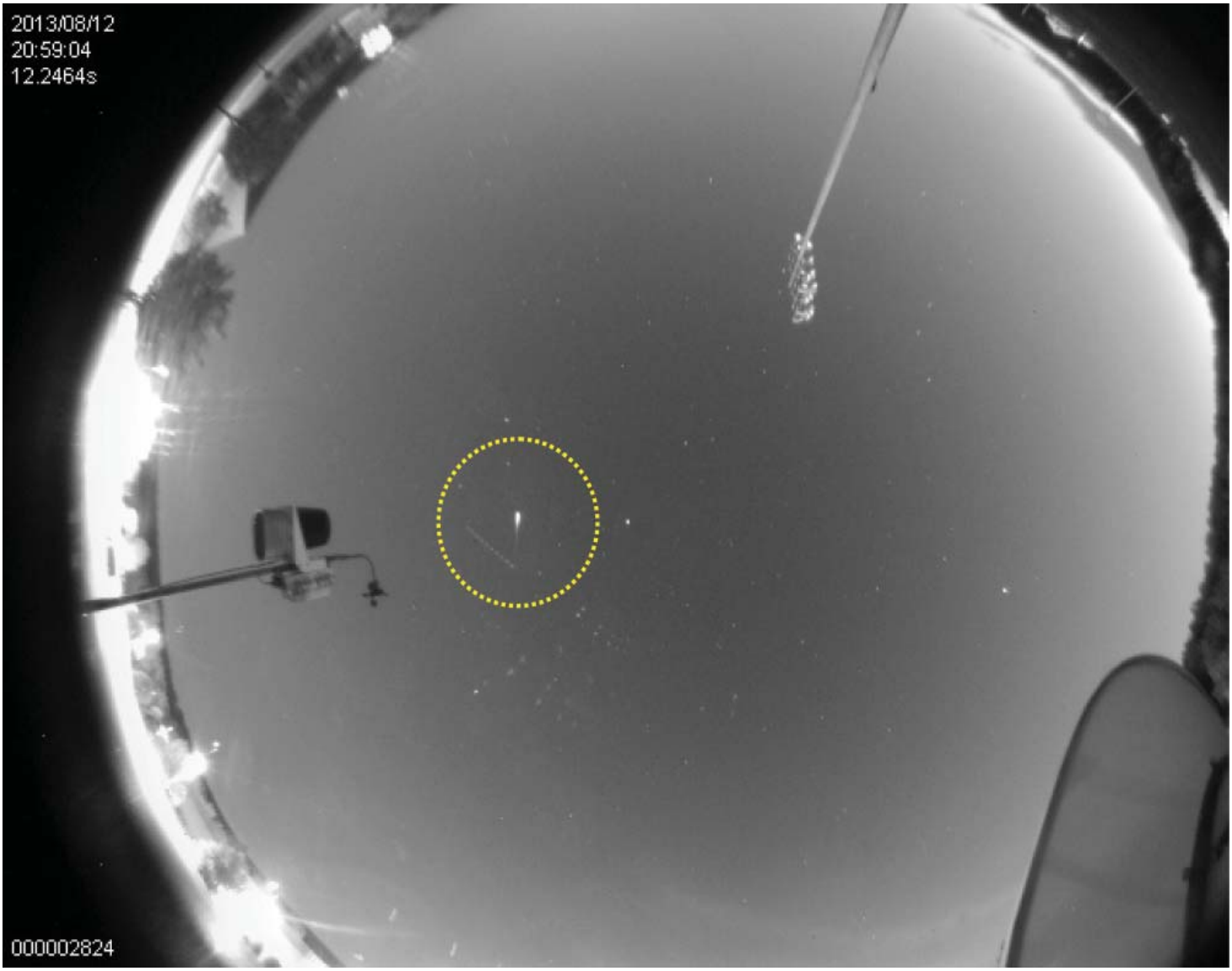


September Calendar and Space Exploration Almanac

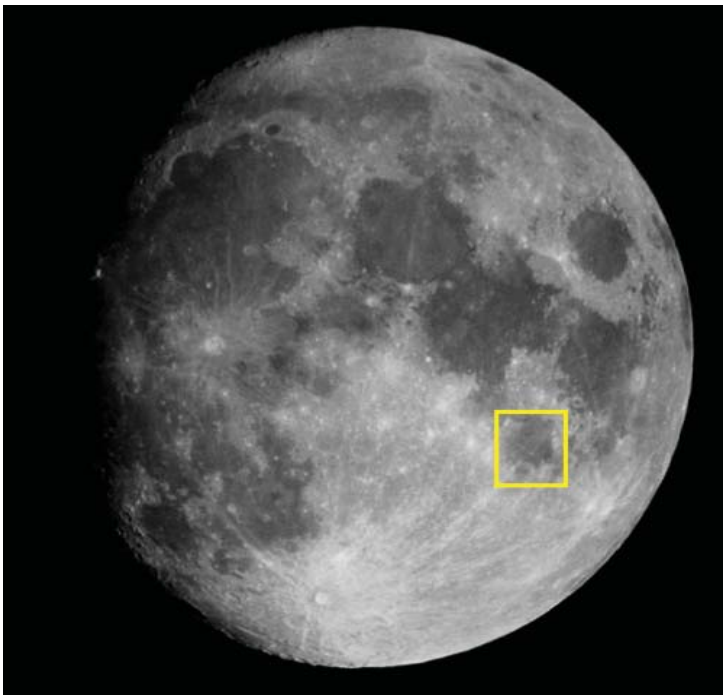


The John J. McCarthy Observatory's new "All Sky" camera captures its first fireball on August 12th during the height of the Perseids meteor shower. The camera, mounted on the roof the Observatory, was acquired with money from a technology grant from United Technologies Aerospace Systems. The camera provides a view of the entire sky, providing not only real-time weather conditions, but data on transient atmospheric phenomena such as meteors and fireballs.

The All Sky camera can be found on the Observatory's home webpage: *www.mccarthyobservatory.org,* where you can also down load the latest time lapse video.

"Out the Window on Your Left"

IT'S BEEN MORE THAN 40 years since we left the last footprint on the dusty lunar surface. Sadly, as a nation founded on exploration and the con quest 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).

The view this month is of Mare Nectaris (the Sea of Nectar) in the southeast quadrant of the lunar nearside and the adjoining crater Fracastorius. The mare occupies the central portion of an ancient impact basin believed to have formed approximately 3.92 billion years ago. The lava that subsequently flooded the basin exceeds a kilometer in depth at its most concentrated. With the exception of the Altai scarp, little remains of the basin's original impact rings.

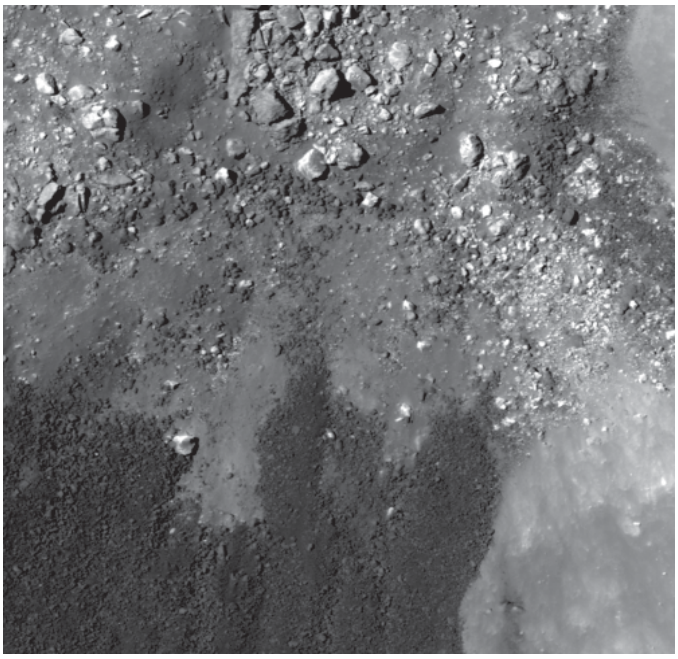
Long ago, the Nectaris lavas breeched the northern wall of the 70 mile (112 km) diameter Fracastorius crater, giving the crater the appearance of a cove along the southern shore of the petrified lava sea. The lava covered the crater floor and the central peaks characteristic of large complex impact craters. A rille (narrow channel) meanders across the crater floor in an east-west direction. The remaining crater walls rise to a maximum height of 1.5 miles (2.4 km) and are interrupted along the western rampart by a smaller crater (Fracastorius D).

Mare Nectaris covers approximately 32,500 square miles (84,100 km^2). The large crater Theophilus (with its rim illuminated by the rising Sun) marks the western extent of the lava flows and the intersection of the southern lava flows from Mare Tranquillitatis (the Sea of Tranquility). Ghost craters (all but submerged remnants) dot the ancient floor of the mare; several can be observed in the vicinity of the 29 mile (46 km) diameter crater Daguerre (named after Louis Daguerre, who in 1839 attempted the first photograph of the Moon). A singular ray appears to originate from Madler before crossing the western rim of Daguerre. Small, secondary craters from the Theophilus impact can also be seen on the lava plains south and east of Madler.

Louis Daguerre

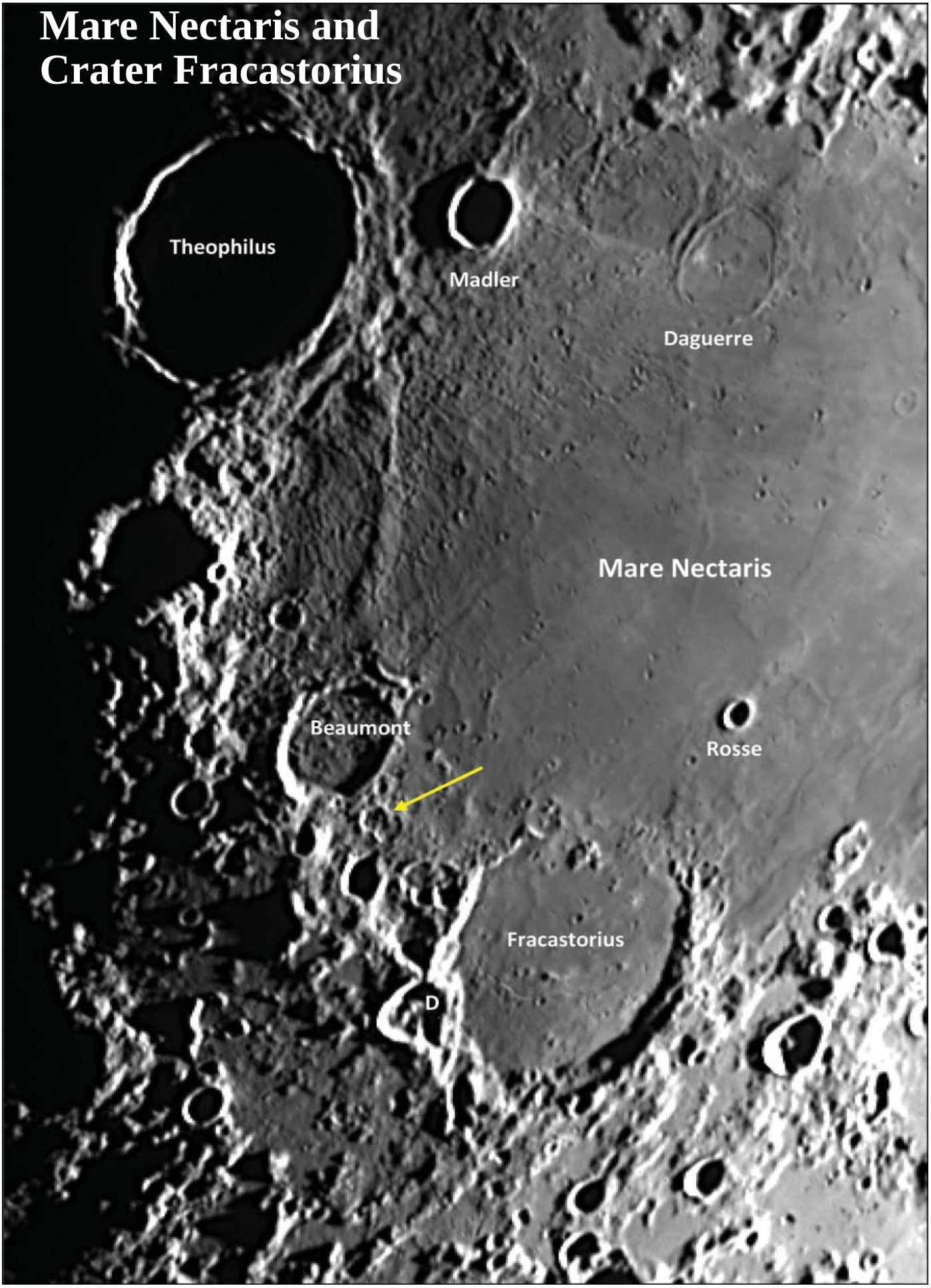
South of the crater Beaumont is a small, concentric crater (marked with an arrow). It is one of a small class of craters with an average diameter 5 miles (8 km) that have an inner, concentric ring wall, the formation of which is still undetermined.

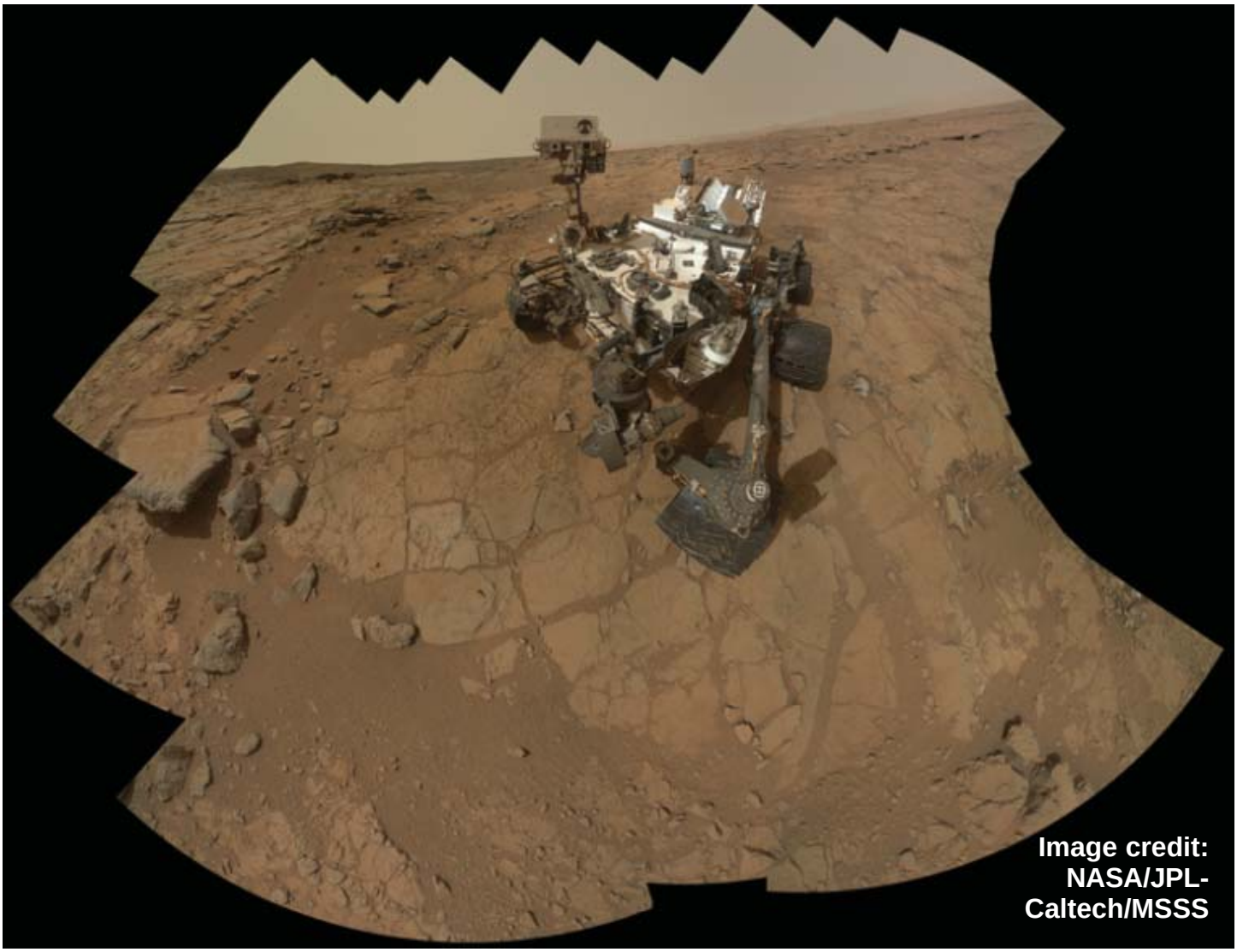
A small bowl-shaped crater Rosse (7½ mile, 12 km diameter) punctuates the mare in the south, the lone bright spot among the darker lava fields.



A variety of textures and reflectivities in the wall and floor of a recent crater within the ghost crater Daguerre in Mare Nectaris (11.9°S; 33.6°E). North is up; illumination is from the west, downslope is toward the top of the frame, image is ~425 m across.
[Source: LROC NAC M174665969R [NASA/GSFC/ Arizona State University].

Mare Nectaris and Crater Fracastorius





One Year (Earth Year) on Mars

It was 1:31:45 A.M. (EDT) just one year ago, on August 5th that the announcement came from Curiosity's Entry, Descent and Landing team that the rover was on the ground after a harrowing seven minute descent through 78 miles (125 km) of thin Martian atmosphere. In the year since setting down at Bradbury Landing inside Gale crater, the rover has driven more than a mile around the foothills of the three-mile-high Mount Sharp. It has provided hourly weather reports and beamed back more than 190 gigabits of data. The 70,000 images returned by Curiosity included the 66 individual images used to assembl a self-portrait (above).

While only half-way through its two year mission, Curiosity has already accomplished its prime objective: determine whether Mars ever had an environment that could have supported life. In its initial excursion, the rover found an ancient stream bed that once held swiftly moving, knee-deep water. Its suite of instruments have detected the ingredients for life: carbon, hydrogen, oxygen, phosphorus and sulfur, and evidence that the water that flowed through Gale crater was benign: not too salty or acidic for primitive life forms. What Curiosity has not found is methane (a biomarker that could suggest living organisms).

Curiosity has also collected data that is being used to model the mechanism by which Mars has lost much of its original atmosphere. The rate of loss will be further explored by NASA's next mission, the Mars Atmosphere and Volatile Evolution Mission (MAVEN), scheduled for launch in November.

Saturn's Rings and the Pale Blue Dot

On July 19th, the Cassini spacecraft moved into Saturn's shadow to observe its rings as backlit by the Sun. This vantage point provided an opportunity to explore Saturn's shadowy dust rings and structural details of the main rings that are not readily apparent or visible when the rings are exposed to full sunlight. During similar maneuvers in 2006 and 2012, previously unseen dusty rings were discovered and wispy jets of icy material detected feeding the E ring from the polar fountains of Saturn's moon Enceladus.

Credit: NASA/JPL Caltech/ Space Science Institute

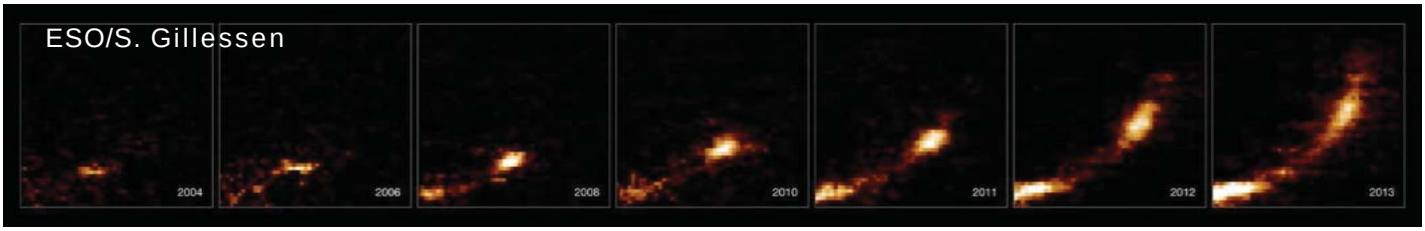
The images taken by the Cassini spacecraft also captured its home planet in the background (marked by an arrow in the photo above). The pale blue dot, home to 7 billion people, occupies but a few pixels in the image taken from 900 million miles away.

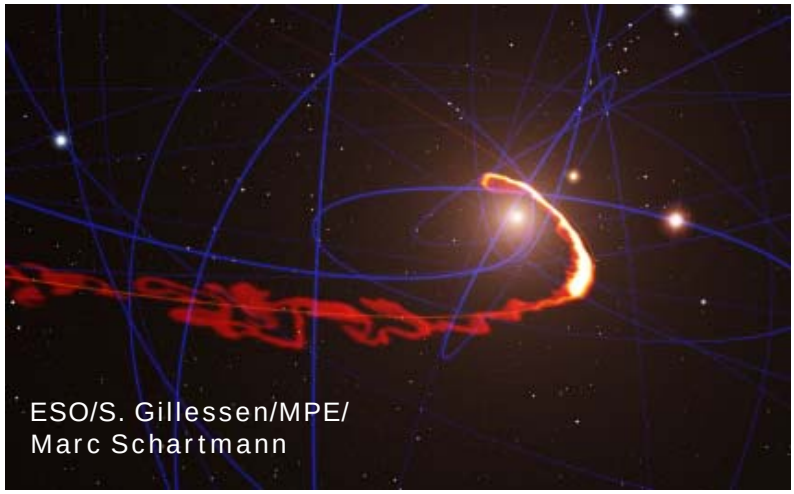
The Earth's moon is clearly seen as a separate but lesser world when the image is magnified (photo on the right). This was the first time that Cassini had captured the Earth and moon as two separate objects.

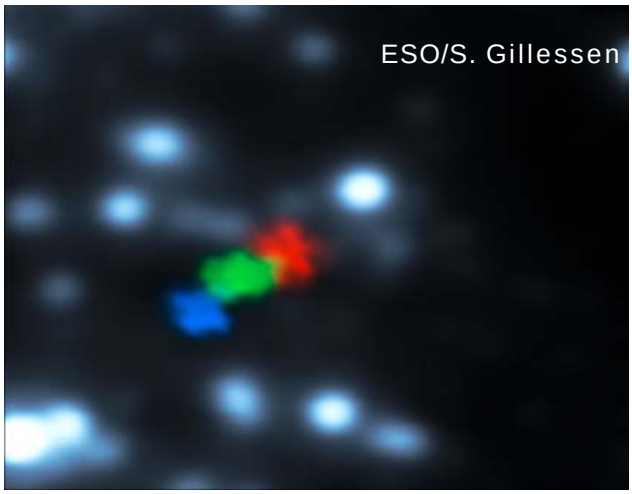
Black Hole Caught Snacking

At the center of our galaxy, a comfortable 26,000 light years away, is a supermassive black hole, four million times the mass of our Sun. While not directly observable, its interaction with nearby stars and interstellar material reveals its location and allows astronomers to study the regions closest to the black hole, where its gravitation field is the most intense. Over the past several years, astronomers have been watching a cloud of gas (several times the mass of the Earth) moving towards a close encounter with Sagittarius A* (the formal name of our black hole). The encounter is now underway and has been closely watched, most recently, by the European Southern Observatory's Very Large Telescope (VLT) at Cerro Paranal in northern Chile.

Observations have shown the gas cloud being stretched and ripped apart as it passes close to the black hole. The leading edge of the cloud has already passed by the black hole, having been accelerated to almost 1% of the speed of light. At is closest, the gas cloud was only 5 times the distance Neptune is from our Sun.





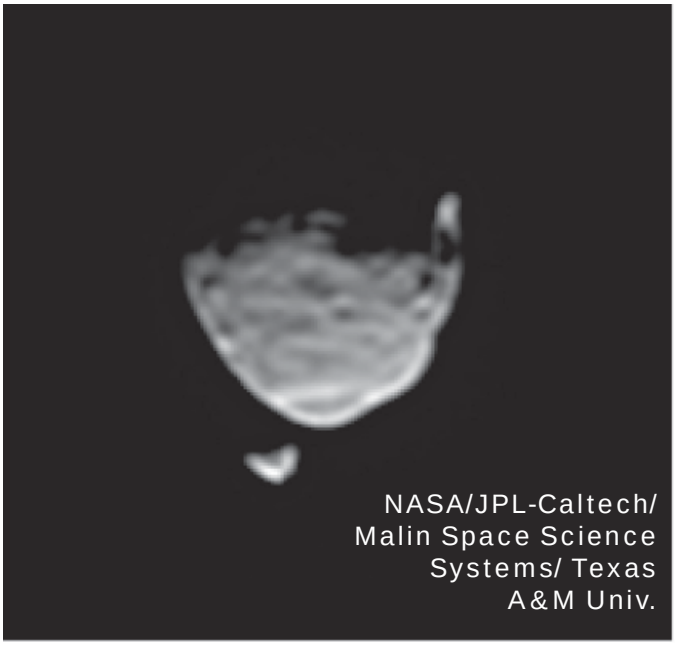


Moons Passing in the Night

On August 1, 2013, Curiosity stayed up late and did some star gazing. In a first, Curiosity imaged Mars' large moon, Phobos, passing in front of its smaller moon, Deimos. While Phobos is considerably smaller than the Earth's moon, it is also considerably closer to Mars and, as such, appears about one-half the size of Earth's moon in the Martian sky. With Curiosity's telephoto lens, large craters can be seen on Phobos' irregular surface.

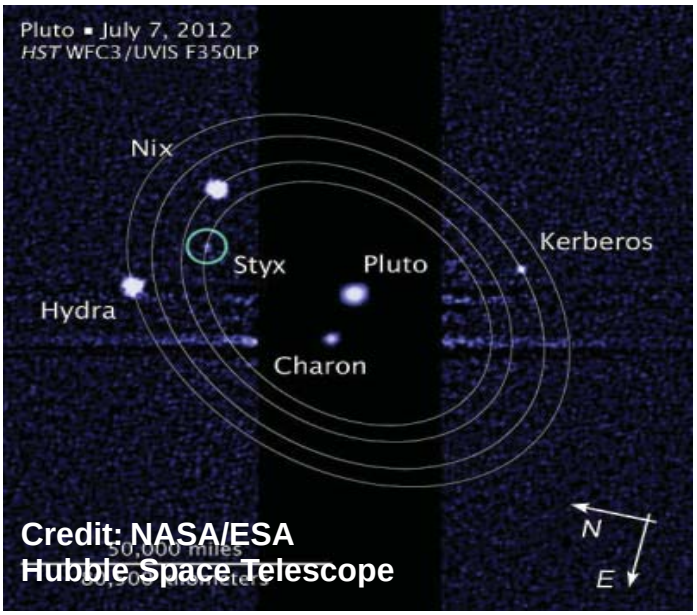
The observations serve a scientific purpose. If the orbit of Phobos (which is slowly decaying) can be known with precision, it can be used to explore the interior of Mars, i.e., similar to the mapping of the Moon's interior by NASA's lunar GRAIL mission.

A movie clip of the transit can be found at *http://www.jpl.nasa.gov/news/news.php?release=2013-253*.



Kerberos and Styx

In the past two years, two new moons have been discovered orbiting Pluto, for a total of five. Until recently, they were known by the provisional designations "P4" and "P5", as more proper names were considered. The wait is over as the International Astronomical Union (IAU) has designated "P4" Kerberos and "P5" Styx. While the public was invited to submit their choices and vote on their favorites, the IAU declined the public's favorite: Vulcan, as advocated by William Shatner (aka Captain Kirk of TV's star ship Enterprise).



The IAU has used Greek and Roman mythology involving the underworld in their naming convention for the plutonian system and Vulcan, the Roman god of fire, didn't conform. Instead,

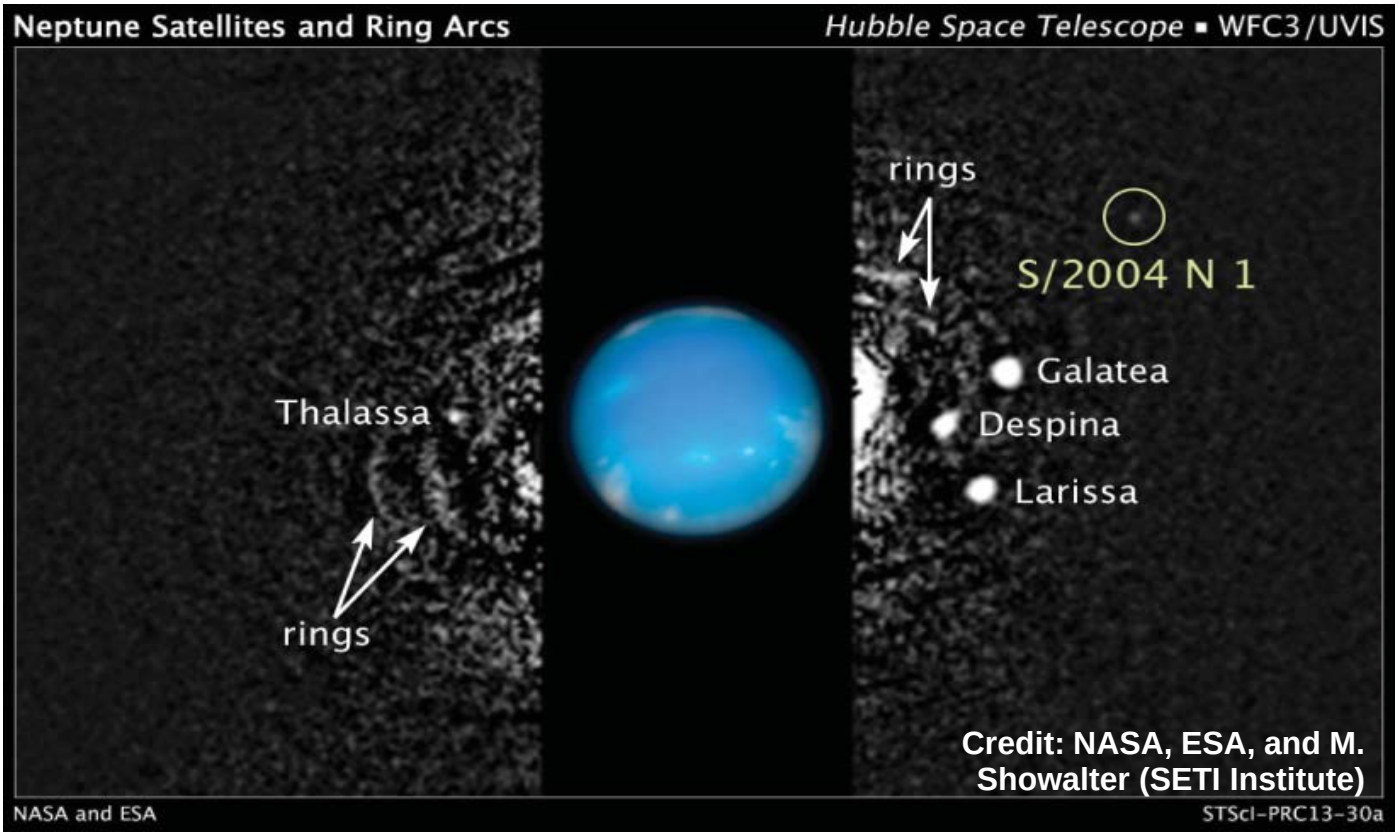
Styx (river of the Underworld) and Kerberos (after Cerberos, the hound of Hades) were selected. The spelling of Cerberos was changed to Kerberos to avoid confusion with the asteroid 1865 Cerberus.

A New Moon for Neptune

There's also news from the "ice giant" realm as a small moon orbiting Neptune was spotted in images taken in 2004 by the Hubble Space Telescope. Mark Showalter (SETI Institute) found the moon during a search for ring arcs.

Neptune has five main rings, all very faint and tenuous. The fifth ring (furthest distant from the planet) called Adams, contains several higher density arcs of material (e.g., dust or organic compounds) that have changed little since they were imaged by the Voyager 2 spacecraft in 1989 (with time, the material should have spread out uniformly along the ring). It is likely that the moon Galatea, located just inward of the ring, is somehow responsible for the stability of the mass concentrations.

Neptune's 14th moon, currently designated S/2004 N1 is located between the orbits of Larissa and Proteus. It is no more than 12 miles across (20 km), with a dark surface, and orbits Neptune in less than a day.



As for a more proper name for this new world, the IAU uses characters from Greek or Roman mythology that are associated with Poseidon or Neptune, the oceans, or the Nereids for neptunian satellites.

When a discovery is made, the discoverer typically suggests a name, in accordance with the IAU's naming convention. While the IAU has the final decision, the discoverer's proposal is given priority.

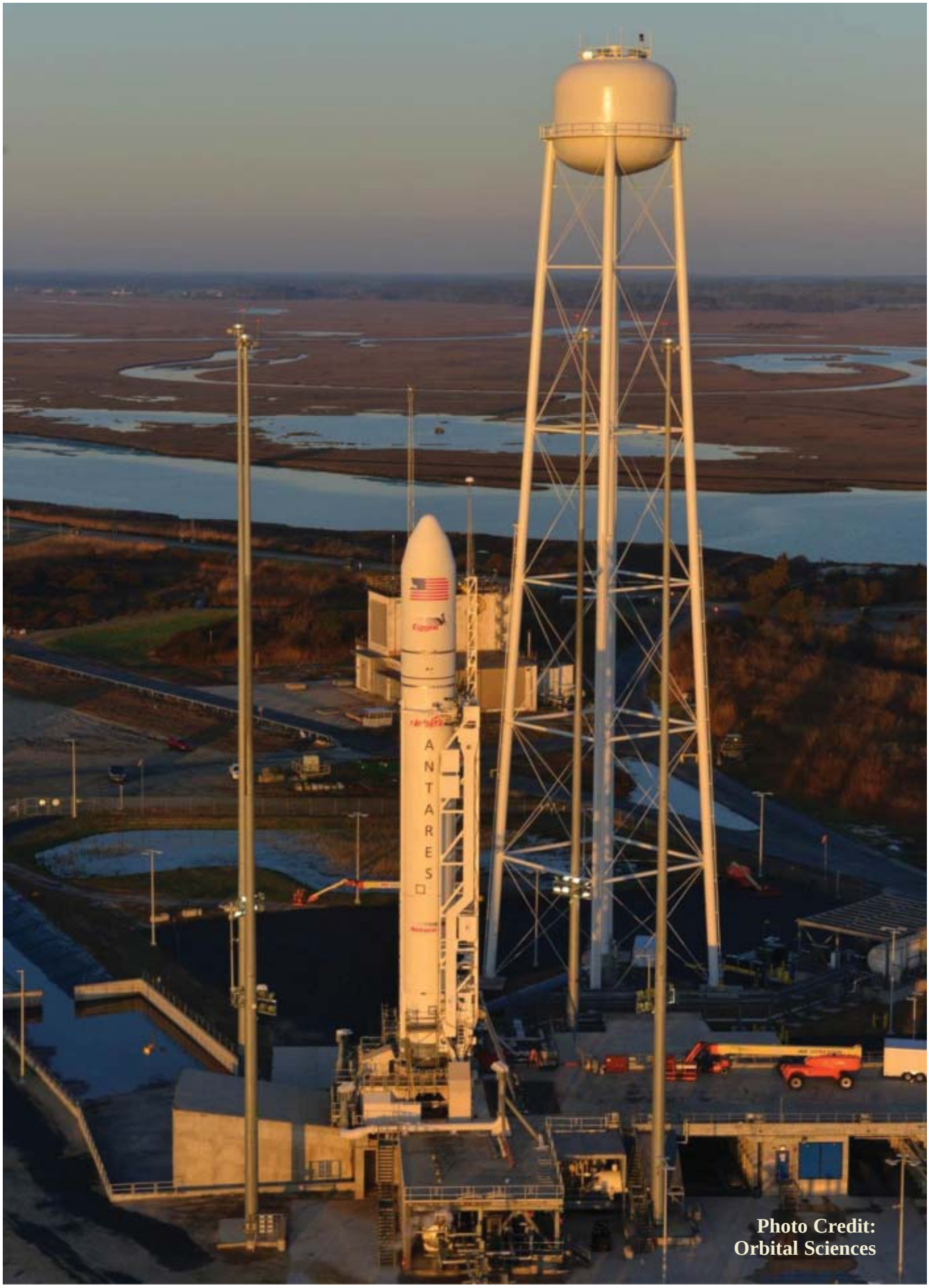
From the Heavens to the Deepest Depths

Four months ago, Jeff Bezos and his crew recovered several F-1 engine components (thrust chambers, gas generators, injectors, heat exchangers, turbines, fuel manifolds, etc.) from the Atlantic seabed. After spending more than forty years three miles below the surface, the components were heavily corroded and mangled from their 38 mile free fall after stage separation and water impact. The engine components were sent to the Kansas Cosmosphere and Space Center in Hutchinson, Kansas for cleaning and stabilization, in preparation for public display. One of the conservators working on the thrust chambers recently found the remains of a stencil, as well as a unit number stamped into a metal surface, both reading "2044." The number corresponds to the Rocketdyne serial number for the No. 5 engine (center) from the Apollo 11 Saturn V rocket.

Of the sixty-five F-1 engines that landed in the Atlantic ocean (five F-1 engines powered the first stage of the Saturn V moon rocket) after two and a half minutes of flight, Jeff Bezos and his team managed to find at least one from the rocket that carried Armstrong, Collins and Aldrin to the Moon. The photo (below) shows the thrust chamber from an F-1 engine resting on the Atlantic seabed prior to recovery. The chamber was approximately 11 feet in length and 9-1/2 feet in diameter. Fuel (RP-1 kerosene) and oxidizer (liquid oxygen) was mixed and burned in the chamber to produce the rocket's thrust.

Orbital Sciences Demonstration

Orbital Sciences is ready to join Space X in the Commercial Orbital Transportation Services (COTS) with a launch from Wallops Flight Facility to the International Space Station in September (launch window opens September 14th). For its COTS demonstration flight, Orbital Sciences will launch its Cygnus cargo carrying spacecraft on its Antares rocket. The two stage rocket (liquid fueled first stage and solid fueled second stage) has been assembled and is undergoing testing. The Cygnus spacecraft, capable of carry-


ANTARES
Photo Credit:
Orbital Sciences

ing 4,400 pounds of cargo (e.g.: crew supplies, equipment and scientific experiments) in its pressurized, solar powered cargo module, is also being readied for flight.

The COTS launch will follow another launch from Wallops: NASA's Lunar Atmosphere and Dust Experiment aboard an Orbital Sciences' Minotaur V rocket.

Mars 2020

NASA has recently announced plans for its next Martian rover (below), based upon the success of its Curiosity design. The scientific objectives for the "Mars 2020" mission include looking for signs of past life, collecting samples for possible future return to Earth, and demonstrating technology for future human exploration. The science instruments and payload will be selected through an open competition. A mechanical platform similar to Curiosity (and its sky crane delivery system) will be used to minimize mission costs and risks. No decision has been made on the power source for the rover (e.g., nuclear or solar) or the landing site.

Back to the Moon

We don't think of the Moon having an atmosphere when we see images of the Apollo astronauts working on the lunar surface wearing their bulky spacesuits. While for all practical purposes, the astronauts were working in a near-perfect vacuum, the Moon is surrounded by a very tenuous atmosphere, so tenuous that the atoms and molecules don't interact with each other. The lunar atmosphere is comparable to the outer reaches of the Earth's atmosphere where the International Space Station orbits.

To gain a better understanding of the lunar atmosphere and its interaction with surface dust, NASA has designed a robotic mission: Lunar Atmosphere and Dust Environment Explorer (LADEE). The spacecraft is scheduled to be launched aboard an Orbital Sciences Minotaur V rocket from Wallop Flight Facility in Virginia on September 6th. It will take approximately 30 days to travel to the Moon.

The journey to the Moon is long by Apollo standards (3 days), but is designed to be efficient (using less propellant). The LADEE spacecraft will be launched into a highly elliptical Earth orbit where it will make 3 orbits of the Earth. The spacecraft's altitude will be raised with each successive Earth orbit before it is transferred to a lunar orbit.

NASA's Surveyor lunar landers imaged a glow on the lunar horizon after the Sun had set. The Apollo astronauts also reported a similar phenomenon before sunrise or after sunset. This would seem to suggest that there is lunar dust suspended above the surface (reflecting sunlight). LADEE may shed

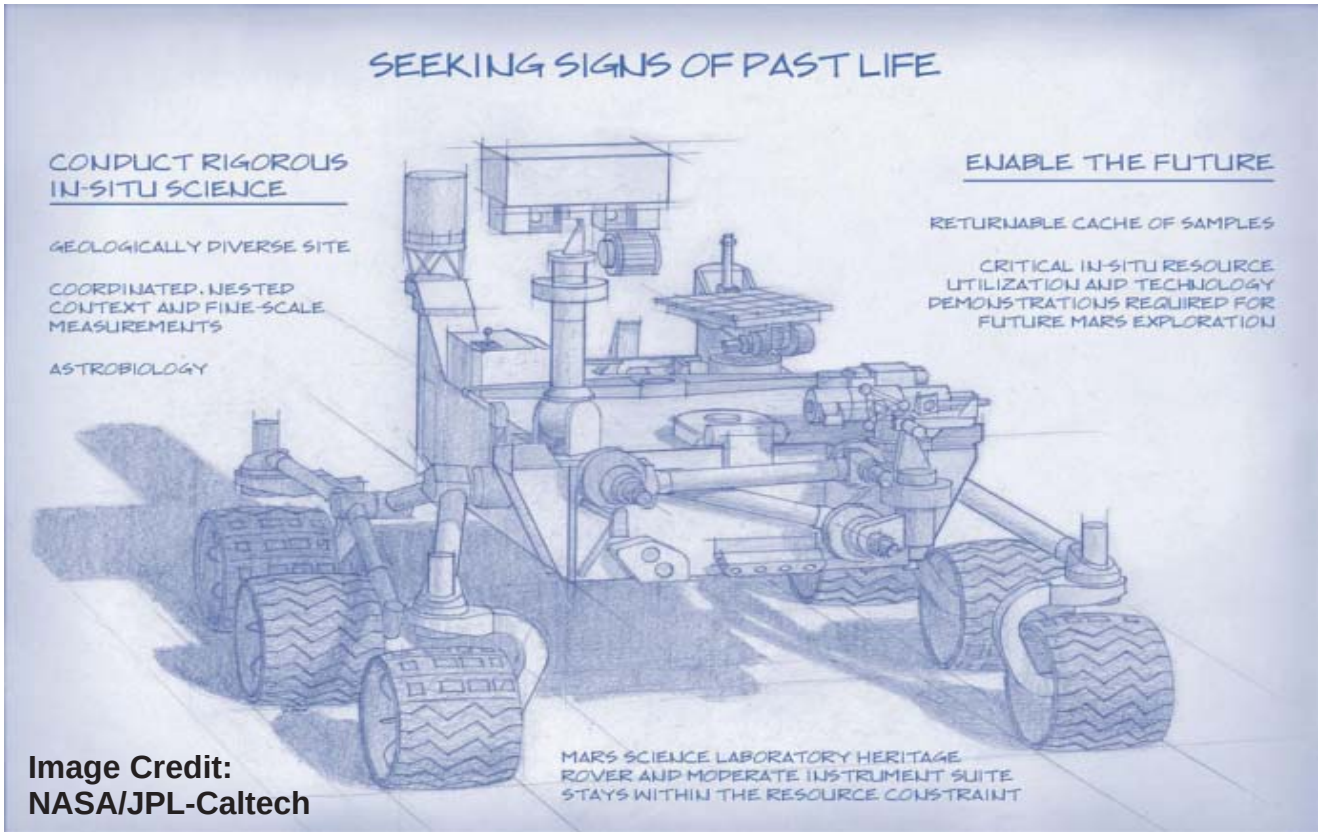


Image Credit: NASA/JPL-Caltech

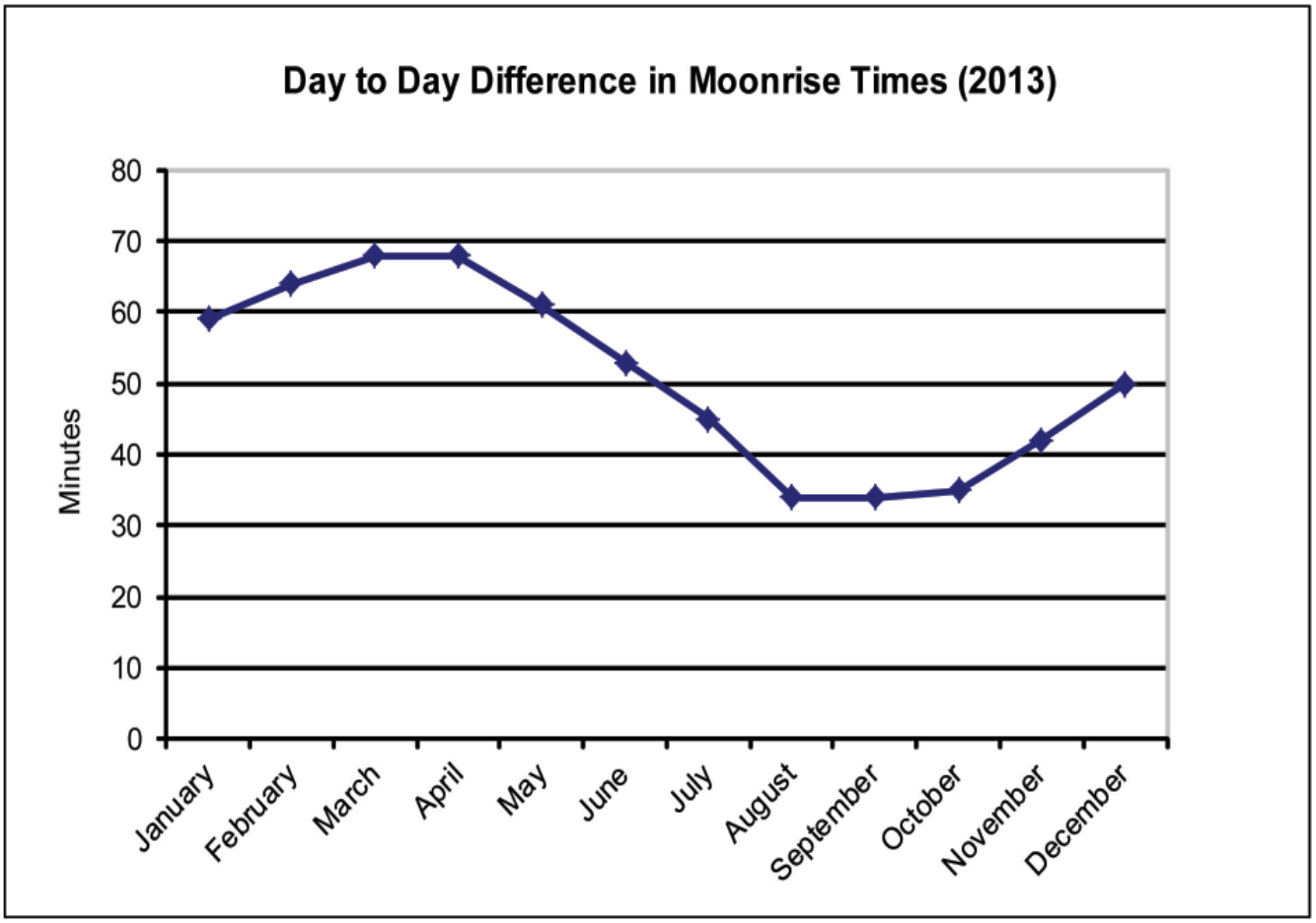
some light on the enduring mystery by measuring the amount of dust in the lunar atmosphere. What is causing the dust to be suspended will need to be explained if dust is found.

Harvest Moon

The full moon that occurs closest to the Autumnal Equinox is known as the Harvest Moon. This year the full moon occurs on September 19th. The Harvest Moon traditionally appears around the time when farmers in the northern hemisphere are working long days to bring in their crops. The full moon provides a bit more light, longer into the evening. However, what is really special at this time of the year is the appearance of the Moon in the days just before and after it reaches its full phase.

Throughout the year the Moon rises, on average, 50 minutes later each day. In September, on the days around the full moon, this difference is less than 35 minutes. On the following graph, the average difference in the time of moonrise on the three days preceding and following the full moon are plotted. The effect is that an almost fully illuminated moon is in the evening sky earlier each evening, benefiting farmers still out in the field (and children playing after school).

For example, the Moon rises at 6:52 P.M. on September 19th, the night of the full Moon. The next two nights the Moon rises about a half hour later. As such, on September 21st, (two days after the full moon) a bright moon is back in the sky a little over an hour after sunset.



Autumnal Equinox

The Sun crosses the celestial equator at 4:44 P.M EDT on the afternoon of September 22rd, marking the beginning of the fall season in the northern hemisphere.

Aurora and the Equinoxes

Geomagnetic storms that are responsible for auroras happen more often during the months around the equinox (March and September). Check your evening sky or log onto www.spaceweather.com for the latest on solar activity.

September Nights

Enjoy the jewels of the summer Milky Way while the nights are still warm and the skies are clear. From Cygnus to Sagittarius, follow the star clouds and dust lanes that comprise the inner arms of our spiral galaxy. In the south after sunset, the stars in the constellation Sagittarius form an asterism, or pattern, of a teapot. The spout of the teapot points the way to the center of the Milky Way galaxy with its resident black hole. Check out the July/August calendar for more details.

Sunrise and Sunset (from New Milford, CT)

Sun	Sunrise	Sunset
September 1st (EDT)	06:20	19:26
September 15th	06:34	19:03
September 30th	06:50	18:37

Present and Future Pole Stars

Vega, the fifth brightest star and located in the constellation Lyra, is placed high in the evening sky during September. Vega is also destined to become the Pole Star in 12,000 years. Precession, or the change in the direction of the rotational axis of the Earth over time, is best exemplified in a comparison of the position of Vega to that of Polaris (the current Pole Star).

Astronomical and Historical Events

1st History: flyby of Saturn by the Pioneer 11 spacecraft (1979)
2nd History: discovery of asteroid *3 Juno* by Karl Harding (1804)
3rd History: controlled impact of the SMART-1 spacecraft on the lunar surface at the conclusion of a successful mission; precursor of NASA's LCROSS mission (2006)
3rd History: Viking 2 spacecraft lands on the Martian surface (1976)
4th Distant flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
5th New Moon
5th History: launch of Voyager 1 to the planets Jupiter and Saturn (1977); at 11.6 billion miles from Earth, Voyager 1 has entered the "heliosheath," the outermost layer of the heliosphere where the solar wind is slowed by the pressure of interstellar gas
6th Scheduled launch of the Lunar Atmosphere and Dust Environment Explorer (LADEE) aboard a Minotaur V rocket from Wallops Flight Facility in Virginia
6th Connecticut Star Party, Ashford, CT, http://www.asnh.org (through the 8th)
8th History: sample return canister from the Genesis spacecraft crashes back to Earth when drogue parachute fails to deploy. Spacecraft was returning to Earth from Lagrange Point 1 with its collection of solar wind particles (2004)
8th History: launch of the Surveyor 5 spacecraft (lunar science mission); landed on Mare Tranquillitatis three days later (1967)
8th History: first Star Trek episode airs on television (1966)
8th History: discovery of Comet Ikeya-Seki by Kaoru Ikeya and Tsutomu Seki (1965)
8th History: Marshall Space Flight Center's dedication by President Eisenhower (1960)
9th History: launch of Conestoga I, first private rocket (1982)
9th History: launch of Soviet spacecraft Venera 11 (Venus lander) to the planet Venus (1978)
9th History: discovery of Jupiter's moon *Amalthea* by Edward Barnard (1892)
10th History: launch of the GRAIL spacecraft aboard a Delta 2 rocket from the Canaveral Air Force Station; lunar gravity mapping mission (2011)
10th History: debut flight of the Japanese H-2 Transfer Vehicle (or HTV) to the International Space Station (2009)

Astronomical and Historical Events for July (continued)

- 11th History: Mars Global Surveyor enters orbit around Mars (1997)
- 11th History: flyby of Comet Giacobini-Zinner by the International Cometary Explorer (ICE), first spacecraft to visit a comet (1985)
- 12th First Quarter Moon
- 12th Scheduled flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
- 12th History: launch of Soviet Luna 16; first robotic probe to land on the Moon and return a sample (101 grams of lunar soil) to Earth (1970)
- 12th History: launch of Gemini XI with astronauts Charles Conrad and Richard Gordon (1966)
- 12th History: launch of the Soviet spacecraft Luna 2, first to impact the Moon's surface (1959)
- 13th History: launch of the Japanese Moon orbiter "Kaguya" (Selene 1) (2007)
- 14th Second Saturday Stars – Open House at the McCarthy Observatory
- 14th Scheduled demonstration flight of Orbital Sciences' Cygnus spacecraft to the International Space Station aboard an Antares rocket from the Wallops Flight Facility in Virginia
- 14th History: launch of Soviet spacecraft Venera 12 (Venus lander) to the planet Venus (1978)
- 14th History: discovery of Jupiter's moon *Leda* by Charles Kowal (1974)
- 14th History: launch of the Soviet Zond 5 spacecraft; first spacecraft to circle the Moon and return to Earth, splashing down in the Indian Ocean seven days later; payload included two turtles that survived the trip (1968)
- 14th History: John Dobson born, architect of the Dobsonian alt-azimuth mounted Newtonian telescope (1915)
- 17th History: Konstantin Tsiolkovsky born in Izhevskoye, Russia; one of the fathers of rocketry and cosmonautics, along with Goddard and Oberth (1857)
- 17th History: discovery of Saturn's moon *Mimas* by William Herschel (1789)
- 15th Moon at perigee (closest distance to Earth)
- 18th History: launch of Vanguard 3, designed to measure solar X-rays, the Earth's magnetic field, and micrometeoroids (1959)
- 19th Full Moon (Full Harvest Moon)
- 19th History: NASA unveiled plans to return humans to the moon (2005)
- 19th History: first launch of the Wernher von Braun-designed Jupiter C rocket from Cape Canaveral (1956)
- 19th History: discovery of Saturn's moon *Hyperion* by William and George Bond, and William Lassell (1848)
- 21st History: second flyby of Mercury by the Mariner 10 spacecraft (1974)
- 21st History: Gustav Holst born, composer of the symphony "The Planets" (1874)
- 21st History: Galileo spacecraft impacts Jupiter after completing its mission (2003)
- 22nd Autumnal Equinox at 20:44 UT (4:44 pm EDT)
- 22nd History: Deep Space 1 spacecraft passes within 1,400 miles (2,200 km) of the 5 mile long potato-shaped nucleus of Comet Borrelly (2001)
- 23rd History: Johann Galle discovers the planet Neptune (1846)
- 24th History: John Young born (1930), first person to fly in space six times, including Gemini 3 (1965), Gemini 10 (1966), Apollo 10 (1969), Apollo 16 (1972), STS-1, the first flight of the Space Shuttle (1981), and STS-9 (1983)
- 25th Scheduled launch of the next crew to the International Space Station aboard a Soyuz spacecraft from the Baikonur Cosmodrome in Kazakhstan
- 26th Last Quarter Moon
- 26th History: Cosmonauts V. Titov and Strekalov escape moments before Soyuz T-10-1 explodes on the pad (1983)
- 27th Moon at apogee (furthest distance from the Earth)
- 27th History: Mission Commander Zhai Zhigang becomes the first Chinese astronaut to complete a spacewalk, retrieving samples mounted on the outside of his Shenzhou 7 spacecraft (2008)

Astronomical and Historical Events for July (continued)

27th History: launch (2007) of the Dawn spacecraft to *Vesta* (2011) and *Ceres* (2015)
27th History: launch of SMART-1, the first European lunar probe (2003)
28th History: launch of Soviet lunar orbiter Luna 19; studied lunar gravitational fields and mascons (mass concentrations), radiation environment, and the solar wind (1971)
28th History: launch of Alouette, Canada's first satellite (1962)
28th History: discovery of Jupiter's moon *Ananke* by Seth Nicholson (1951)
29th History: launch of Salyut 6, first of a second generation of Soviet orbital space station designs (1977),
30th History: all instruments deployed on the Moon by the Apollo missions are shut off (1977)
30th History: discovery of Jupiter's moon *Themisto* by Charles Kowal (1975)

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 calendars: Allan Ostergren

Second Saturday Stars poster: Sean Ross, Ross Designs

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Second Saturday Stars

FREE EVENT

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

September 14th
8:00 - 10:00 pm

Wanderers
The Inner Planets

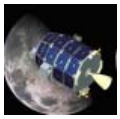
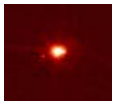
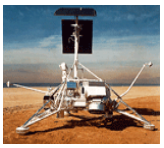
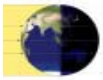
Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

Map

art & design • sean ross • rossdesign@charter.net

September 2013

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1  Flyby of Saturn by Pioneer spacecraft (1979)	**2**  Discovery of asteroid 3 Juno by Karl Harding (1804)	**3**  Viking 2 lands on Mars (1976)  SMART-1 spacecraft controlled impact on Moon (2006)	**4**  Oscar E. Monnig born, American amateur astronomer, contributed to the study of Meteoritics - a science that deals with meteorites and other extraterrestrial materials (1902)	**5**  Launch of Voyager 1 to Jupiter and Saturn (1977)	**6**   Scheduled launch of the Lunar Atmosphere and Dust Environment Explorer (LADEE) from Wallops Flight Facility in Virginia	**7**  James Alfred van Allen born, an American space scientist whose proposal to use geiger counters on Explorer missions to detect charged particles gave his name to the van Allen Belt (1914)
Comet Ikeya-Seki (1965) **8**  Marshall Space Center born (1960)  launch of the Surveyor 5 spacecraft to Mars (1967)   first Star Trek episode airs on television (1966)	**9** Launch of Conestoga 1, first private rocket 1982   Discovery of Jupiter's moon Analthea by Edward Barnard (1892)	**10** GRAIL spacecraft launch to study Moon's gravity (2011)   James Edward Keeler, American astronomer, discovered gap in Saturn's rings; later gave name to Keeler Gap, discovered by Voyager (1857)	**11**  Mars Global Surveyor enters orbit around Mars (1997) Flyby of Comet Giacobini-Zinner by the ICE spacecraft, first to visit a comet (1985) 	**12**  Launch of Luna 2, 1st to impact Moon's surface (1959) and Luna 16, 1st robotic probe to return a sample to Earth (1970) Launch of Gemini XI with astronauts Charles Conrad and Richard Gordon (1966) 	**13**  Eris and its satellite dysnomia Trans-Neptunian dwarf planet, 2003 UB313, is officially named "Eris", after Greek goddess of strife and conflict; estimated to be 27% more massive than pluto (2006)	**14**  John Dobson born, father of dobsonian telescope (1915) Discovery of Jupiter's moon Leda by Charles Kowal (1974)  Scheduled demonstration flight of Orbital Sciences' Cygnus spacecraft to the ISS.  2nd Saturday Stars Open House McCarthy Observatory
15  Jean-Sylvain Bailly, French astronomer, mathematician, and political revolutionary leader; predicted return of Halley's Comet and researched the satellites of Jupiter; died on guillotine (born 1736)	**16**  Robert Jay GaBany born, American amateur astronomer and astrophotographer, developed use of smaller telescopes and CCD cameras to produce long-exposure high resolution images of distant galaxies (1954)	**17**  Discovery of Saturn's Moon Mimas by William Herschel - 1789 Konstantin Tsiolkovsky born in Izhevskoye, Russia; one of the fathers of rocketry and cosmonautics, along with Goddard and Oberth (1857) 	**18**  Launch of Vanguard 3, designed to measure solar x-rays, the Earth's magnetic field and micrometeoroids (1959)	**19** Full Harvest Moon at Perigee (closest distance to Earth)   Launch of von Braun-designed Jupiter-C rocket from Cape Canaveral (1956)   Discovery of Saturn's Moon Hyperion by William and George Bond and William Lassell (1848)	**20**  Surveyor 2 lunar lander launched, loses mission control, tumbles and crashes onto surface of Moon two days later (1966)	**21**  Jupiter impact ends successful Galileo mission (2003) Gustav Holst born, composer of The Planets (1874) 
22  Autumnal Equinox at 20:44` am UT (4:44 pm EDT)  Flyby of comet Borrelly by Deep Space 1 (2001)	**23**  Johann Gottfried Galle discovers planet Neptune (1846)	**24** John Young born - first to fly six times in space (1930) Soviet spacecraft Luna 16 returns 101 grams of lunar soil to Earth (1970) 	**25** Launch of NASA Mars Observer spacecraft, also known as the Mars Geoscience/Climatology Orbiter, a robotic space probe; communication with the spacecraft was lost on August 21, 1993, 3 days prior to orbital insertion. (1992)	**26** Cosmonauts V. Titov and Strelkov escape moments before Soyuz T-10-1 explodes on the pad (1983)	**27** Moon at Apogee (furthest distance from Earth) Launch of Dawn spacecraft to Vesta and Ceres (2007) Launch of SMART-1, first European lunar probe - 2003	**28** Discovery of Jupiter's moon Ananke by Seth Nicholson (1951) Launch of Alouette, Canada's first satellite (1962)
29 SpaceshipOne X1 achieves altitude of 102.9 kilometers, first of two flights to win X Prize competition (2004) Launch of Salyut 6, first of a second generation of Soviet orbital space station designs (1977) 	**30** Discovery of Jupiter's moon Themisto by Charles T. Kowal (1975)					

Phases of the Moon