Galactic Observer

John J. McCarthy Observatory

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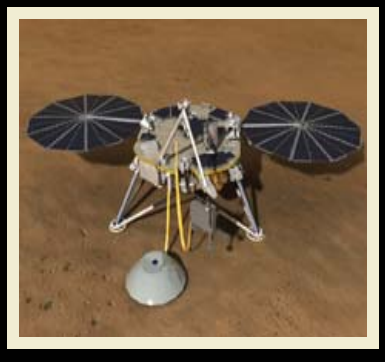
Cutting to the Core

As Curiosity Rover makes its first baby steps for mankind, NASA is already planning for future missions to Mars. The *InSight* lander ("Interior Exploration using Seismic Investigations, Geodesy and Heat Transport" will employ a German-made internal hammer - or "tractor mole" - to probe the Martian crust and descend up to 16 feet (five meters) below the surface. The mission will attempt to find out why Earth and its half-sister have evolved so differently. For more information, go to http://discovery.nasa.gov/index.cfml

Image credit: NASA/JPL-Caltech



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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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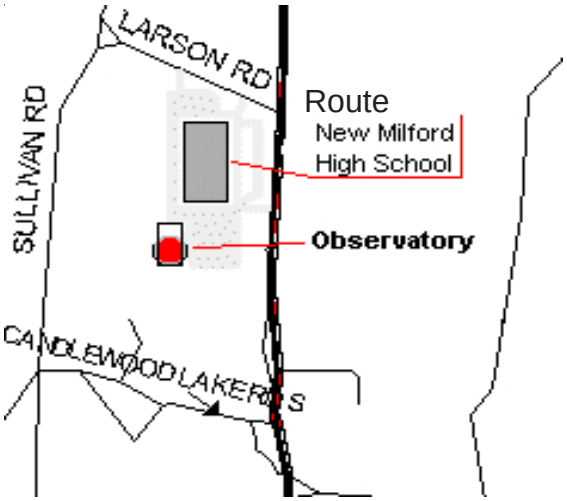


In This Issue

September Calendar and Space Exploration Almanac

Silenced Footfalls

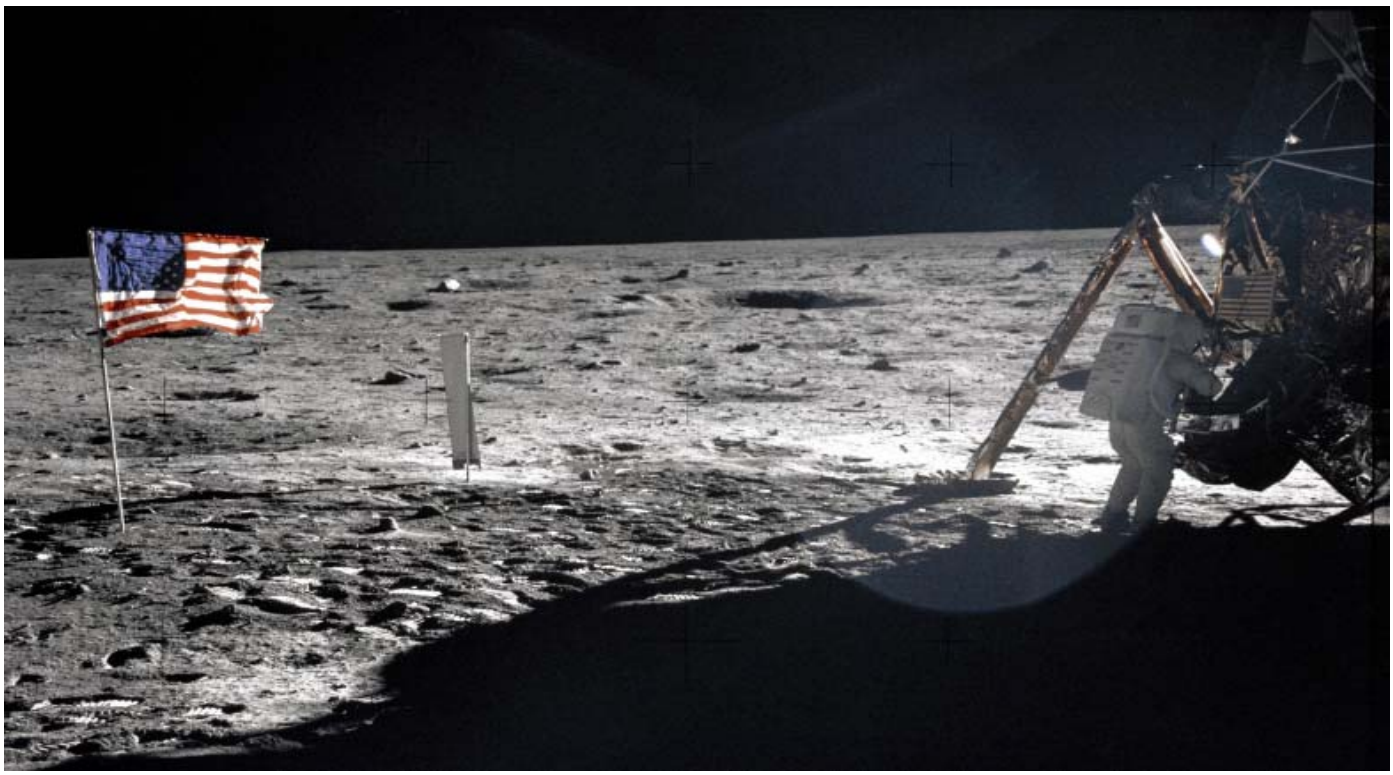
Neil A. Armstrong, the first man to walk on the Moon, passed away at the age of 82 on August 25th. Born in Wapakoneta, Ohio on August 5, 1930, Armstrong served as a naval aviator from 1949 to 1952, flying 78 combat missions from USS Essex in a Grumman F9F-2 Panther during the Korean War. He joined the National Advisory Committee for Aeronautics, predecessor of NASA, in 1955. Until he was transferred to astronaut status in 1962, he flew dozens of high-performance test and experimental aircraft at NASA's Flight Research Center at Edwards Air Force Base in California.

As an astronaut, Armstrong flew the Gemini 8 mission with David Scott. The Gemini spacecraft rendezvoused with an Agena target vehicle, successfully executing the first docking of two vehicles in space. The mission was almost lost (along with the astronauts) when a faulty thruster caused the Gemini capsule to spin (up to one revolution per second). Armstrong was able to disable the thruster by switching to a backup system reserved for re-entry (saving the spacecraft but effectively aborting the mission). Three years later, Armstrong was at the controls of Apollo 11's lunar lander ("Eagle") as it set down upon the Sea of Tranquility.

Upon leaving NASA, Armstrong taught at the University of Cincinnati for eight years as a Professor of Aerospace Engineering. Leaving academia, he served as the chairman of Computing Technologies for Aviation, Inc., in Charlottesville, Virginia until 1992.

Armstrong made a rare public appearance in May of 2010 when he testified before the U.S. Senate Committee of Commerce, Science and Transportation on the absence of vision, consensus and funding of the administration's misguided space plan. "I believe that, so far, our national investment in space exploration, and our sharing of the knowledge gained with the rest of the world, has been made wisely and has served us very well. America is respected for the contributions it has made in learning to sail upon this new ocean. If the leadership we have acquired through our investment is allowed simply to fade away, other nations will surely step in where we have faltered. I do not believe that this would be in our best interests."

Armstrong was the emblematic engineer: "I am, and ever will be, a white socks, pocket-protector nerdy engineer – born under the law of thermodynamics, steeped in the steam tables, in love with free-flow dynamics, transformed by Laplace, and propelled by compressible flow."



Armstrong on the lunar surface , in panorama of landing site taken by Buzz Aldrin (Source: NASA)

End of the Year of the Solar System

NASA announced on Oct. 7, 2010 that the following year would be "The Year of the Solar System." The "Year," however, was a Martian year and, as such, 23 months in length. Ending in August, some of the highlights of the "Year" of exploration were:

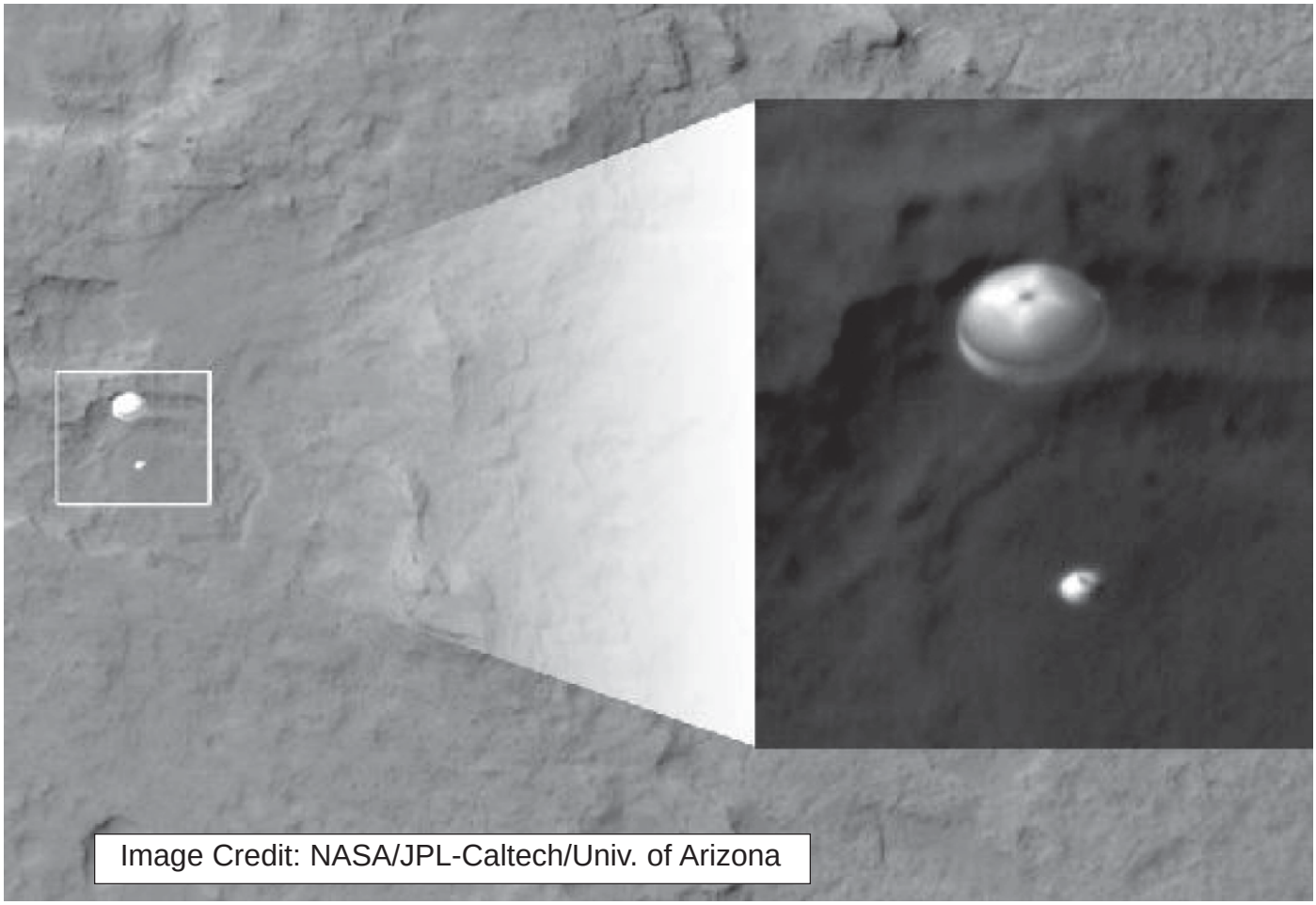
Date	Mission		Status
4 Nov 2010	Deep Impact encounters Comet Hartley 2		Successful rendezvous, see *http://www.nasa.gov/mission_pages/epoxi/index.html*
19 Nov 2010	Launch of O/OREOS, a shoebox-sized satellite designed to test the durability of life in space		Ground stations receiving data
19 Nov 2010	Launch of experimental solar sail (NanoSail-D)		Mission completed (successfully)
7 Dec 2010	Japan's Akatsuki (Venus Climate Orbiter) spacecraft		Spacecraft fails to enter orbit around Venus - now in orbit around the Sun
14 Feb 2011	Stardust NExT encounters Comet Tempel 1		Successful rendezvous; see *http://stardustnext.jpl.nasa.gov/*
17 Mar 2011	MESSENGER enters orbit around Mercury		First spacecraft to achieve orbit around Mercury; see *http://messenger.jhuapl.edu/*
18 Mar 2011	New Horizons spacecraft crosses the orbit of Uranus		see *http://pluto.jhuapl.edu/*
16 Jul 2011	Dawn spacecraft arrives at the asteroid Vesta		Orbit achieved; see *http://dawn.jpl.nasa.gov/*
5 Aug 2011	Launch of the Juno spacecraft to Jupiter		Successful launch/deployment; see *http://missionjuno.swri.edu/*
10 Sept 2011	Launch of twin GRAIL spacecraft to map Moon's gravitational field		Successful launch/deployment; see *http://solarsystem.nasa.gov/grail/*
8 Nov 2011	Launch of the Russian Phobos-Grunt sample-return mission		Successful launch/failure to leave low-Earth orbit/re-entered Earth's atmosphere on January 15th
26 Nov 2011	Launch of Mars Science Laboratory (MSL)		Successful launch/deployment; see *http://marsprogram.jpl.nasa.gov/msl/*
06 Aug 2012	MSL lands on Mars		Successful landing; see *http://www.jpl.nasa.gov*

Year of the Solar System Scorecard

IT WAS A VERY BUSY "YEAR" for planetary exploration. The missions identified in the chart are generally those with notable milestones (e.g., launches or encounters). Absent are the remarkable discoveries from ongoing missions by spacecraft such as Cassini at Saturn, the reconnaissance orbiters at Mars and the Moon, the plethora of spacecraft involved in solar observation, exoplanet detection, solar system surveys, and the study of high-energy objects in deep space, in addition to the fleet of scientific spacecraft studying the Earth.

There was only one irreversible failure included in the chart: the Phobos-Grunt mission. The Russian spacecraft was successfully launched on, what would have been, a three-year mission to the Martian moon Phobos. Mission objectives included landing on Phobos, collection of soil samples that would be returned to Earth, and a deployment of a Chinese micro-satellite. The spacecraft failed to leave Earth orbit and, after several attempts to establish contact with the spacecraft were unsuccessful, the spacecraft crashed into the Pacific Ocean off the coast of Chile on February 15th. After wild speculation that tried to point blame on outside operatives such as the United States, mission failure was eventually attributed to the lack of sufficient ground testing of the flight control system and related engineering and management incompetence.

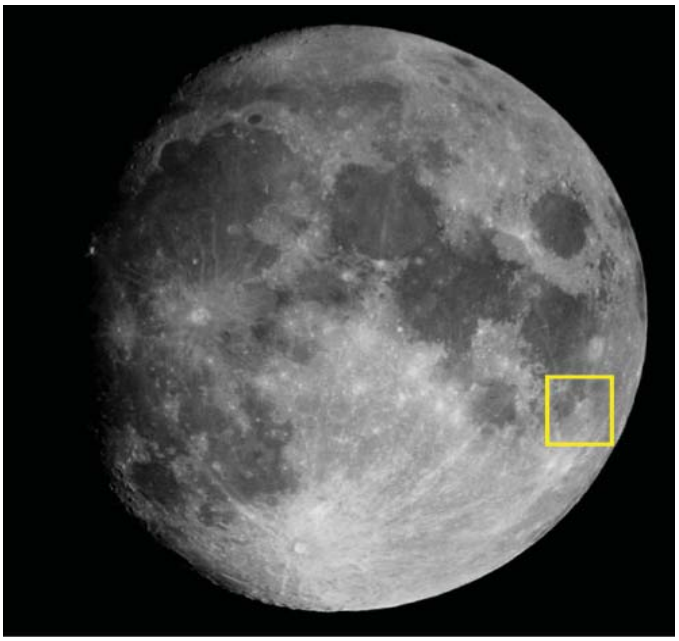
The other mission failure identified in the chart is Japan's Venus Climate Orbiter (Akatsuki) spacecraft. The spacecraft was to enter a highly elliptical orbit around Venus where it could observe global meteorological phenomena, as well as take close up photos of the cloud-shrouded planet. The detection of thunder in the atmosphere and active volcanism on the surface were among the objectives. Unfortunately, the spacecraft failed to enter orbit around Venus and is now in orbit around the Sun. The Japanese have been working on modifying the spacecraft's orbit so that it would intercept Venus in 2015 or 2016 for another attempt.



A successful landing by NASA's Curiosity rover was one of the highlights as the Year came to an end. Its parachute (shown above) was imaged by the Mars Reconnaissance Orbiter as the rover, tucked up into the backshell, descended towards Gale crater on August 6th (EDT).

"Out the Window on Your Left"

It's been 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).

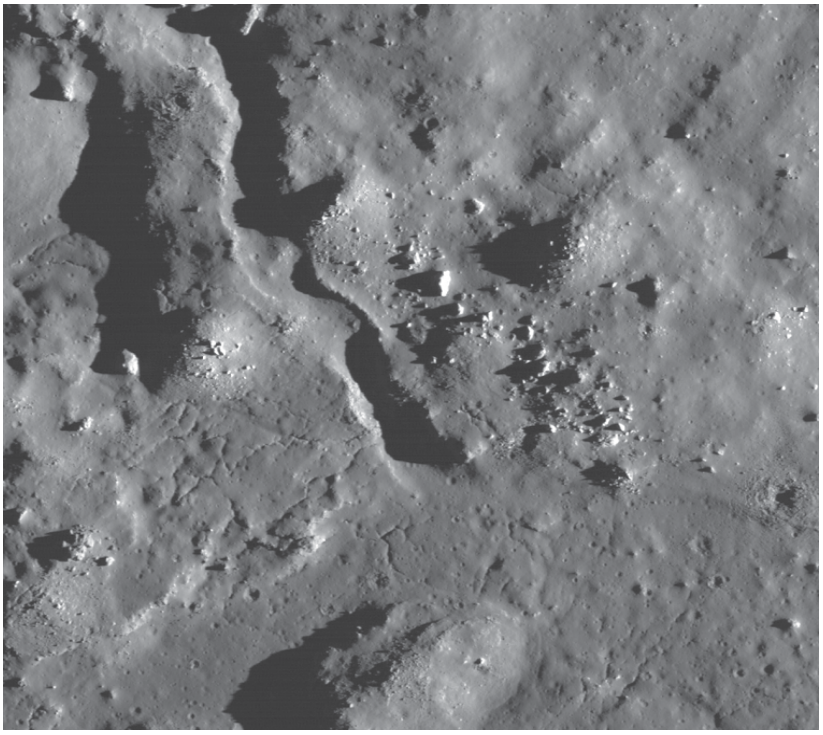
The view this month is of the crater Petavius, located not far from the southeastern reaches of Mare Fecunditatis (Sea of Fertility). The ancient basin predates and has been heavily modified by later impacts that created the Nectaris, Tranquillitatis, and Crisium basins. As a result, much of the original structure of the basin has been destroyed; giving the mare lava an irregular shape.

Petavius is one of several large craters along the eastern limb and bordering Mare Fecunditatis; Langrenus and Vendelinus to the north and Furnerius to the south. The observational challenge to Earth-bound viewers is that craters such as Petavius are best viewed when the Moon is young (waxing crescent) and the craters lie along the terminator. Unfortunately, these conditions occur when the Moon is low in the western sky.

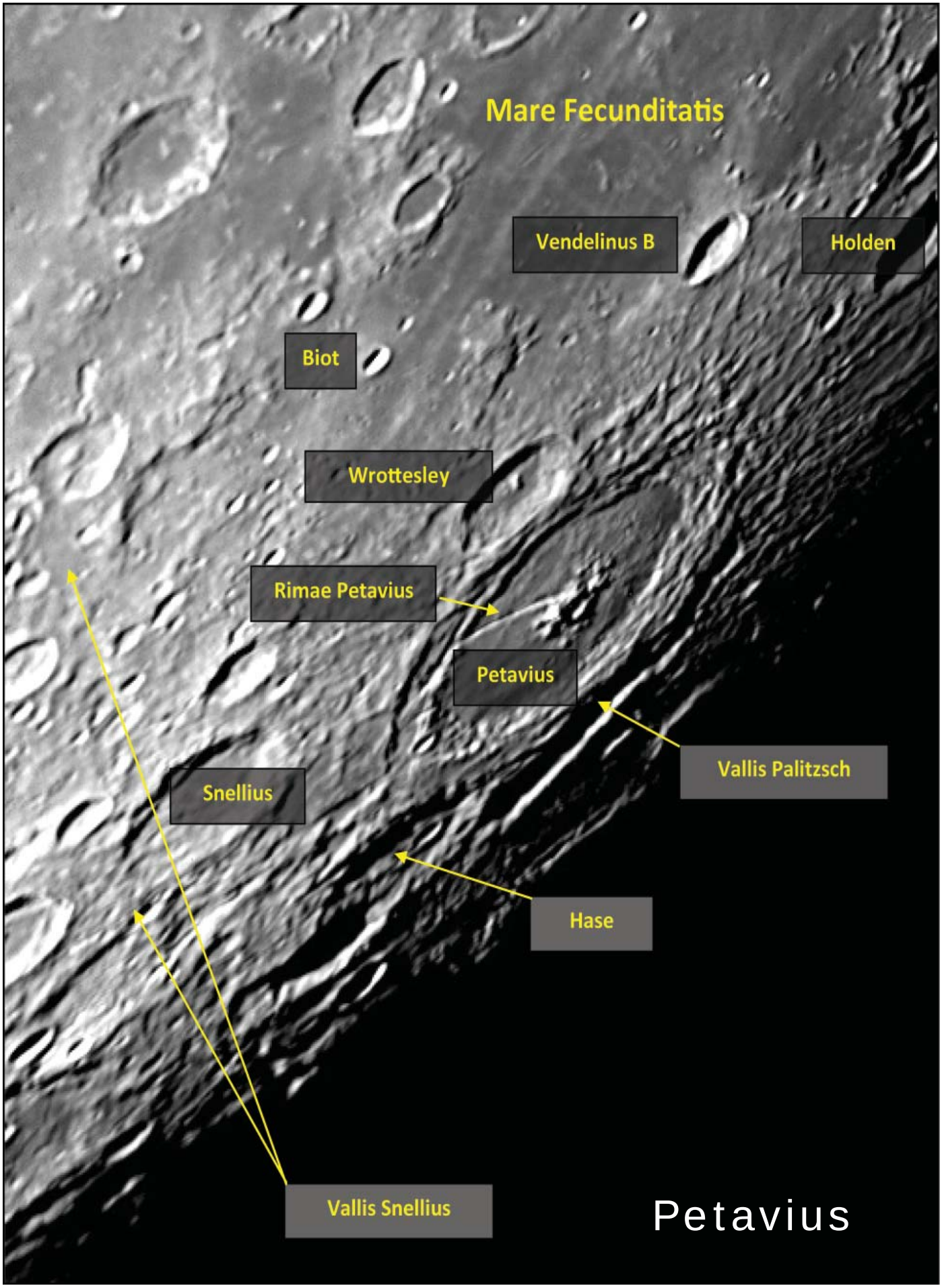
Petavius crater, named after a 17th century French astronomer, is an older crater that was created by an impact during the Lower Imbrian geologic period (a brief period 3.75 to 3.85 billion years ago between the Imbrium basin impact and the Orientale basin impact). It is approximately 117 miles (188 km) in diameter with a depth of 2 miles (3.3 km). Petavius has been volcanically modified, most likely by an upwelling of magma that has raised and fractured its floor. Its most notable feature is a large, v-shaped rille or cleft (Rimae Petavius) that traverses the floor from the central mountain peaks to the southwest rim.

While Rimae Petavius dominates the central floor of the crater, the central peaks are noteworthy in themselves as they rise nearly 6,000 feet above the plain. Other features of interest include a rille that hugs the western wall before traversing the southern rim and heading towards the crater Hase, and several dark patches on the crater floor that suggest either encroaching mare lava or lava extrusions from fractures in the floor.

East and adjacent to Petavius is Vallis Palitzsch, an 82 mile (132 km) long depression that appears to be formed by a series of eroded craters. Another, longer depression, Vallis Snellius passes just south of the crafter Snellius, before taking a slight jog and heading northwest.



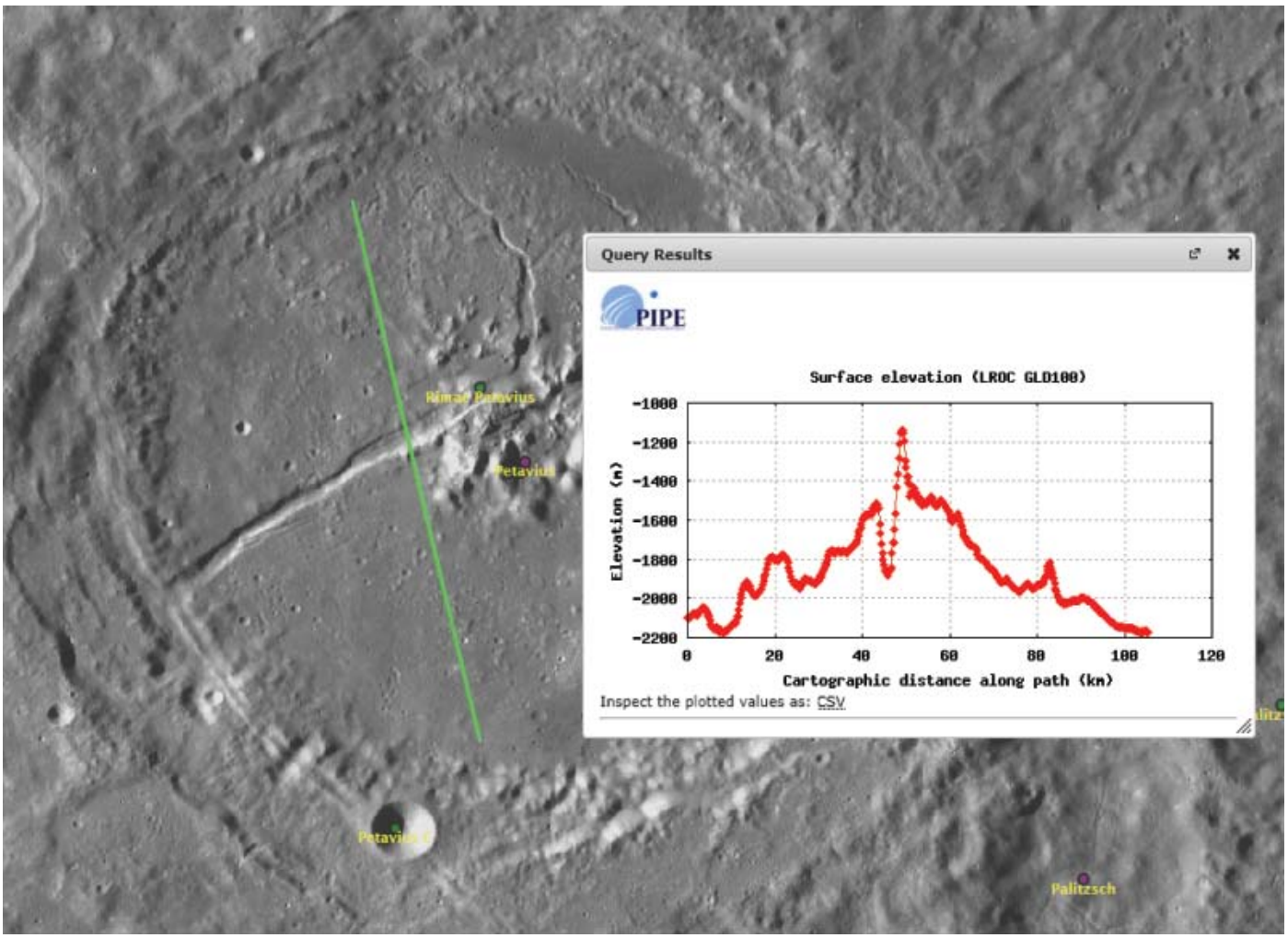
Impact melt channel 2.5 km from the rim of Petavius B crater, taken by the Lunar Reconnaissance Orbiter (LROC). Source: NASA/GSFC/Arizona State University.


Mare Fecunditatis
Vendelinus B
Holden
Biot
Wrottesley
Rimae Petavius
Petavius
Vallis Palitzsch
Snellius
Hase
Vallis Snellius
Petavius

A Tool for Lunar Observers

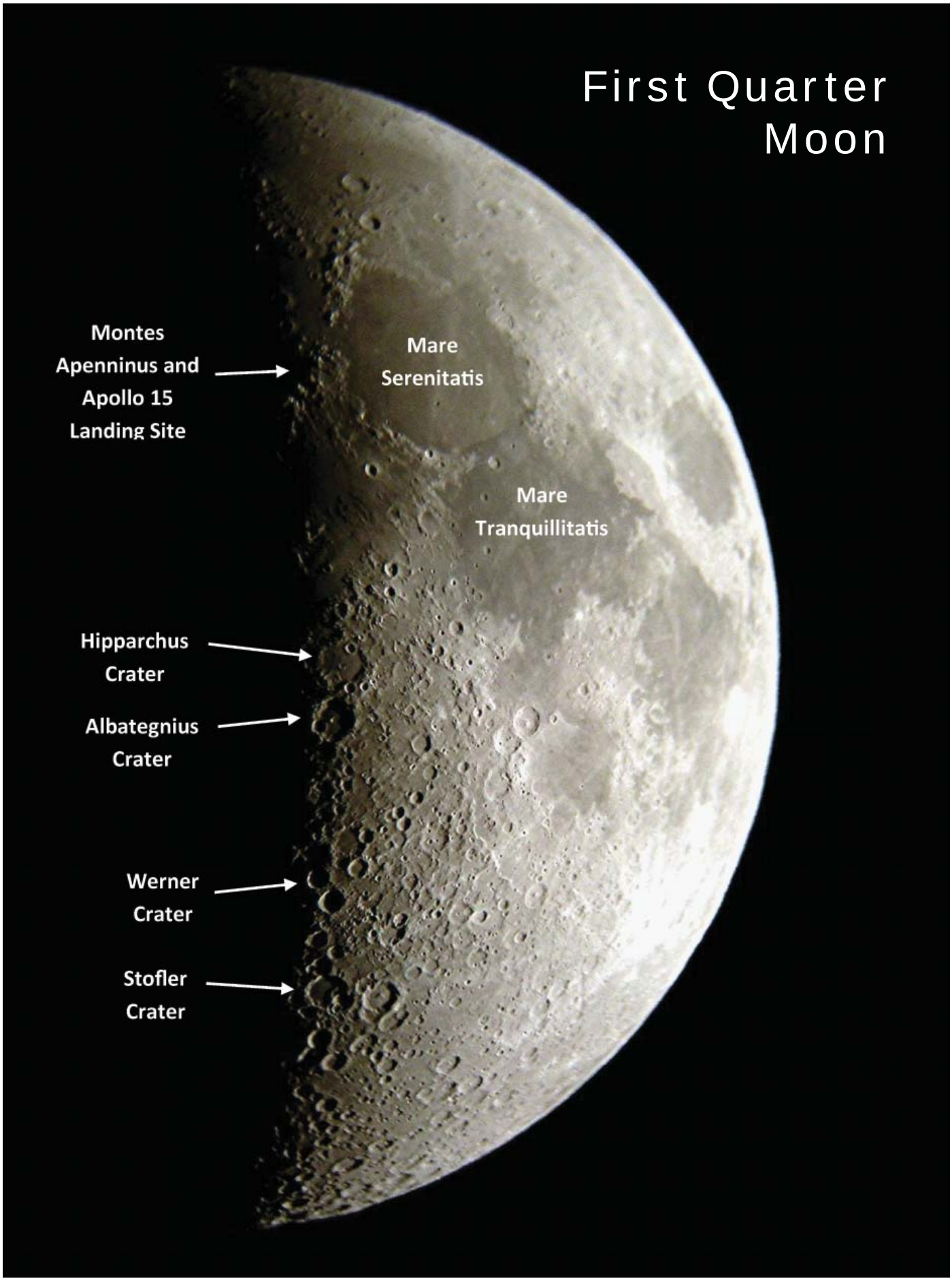
In the three years since launch, the Lunar Reconnaissance Orbiter has provided a wealth of information on the Moon's topography. The high resolution imagery has been used to create the zoomable Moon map: ACT-REACT QuickMap (http://target.lroc.asu.edu/da/qmap.html). The map and associated databases provide overlays that allow the user to identify major features and a tool to create elevation profiles.

The elevation profile tool (Path) can be used to explore the lunar surface and interesting features in your images. Above is the LRO image of Petavius crater in Quick Map. Using the Path tool, you can select a start and end point, from which a cross section of the surface elevation will be generated. Selecting a path that cuts through Rimae Petavius shows the raised floor of the crater and the v-shaped cleft with its higher southern rim.



International Observe the Moon Night

September 22nd is the third annual International Observe the Moon Night (InOMN). The event was first inspired by public outreach events held in August 2009 by the Lunar Reconnaissance Orbiter (LRO) and Lunar CRater Observation and Sensing Satellite (LCROSS) educational teams at the Goddard Space Flight Center in Greenbelt, Maryland and at the Ames Research Center in Moffett Field, California, respectively. In 2010 the Lunar and Planetary Institute and Marshall Space Flight Center joined Goddard and Ames in a world-wide event to raise public awareness of lunar science and exploration. Additional information on scheduled events can be found on *http://observethemoonnight.org/*.


First Quarter Moon
Montes Apenninus and Apollo 15 Landing Site
Mare Serenitatis
Mare Tranquillitatis
Hipparchus Crater
Albategnius Crater
Werner Crater
Stofler Crater

Tango Delta Nominal

THE FIRST ANNOUNCEMENT from Curiosity's Entry, Descent and Landing team that the rover was on the ground came at 1:31:45 a.m. EDT. The call "Tango Delta [touch down] nominal" came as the descent stage/sky crane placed the rover on the surface. However, it was only the first of three indicators that the landing was a success. Eight seconds later, the team announced that the rover's Inertial Measurement Unit reported that the rover was stable ("RIMU Stable"), i.e., the sky crane had successfully disengaged and the ground underneath the rover was firm. After another eight seconds, the team received confirmation of a successful landing when the team received a strong signal from the rover's UHF antenna ("UHF strong"). Only after the third successive positive indicator was "Touchdown confirmed." The site where Curiosity landed is now called Bradbury Landing after the late author Ray Bradbury (his hundreds of short stories and dozens of novels included the classic "The Martian Chronicles").

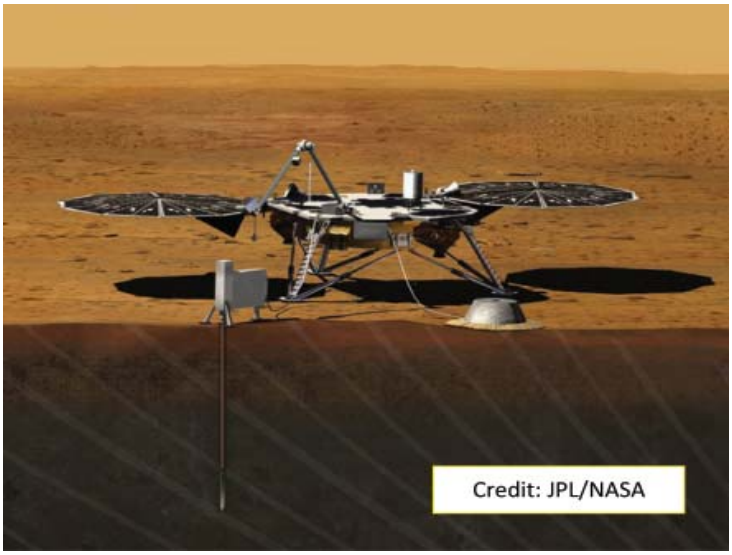
The rover's weather station reports hourly on the air temperature, ground temperature, air pressure, wind and other variables. In the first two weeks on the Martian surface, the day/night air temperature has ranged from a high of 28° F to a low of -103° F (-2° C to -75° C).

Daily weather conditions at the landing site will soon be available at http://cab.inta-csic.es/rems/marsweather.html.

Weather and Traffic Report from Bradbury Landing: Sunny and 28 degrees, no traffic problems reported in Gale crater

New Mars Mission Announced

On August 20, 2012, NASA announced its next mission to Mars. Scheduled for launch in 2016, the mission named InSight will build on the success of the Phoenix lander mission. The low-cost Discovery-class mission will explore the interior of the planet through a suite of surface instruments and a subsurface heat probe. During the two year mission, InSight's science team will model the planet's interior, hoping to learn whether Mars still has a liquid core and whether tectonic plates played a role in the evolution of the Red Planet.



On the (Heliosheath) Bubble

On August 13, 2012, the Voyager 2 spacecraft became the longest operating spacecraft, surpassing Pioneer 6. Launched in August of 1977, Voyager 2 has been heading out of the solar system since its encounter with Neptune in August of 1989. At approximately 9 billion miles (15 billion kilometers) away from the Sun, the spacecraft has reported a recent increase in high energy particles streaming in from outside the solar system and the decrease in lower energy particles from our Sun. These changes are consistent with expectations at the boundary of interstellar space. Confirmation that the spacecraft has left the solar system and reached interstellar space is expected to come with a change in the direction of the magnetic field in interstellar space. The spacecraft is expected to have enough electrical power to operate for another 8 to 13 years.

Explorer 1 team members triumphantly display a full-scale model of the satellite after its successful launch in January 1958. From left to right: William H. Pickering, director of the Jet Propulsion Laboratory, which designed and built Explorer, James A. Van Allen, University of Iowa physicist who directed the design and creation of Explorer's instruments, and Wernher von Braun, head of the U.S. Army Ballistic Missile Agency team that designed and built the Jupiter-C rocket.

Credit: JPL/NASA

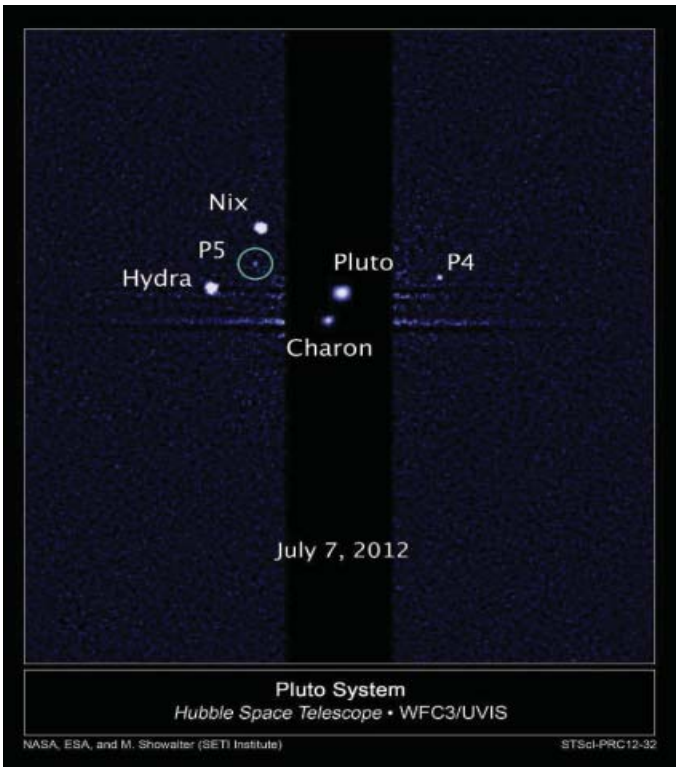
Return to the Van Allen Belts

The first major scientific discovery of the space age was made by the Explorer satellites launched in 1958. The satellites provided evidence of intense bands of radiation surrounding the Earth (named Van Allen belts after James A. Van Allen, the University of Iowa physicist who is credited with the design of Explorer's radiation detectors). Almost fifty-five years later, an Atlas V rocket will carry two spacecraft into highly elliptical orbits that will enable the spacecraft to pass through the entire radiation belt region [with a minimum altitude of 311 miles (500 km) and a maximum altitude of 19,417 miles (31,250 km)].

The Radiation Belt Storm Probes will provide information on the charged particles trapped within the belts as well as the properties of the belts themselves and how they change over time as the belts react to solar events such as coronal mass ejections, solar flares and geomagnetic storms. A better understanding of how the belts respond to changes in the Sun and impact space weather in near-Earth orbit and on the Earth will allow us to better protect spacecraft, satellites, aircraft passengers, ground-based assets such as transmission systems, and astronauts traveling through the belts or living and working in space.

Yet Another Moon for *Dwarf* Planet Pluto

In 2011, a team of astronomers using NASA's Hubble Space Telescope announced the discovery of a fourth moon orbiting the icy dwarf planet Pluto (designated P4, pending approval of a more formal name by the International Astronomical Union). P4 is estimated to be 8 to 21 miles in diameter (13 to 34 km) and orbits Pluto every 31 days. Its orbit is between that of Nix and Hydra (discovered by Hubble in 2005).



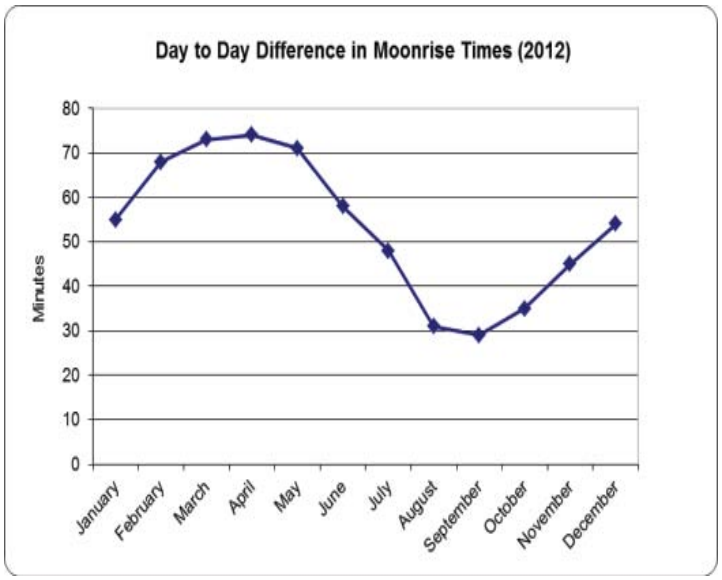
This summer (2012), astronomers announced the discovery of another, even smaller moon (designated P5). The moon is estimated to be irregular in shape and 6 to15 miles across (10 to 24 km). The increasingly crowded space around Pluto, and the possibility of even smaller debris, is a concern to the scientists operating the New Horizons spacecraft which will be traveling at 30,000 mph during its brief encounter in 2015.

Harvest Moon

The full moon that occurs closest to the Autumnal Equinox is known as the Harvest Moon. This year the full moon occurs late in the evening of September 29th. 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 30 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. In September, the difference is as little as 28 minutes (from one night to the next). 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 6:09 p.m. on September 29th, the night of the full Moon. The next two nights the Moon rises about a half hour later. As such, on October 2nd, (three days after full) a bright moon is back in the sky a little over an hour after sunset.



Morse Code

The track pattern on Curiosity's wheel includes a pattern of holes, both square and rectangular. The holes represent dots and dashes and spell out JPL in Morse Code (dot-dash-dash-dash for "J", dot-dash-dash-dot for "P", and dot-dash-dot-dot for "L"). Morse code was developed and used extensively to transmit messages by radio before it was possible to transmit voice.

Autumnal Equinox

The Sun crosses the celestial equator at 10:49 am EDT on the morning 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.

Sunrise and Sunset

Sun	Sunrise	Sunset
September 1st (EDT)	06:20	19:26
September 15th	06:34	19:02
September 30th	06:50	18:36

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.

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 Distant flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
2nd History: discovery of asteroid *3 Juno* by Karl Harding (1804)
3rd Asteroid *11 Parthenope* at Opposition (9.0 Magnitude)
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)
5th History: launch of Voyager 1 to the planets Jupiter and Saturn (1977); at more than 11 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
7th Moon at apogee (furthest distance from the Earth)
8th Second Saturday Stars – Open House at the McCarthy Observatory
8th Last Quarter Moon
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 Moon occults asteroid *1 Ceres*
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)
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 History: launch of Soviet Luna 16; first robotic probe to land on the Moon and return a sample 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 Connecticut Star Party, Ashford, CT, http://www.asnh.org (through the 16th)

Astronomical and Historical Events for September (continued)

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: John Dobson born, architect of the Dobsonian alt-azimuth mounted Newtonian telescope (1915)
15th New Moon
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)
18th 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 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: Soviet spacecraft Zond 5 returns after circumnavigating the Moon (1968)
21st History: Galileo spacecraft impacts Jupiter after completing its mission (2003)
22nd Autumnal Equinox at 10:49 am (EDT)
22nd First Quarter Moon
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 Asteroid *2 Pallas* at Opposition (8.3 Magnitude)
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)
24th History: Soviet spacecraft Luna 16 returns 101 grams of lunar soil to Earth (1970)
26th Scheduled flyby of Saturn's largest moon *Titan* by the Cassini spacecraft
26th History: Cosmonauts V. Titov and Strekalov escape moments before Soyuz T-10-1 explodes on the pad (1983)
27th Asteroid 3530 Hammel closest approach to Earth (0.913 AU); named in honor of Dr. Heidi Hammel, distinguished planetary scientist
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 Full Moon (Full Harvest Moon)
29th Uranus at Opposition (rising with the setting Sun and visible all night)
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.*

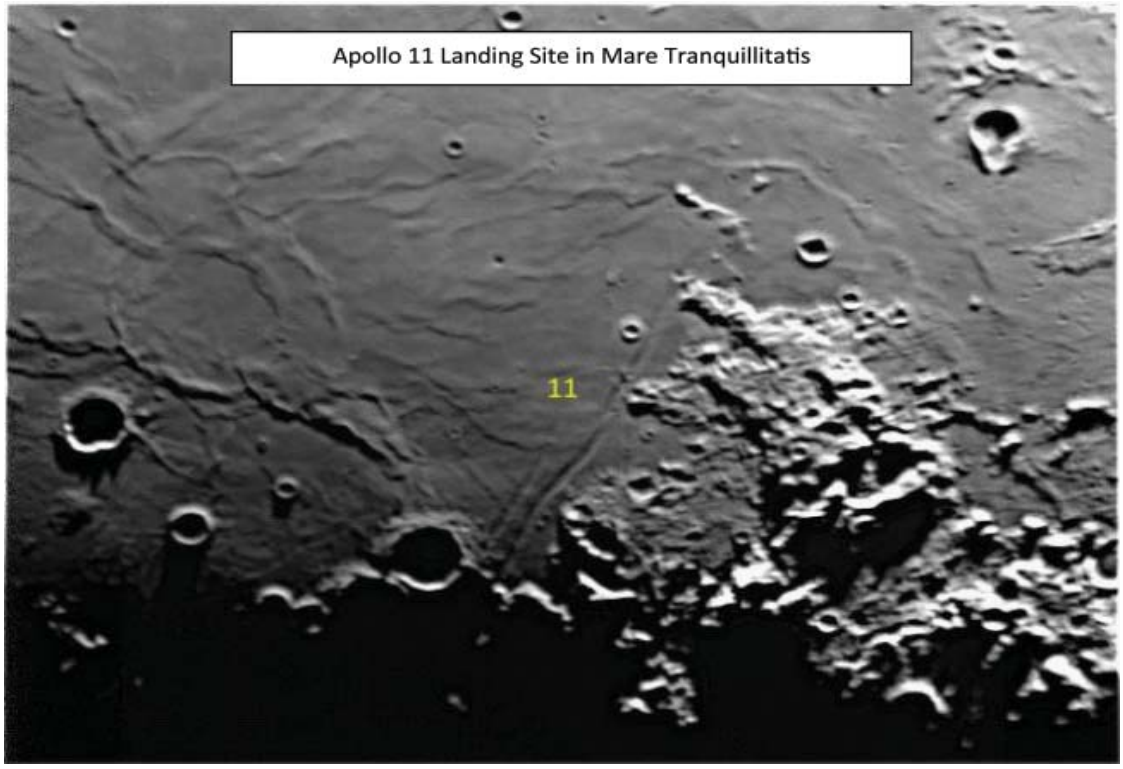
Image Credits

Front page design and graphic calendars: Allan Ostergren

Page 3 Photo: The 77th Convention of Amateur Telescope Makers on Breezy Hill in Springfield, Vermont took place on August 17th and 18th. The Stellafane Pink Club House can be seen in the background while in the foreground (white structure with the date 1930 on it) stands the world's only reflecting turret telescope. The telescope/structure was designed by Russell W. Porter who also worked on the design of the 200-inch telescope on Palomar mountain. At the time the photo was taken, the 16 inch turret telescope was tracking the Sun, projecting a large image on a screen on the inside of the turret.

Image by Bill Cloutier with a Nikon D-80

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

September 8th
8:00 - 10:00 pm

the Challenging SEARCH FOR LIFE Elsewhere

Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

Map

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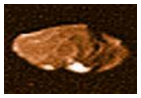
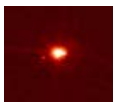
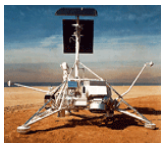
September 2012

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** American Astronomical Society founded (1899)	**7**  Moon at apogee (farthest from Earth)  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)	**8** Comet Ikeya-Seki (1965)   Marshall Space Center born (1960)  2nd Saturday Stars Open House McCarthy Observatory
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) 	**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	**18** Moon at Perigee (closest distance to Earth)   Launch of Vanguard 3, designed to measure solar x-rays, the Earth's magnetic field and micrometeoroids (1959)	**19**  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 10:49 am (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** Launch of Dawn spacecraft to Vesta and Ceres (2007) Launch of SMART-1, first European lunar probe - 2003 Asteroid 3530 Hammel closest approach to Earth (0.913 AU); named in honor of Dr. Heidi Hammel, distinguished planetary scientist	**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)
Discovery of Jupiter's moon Themisto by Charles T. Kowal (1975)						

Phases of the Moon

Sep 8 Sep 15 Sep 22 Sep 29