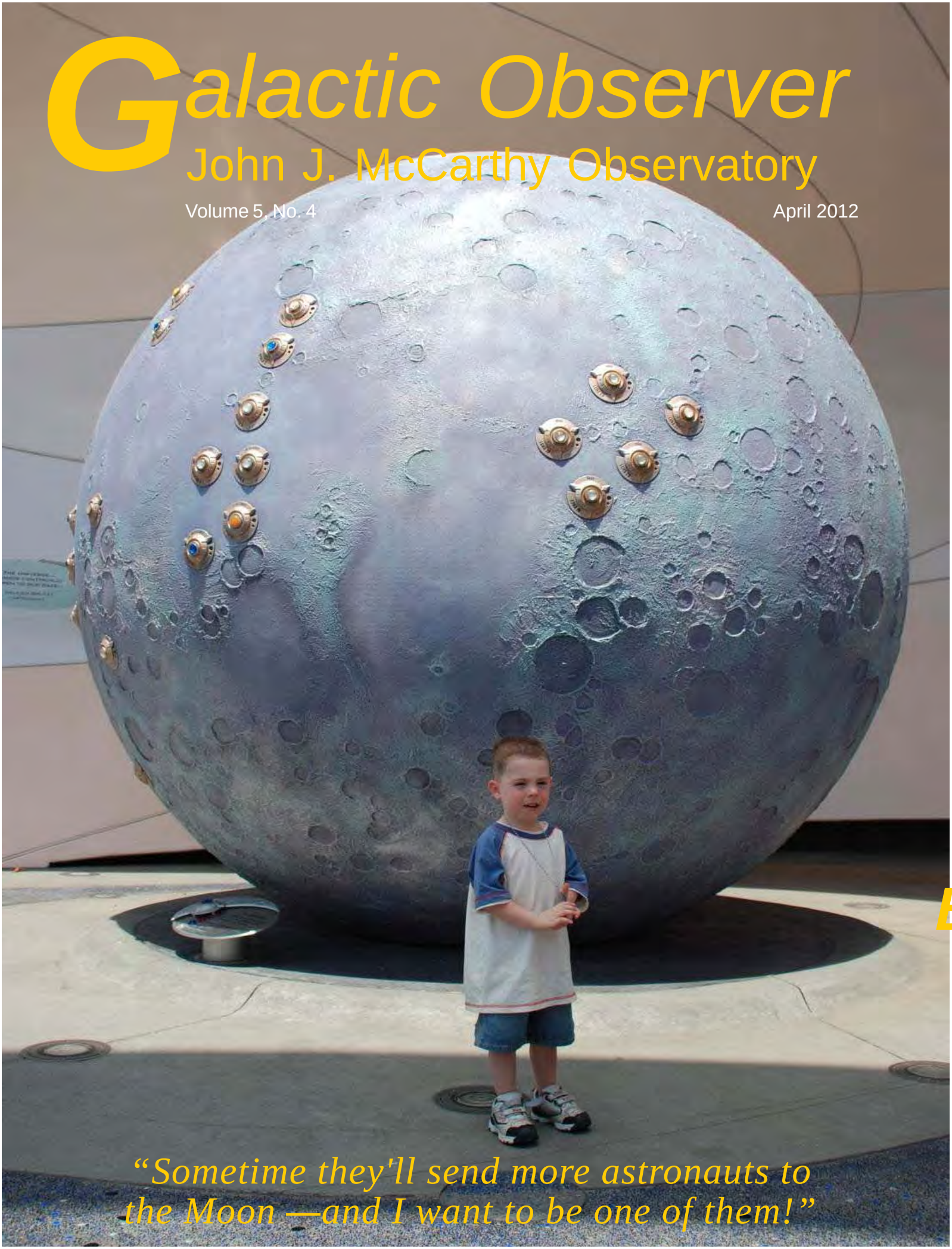
Galactic Observer

John J. McCarthy Observatory

Volume 5, No. 4 April 2012



"Sometime they'll send more astronauts to the Moon —and I want to be one of them!"

The John J. McCarthy Observatory

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

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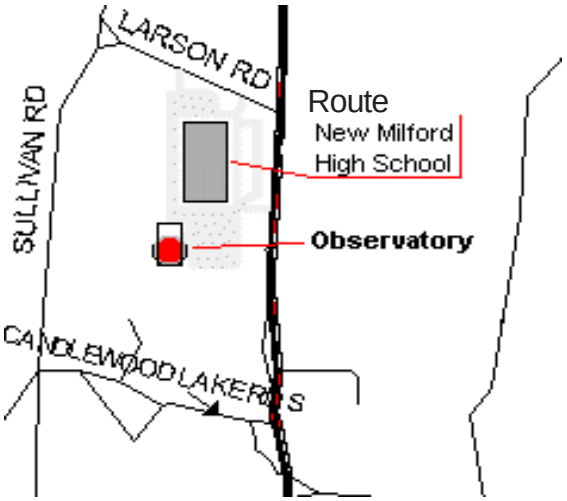
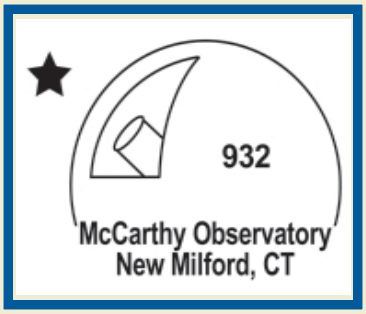


In This Issue



The Year of the Solar System

NASA announced on Oct. 7, 2010 that the upcoming year would be "The Year of the Solar System." The "Year," however, is a Martian year and, as such, 23 months in length. Some of the highlights of the "Year" of exploration are:

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 Sep 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 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/*
05 Aug 2012	MSL lands on Mars		

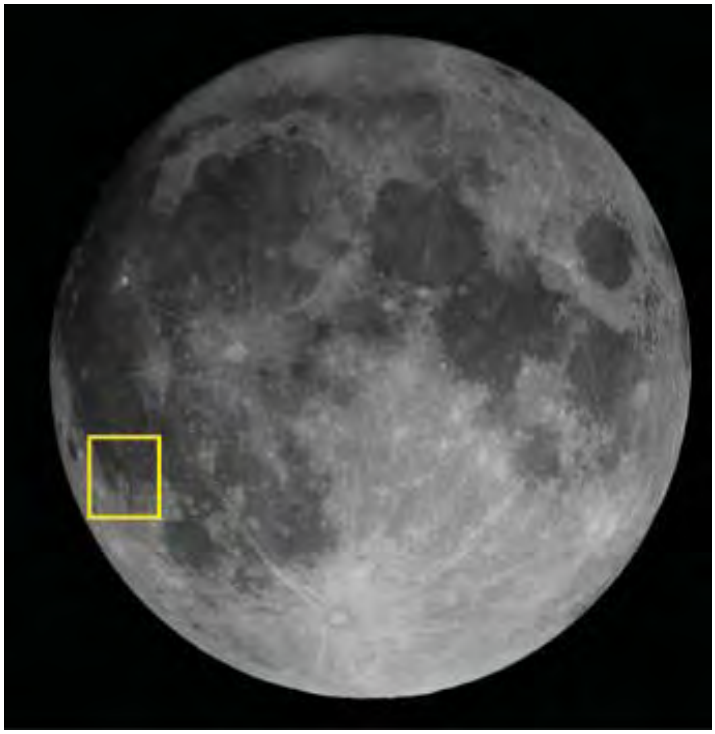
Other notable events:

- March 3, 2012 — Mars at Opposition
- April 15, 2012 — Saturn at Opposition
- May 20, 2012 — Annular Solar Eclipse (visible in southwest U.S.)
- June 5, 2012 — Venus Transit (visible before sunset on the east coast)
- July 2012 — Dawn spacecraft leaves Vesta for Ceres

"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).

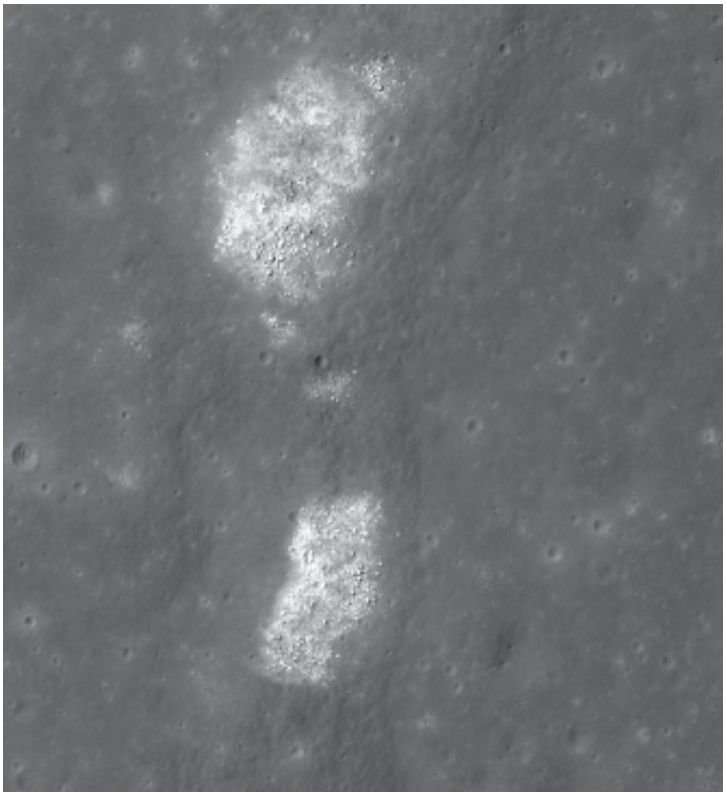
The view this month is of the southwestern region of Oceanus Procellarum (the Ocean of Storms). Among



the battered landscape are two similarly sized craters – Hansteen and Billy.

The crater Hansteen is named for Christopher Hansteen, a Norwegian geophysicist, astronomer and physicist known for mapping the Earth's magnetic field. The floor-fractured crater, thought to be caused by a ponding of magna underneath the floor, contains several ridges and grooves. The crater wall has an appearance of a polygon rather than a circular ring and is interrupted by a collapsed portion along the northern rim. Exterior to the southwestern rim is Rima Hansteen, a short rille, or channel, approximately 15 miles in length.

While similar in size, Billy has a much different appearance. Named for Jacques de Billy, a 17th century French Jesuit mathematician, the crater has a dark, lava-covered floor, depressed below the surrounding plain. The



Portion of wrinkle ridge extending from Mons Hansteen to the northeast. Illumination is from left, incidence angle is 26°, image width is 550 m [NASA/GSFC/Arizona State University]. Photo: Hiroyuki Sato

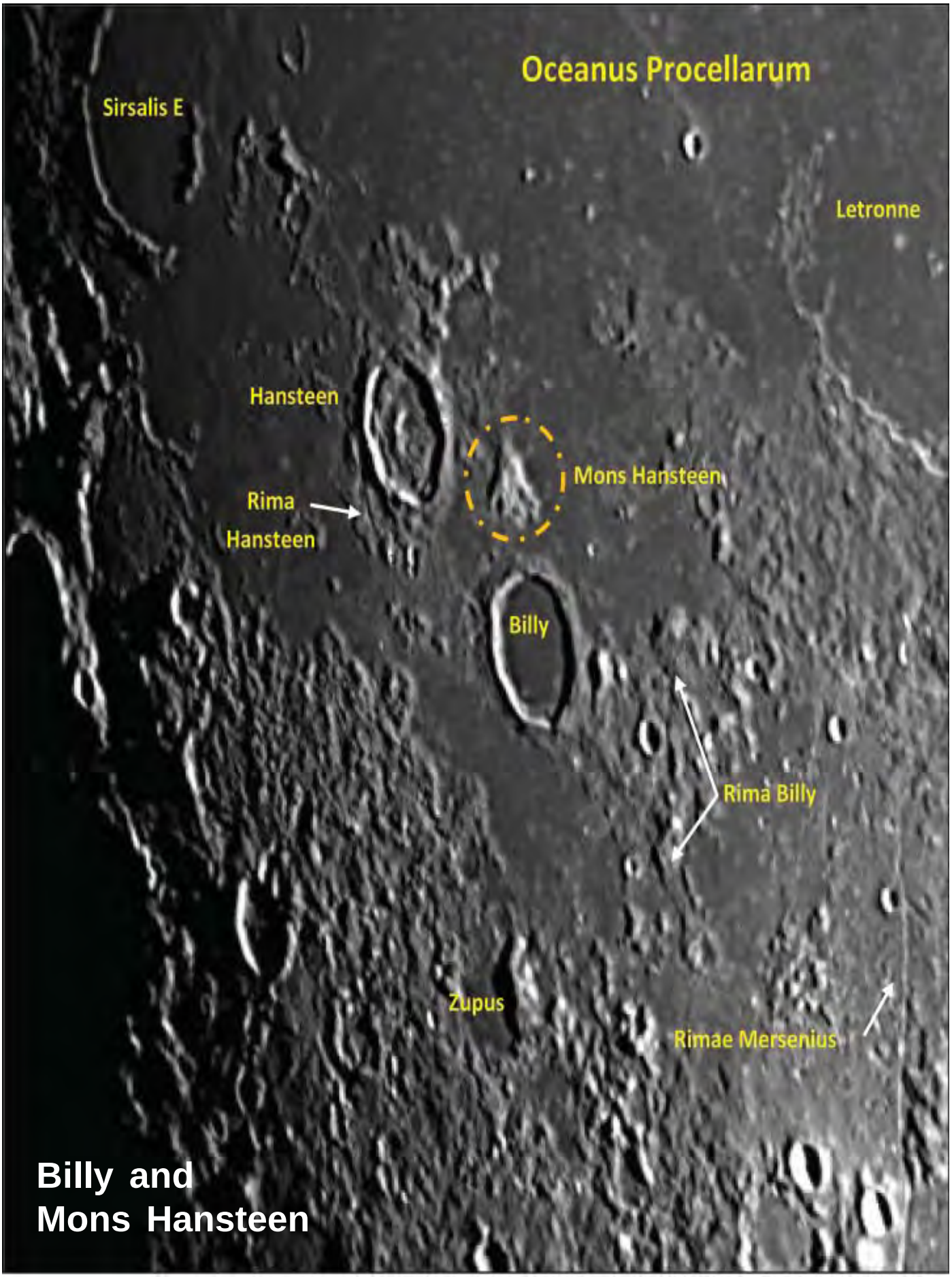
crater's rim appears to be interrupted along the southern portion by a narrow break. Images from the Lunar Reconnaissance Orbiter show few craterlets on the floor of Billy (*http://wms.lroc.asu.edu/lroc_browse/view/wac_nearside*); one with a bright halo indicating a relatively recent event.

The most intriguing feature in the area is located to the southeast of Hansteen and north of Billy - Mons Hansteen, or Hansteen Alpha. This bright, arrow-shaped mountain, 15 miles on a side, is younger than either of the adjacent craters (since the mountain rests on top the ejecta from the impacts that created Hansteen or Billy, rather than being covered with it).

Mons Hansteen appears to be a volcanic outcropping; however, the chemical nature of the lava mound, as determined by spectral analysis, is much different than the surrounding mare basalt. As such, Hansteen Alpha is unique in that it is considered a non-mare volcanic landform.

Hansteen Alpha is grouped along with non-mare domes Gruithuisen and Mairan as "red spots."

Red Spots most likely formed around the time of the Imbrium impact and are characterized by high albedo (measure of reflected sunlight) and strong ultraviolet absorption.



Billy and Mons Hansteen

Missed Opportunity

Less than six months after Neil Armstrong took the first step onto the lunar surface, NASA began the difficult task of canceling future flights to the Moon. While most of the hardware had been built, and the incremental costs of flying the last three missions was relatively small, political and public support for the Moon program was already waning before Armstrong and his crew returned to Earth.

Had we stayed the course, the final three flights (Apollo 18, 19 and 20) would have been the most ambitious undertakings of the Apollo program. Although mission plans continued to evolve with each new flight, the areas of Moon targeted for exploration in late 1969, particularly after Apollo 12 demonstrated the ability to make precision landings, included the craters Copernicus and Tycho, and the Marius Hills.

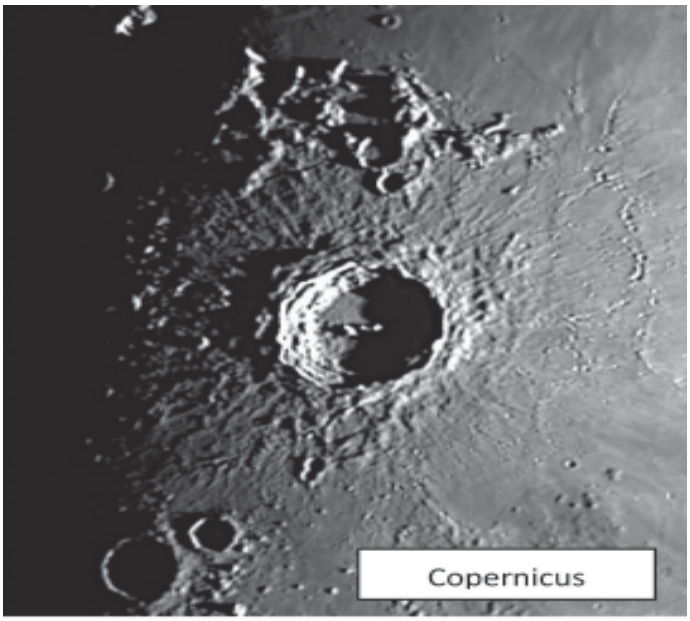
While crews were not officially assigned to the last three missions, the standard rotation of backup crews would have placed Richard Gordon (Gemini 11, Apollo 12) in command of the Apollo 18 mission with test pilot Vance Brand as the Command Module Pilot and geologist Harrison Schmitt as the Lunar Module Pilot. The mission was originally scheduled for February of 1972.

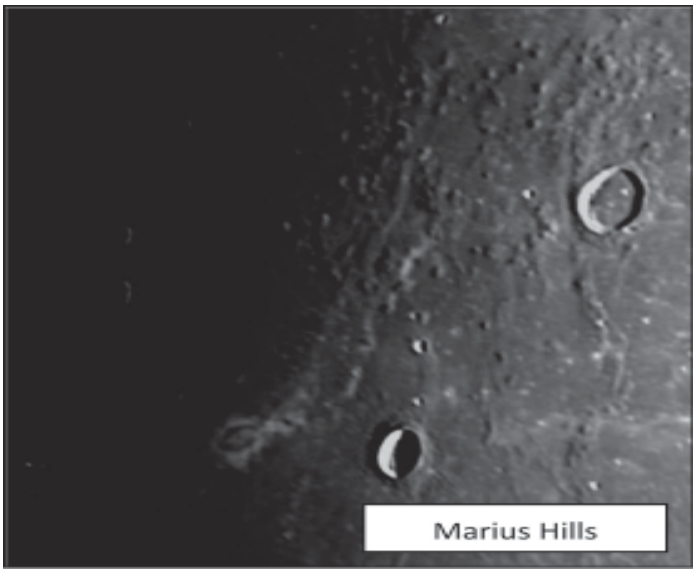
Schmitt, the only scientist (geologist) to walk on the Moon, would later be reassigned to Apollo 17 after the cancellation of Apollo 18 in September 1970.

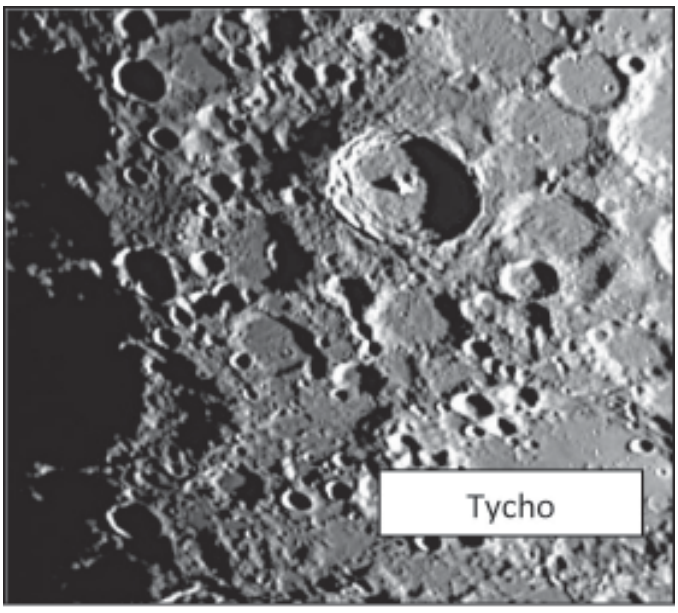
Fred Haise (Apollo 13) would have likely commanded Apollo 19 with test pilot William Pogue as the Command Module Pilot and Gerald Carr as the Lunar Module Pilot. Charles "Pete" Conrad (Apollo 12) would have been in line to command Apollo 20 with test pilot Paul Weitz as the Command Module Pilot and Jack Lousma as the Lunar Module Pilot.

Copernicus was listed as either a prime or alternative landing site at the meetings of the Apollo Site Selection Board or the Group for Lunar Exploration Planning in 1969, despite the rough terrain and operational challenges. Unfortunately, with the cancellation of three missions and the failure of Apollo 13 to complete its objectives, this magnificent crater (as well as the volcanic domes of the Marius Hills) did not make the final cut. Tycho, possibly the most science-rich target, was the most difficult to reach and was also dropped from consideration.

The view from inside Copernicus would have been breathtaking. Terraced walls reach more than two miles above the floor, low-lying hummocks of rebounded rock huddle around its center, and the deep shadows that hide from the Sun create visual voids in the moonscape.







New Lunar Resources

NASA's Goddard Space Flight Center has released a new tool to assist in planning your lunar observations and several new educational videos on the Moon. The planning tool (shown on the right) provides the user with the phase and libration of the Moon at hourly intervals for any date in 2012. The animation was developed from data gathered by the Lunar Reconnaissance Orbiter (LRO). While the same side of the Moon faces the Earth, we can actually see (over time) more than 50% of its surface. This is a result of the Moon's elliptical orbit, tilt of its axis and inclination of its orbit around the Earth, and our vantage point over the course of a night. The interaction produces an apparent rocking or oscillating motion in the Moon's appearance if charted over an extended period of time. The effect, called libration, allows Earth-dwellers to catch periodic glimpses of the lunar terrain past the limbs and over the poles. The application can be found at *http://svs.gsfc.nasa.gov/vis/a000000/a003800/a003894/* .

Goddard Multimedia has also assembled several animations based upon LRO data. The general tour of the Moon (*http://svs.gsfc. nasa.gov/vis/a010000/a010900/a010929/*) visits the immense impact basins, bright young craters, winding chasms carved by ancient lava flows, the dark and cold polar regions, as well as the battered far side of the Moon.

The Evolution of the Moon animation (*http://svs.gsfc.nasa.gov/vis/a010000/a010900/a010930/*) provides an overview of the events that shaped the Moon over the past 4.5 billion years.

Twenty-Two Years in Space

The Hubble Space Telescope is one of the four "Great Observatories" along with the Compton Gamma-Ray, Chandra X-Ray and Spitzer (infrared) telescopes. However, it is the only space telescope that can be serviced by astronauts. Over the past twenty-two years, the five servicing missions have given the telescope a new lease on life, replacing and repairing many of the telescope's original components and extending its capabilities many times over. The Hubble Space Telescope in orbit today is a far superior instrument to the one originally launched.

The image (right) shows the telescope during its original deployment from the cargo bay of the space shuttle Discovery (STS-31) on April 29, 1990. This was followed by five servicing missions:

Servicing Mission 1 (December 1993)	Space shuttle Endeavour (STS-61) delivered/ installed corrective optics, replaced/ installed a new Wide-Field and Planetary Camera, solar arrays and gyroscopes
Servicing Mission 2 (February 1997)	Replaced original spectrograph with the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS), repaired insulation and upgraded instrumentation
Servicing Mission 3A (December 1999)	Replaced/installed all six gyroscopes, a fine guidance system, main computer and thermal insulation blankets
Servicing Mission 3B (March 2002)	Installed the Advanced Camera for Surveys, revived the dormant NICMOS and replaced the solar arrays
Servicing Mission 4 (May 2009)	Replaced batteries, gyroscopes, a fine guidance system, installed a new Wide-Field and Planetary Camera, Cosmic Origins Spectrograph and repaired failed electronics in two instruments

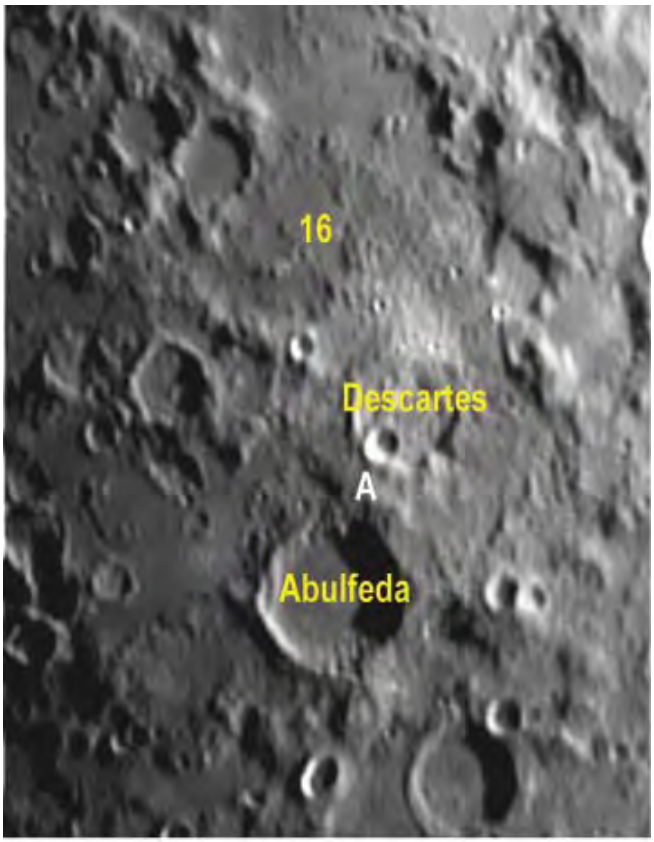
Hubble Trivia

The pilot of the space shuttle Discovery (STS-31) that deployed the Hubble Space Telescope was Charles F. Bolden. In 2009, Mr. Bolden was appointed NASA's twelfth Administrator

Our Mysterious Moon

The Earth's moon does not give up its secrets easily. After six manned missions, several sample return attempts and extensive surveys from orbiting satellites, there is still so much that we don't know about our mysterious neighbor. One of those mysteries involves the formation of the area around the crater *Descartes*. The early Apollo missions targeted the relatively smooth maria (lunar seas). The maria are remnants of spectacular impacts at the time when the Moon's crust was relatively thin and its interior molten. The impacts fractured the crust, allowing the molten magma to flood the impact sites. Although they cover less than 20 percent of the lunar surface, the maria offered more appealing (and safer) landing sites. However, for the Apollo 16 mission, geologists convinced NASA to visit the lunar highlands. Unlike on Earth, the lunar highlands did not form through some geologic process - for example, plate tectonics. The highlands represent the Moon's original crust, pushed upward by the tremendous energy from the impacts that created the maria. Scientists hoped that by analyzing samples of the original crust, answers might be found to many of the questions related to the Moon's origin and formation.

Descartes is a broken and battered crater. Its wall is breached to the north and topped by a small crater to the south. Spilling out of the crater is some rather unusual furrowed material, unlike any found elsewhere on the Moon. Scientists originally theorized that the material was from lunar volcanoes that had piled up around the vents rather than flowing away. To test their hypothesis, a landing site for Apollo 16 was selected just north of *Descartes* where a smooth plain met the furrowed or hilly material. The site was 7,400 feet higher than the Apollo 11 site just to the north. Unfortunately, the crew of Apollo 16 (John Young and Charles Duke) never got as far as *Descartes* in their travels, and all the samples brought back were of the lunar crust, not dark lavas which would be produced from volcanic activity. So, the mystery of the *Descartes* formation remains.



The best time to view the *Descartes* region is when it is near the terminator (the line that separates the sunlit portion of the Moon from the darkened portion). Sunrise occurs a day or two before First Quarter. Try looking for this area on the evening of April 9th. Sunset occurs a few days prior to Last Quarter, around the morning of April 23rd. The *Descartes* region can best be found by starting at the three large craters (*Theophilus*, *Cyrillus* and *Catharina*) located on the western shore of the *Sea of Nectar*. West of *Cyrillus* is the crater *Abulfeda*. Look for a string of craterlets trailing from its southern rim. *Descartes* is located just to the north of *Abulfeda*. The furrowed material breaches the north wall of the crater and *Descartes A* is the small crater on the southern rim.

The Apollo 16 landing site is near a bright spot on the edge of the smooth *Cayley Plains*, just to the north of *Descartes* and west of the *Sea of Nectar*. For scale, the craters *Abulfeda* and *Descartes A* are approximately 39 miles and 9 miles in diameter, respectively.

Swirls are bright features that resemble splashes on the dark lunar surface. They are typically associated with strong magnetic anomalies. *Reiner Gamma*, located near the western shore of the *Ocean of Storms*, is the most familiar swirl on the Moon. However, in a low pass over the *Descartes Mountains* in 1999, the Lunar Prospector spacecraft detected the strongest magnetic anomaly yet on the rim of the *Descartes* crater. The discovery raises even more questions on how these anomalies form (e.g., are they surface phenomena or do they extend deep into the lunar crust; did the rocks become magnetized by an impact or from a volcanic eruption; and why is the anomaly so localized). Hopefully, future missions to the Moon will provide some clues to the formation of these unusual features and whether these areas that divert the solar wind could someday be useful (e.g., as a refuge for colonists during a solar storm).

Life without the Moon

You might wonder why you should direct your gaze upon this desolate world when so many other celestial treasures await in the night sky. The Moon is more extraordinary than you might first think. No other planet (except for the dwarf planet Pluto) has a larger moon (compared to the size of the planet around which it revolves). Many believe that life on Earth would have been much different without the Moon.

The tidal forces of the Moon act as a brake to slow down the Earth's rotation. Without the Moon, the Earth would spin much faster. The faster rotation could lead to higher winds and stronger storms, similar to conditions on Jupiter. Gale force winds would have altered how life would eventually evolve. It might have created conditions under which some life forms could not have existed.

The Moon also stabilizes the Earth's axis of rotation. A stable axis is necessary for long-term climates to develop and ecologies to take hold. Most important, the Moon has shielded the Earth from swarms of cosmic debris. The battered lunar surface provides a visual record of the vast number of objects that could have impacted the Earth had the Moon not been present.

April History

Apollo 16 wasn't the only lunar mission launched in the month of April. Two years earlier, on April 11, 1970, Apollo 13 lifted off from Cape Canaveral in what was intended to be the third manned mission to the Moon. The crew of James Lovell, Fred Haise and Jack Swigert never got their chance.

Two days later and almost 200,000 miles from Earth, the No. 2 oxygen tank exploded, cracking the feed pipe to the No. 1 oxygen tank and crippling the fuel cells providing the electrical power to the Command Module. The next four days would become the greatest human drama in space history.

On April 11, 1970, Apollo 13 lifted off for the Moon with Commander Jim Lovell, Command Module Pilot Jack Swigert and Lunar Module Pilot Fred Haise aboard. Two days later, with the spacecraft well on its way to the Moon, an oxygen tank exploded, scrubbing the lunar landing and putting the crew in jeopardy. Source: NASA

With failing power and a cloud of debris surrounding the space craft, the three astronauts shut down the Command Module and moved into the Lunar Module (LM). The LM was designed to support two astronauts for a maximum of 45 hours. The LM needed to support the three astronauts for 75 to 100 hours for a safe return to Earth. To conserve supplies, almost all the spacecraft's systems were turned off. The temperature dropped to just above freezing, water condensed on all the internal surfaces and instruments and the level of carbon monoxide increased to life-threatening levels. Fluids and gases being expelled from the crippled Command Module acted like small rockets, continually pushing the spacecraft off course. The debris cloud prevented anything more than rudimentary navigation. The astronauts became dehydrated (fuel cells also provide water) and the conditions inside the spacecraft became increasingly unsanitary when the crew, through a misunderstanding, began to accumulate human waste inside the spacecraft (instead of discharging it).

Only through the ingenuity of the engineers back in mission control, the backup crew and hundreds of contractors involved in the assembly and operation of the spacecraft, was the crew returned safely to Earth. The crew and the spacecraft reentered the Earth's atmosphere not knowing whether the heat shield had been damaged in the explosion or whether the parachutes would still deploy after four days of extreme cold. While Houston lost contact with the spacecraft for a minute longer than expected, Apollo 13 splashed down right on target.

The cause of the accident was eventually traced to damage the oxygen tank had sustained during its removal from Apollo 10. Due to a defective drain, internal heaters were used to empty the tank. Unfortunately the pad power supply was not compatible with the spacecraft's power systems. The higher voltage melted the insulation leaving bare metal exposed to the pure oxygen environment. When Jack Swigert turned on the tank fan, the contents exploded. The story of Apollo 13 is detailed in astronaut Jim Lovell's book "Lost Moon," former Flight Director Gene Kranz's book "Failure is Not an Option," and recreated in the Ron Howard/Tom Hanks film "Apollo 13."

April Showers

The Lyrid meteor shower is expected to peak just before dawn on April 22nd. The dust producing the shooting stars is from *Comet Thatcher*. Expect to see 10 to 20 meteors per hour. As with all meteor showers, the Lyrids are named for the constellation (Lyra) from which they appear to radiate.

Easter and the Full Moon

Although the Christian celebration of Easter is always on a Sunday, the date can vary by more than a month. Unlike many religious observances which are associated with a particular calendar date, Christian churches use a method developed by Pope Gregory XIII to establish the annual date of Easter. As a general rule, Easter falls on the first Sunday that follows the first full moon that occurs on or after the vernal equinox. It is important to note that the church has its own method of determining when the moon is full and the church has also fixed the date of the vernal equinox as March 21st. Consequently, the church's date of Easter may be different than if determined using more precise astronomical data.

This year (2012), the vernal equinox occurred on the evening of March 20th (the earliest vernal equinox in over one hundred years). The next full moon occurs on April 6th. Easter, therefore, falls on the following Sunday (8th).

According to the Church's ecclesiastical rules for determining the date, Easter can occur no earlier than March 22nd or later than April 25th.

Sunrise and Sunset

Sun	Sunrise	Sunset
April 1st (EDT)	06:36 am	7:20 pm
April 15th	06:13 am	7:35 pm
April 30th	05:51 am	7:51 pm

April Nights

Saturn reaches opposition on April 15th, as the magnificent ringed world rises in the eastern sky as the Sun sets in the west. Saturn will reach maximum altitude, with the best viewing, around midnight. You can find Saturn (and its largest moon *Titan*) in the constellation Virgo. *Titan* (larger than the planet Mercury) can be identified by its orange hue.

The 2011 *Astronomy Picture of the Day* for March 15th combines images taken by the Cassini spacecraft to create flyby videos of Saturn, its rings and several moons as they would appear to the space traveler. The video can be found at *http://apod.nasa.gov/apod/ap110315. html*.

Comet History

In the photo (below) *Comet Hale-Bopp* graces the evening sky on April 2, 1997, one day after perihelion (closest approach to the Sun). The comet was brighter than the brightest stars in the sky, with a dust tail that stretched almost 45 degrees across the sky. The photo shows the brighter, yellow dust tail and the dimmer, blue ion (gas) tail.

The orbital period of *Hale-Bopp* as it entered the inner solar system was 4,206 years. A close encounter with Jupiter in April of 1996 modified its orbit, shortening its orbital period to 2,380 years as it returned to the outer solar system.

Astronomical and Historical Events

1st History: launch of the first weather satellite, Tiros 1 (1960)
2nd History: launch of Zond 1, Soviet Venus flyby mission (1964)
2nd History: selection of the Mercury 7 astronauts (1959)
3rd History: Soviet spacecraft Luna 10 becomes the first artificial satellite to orbit the Moon (1966)
4th History: launch of Apollo 6, last test flight of the Saturn V rocket (1968)
5th Asteroid *11 Parthenope* at Opposition (9.9 Magnitude)
5th History: launch of the Compton Gamma Ray Observatory (1991)
5th History: launch of the first Pegasus rocket (1990)
5th History: launch of Pioneer 11, Jupiter and Saturn flyby mission (1973)
6th Full Moon (Full Pink Moon)
6th History: launch of Intelsat 1, first commercial communications satellite (1965)
7th Moon at perigee (closest distance from Earth)
7th History: launch of Luna 14, Soviet Moon orbiter mission designed to test radio transmission stability, measure the lunar gravity field, solar wind and cosmic rays (1968)

Astronomical and Historical Events (continued)

8th Easter Sunday
8th Kuiper Belt Object and Dwarf Planet 136108 *Haumea* at Opposition (50.016 AU)
8th History: discovery of Saturn moon's *Telesto* by the Voyager 1 spacecraft (1980)
8th History: launch of the unmanned Gemini 1 (1964)
8th History: Project Ozma, the search for extraterrestrial intelligence, begins as Frank D. Drake, an astronomer at the National Radio Astronomy Observatory in Green Bank, West Virginia, turns the 85-foot Howard Tatel telescope toward the star Tau Ceti (1960)
10th History: Japanese lunar probe Hiten impacts Moon; first non-U.S. or Soviet lunar probe, also first to visit the Lagrangian Points L4 and L5 during its three year mission (1993)
11th History: ESA spacecraft Venus Express enters orbit around the planet Venus (2006)
11th History: launch of Apollo 13 with astronauts James Lovell, Fred Haise and Jack Swigert, mission aborted when oxygen tank explodes and cripples the Command Module (1970)
12th Asteroid 51 *Nemausa* at Opposition (9.9 Magnitude)
12th History: launch of the first space shuttle (Columbia) with astronauts John Young and Robert Crippen (1981)
12th History: launch of Vostok 1 with cosmonaut Yuri Gagarin, first person to orbit the Earth (1961)
12th History: Edward Maunder born; studied solar cycle and sunspots. Analyzed period between 1645 and 1715 when almost no sunspots where recorded - known as the "Maunder minimum" or "Little Ice Age" because of the severe winters (1851)
12th History: discovery of Asteroid 10 *Hygiea* by Annibale de Gasparis (1849)
13th Last Quarter Moon
13th History: launch of Transit 1B, first experimental navigation satellite (1960)
14th **Second Saturday Stars - Open House at McCarthy Observatory**
14th Flyby of Saturn's moon *Enceladus* by the Cassini spacecraft
14th Distant Flyby of Saturn's moons *Helene, Dione, Promentheus, Pandora, Titan* and *Tethys* by the Cassini spacecraft
14th History: Christiaan Huygens born, Dutch scientist and discoverer of Saturn's rings and largest moon *Titan* (1629)
15th Saturn at Opposition
16th Distant flyby of Saturn's moon *Hyperion* by the Cassini spacecraft
16th History: launch of Apollo 16 with astronauts John Young, Ken Mattingly and Charles Duke, the only mission to the lunar highlands (1972)
16th History: Leonardo Da Vinci born, first to correctly explain Earthshine (1452)
17th History: closest flyby of the Sun by a spacecraft, Helios 2 (1976)
17th History: launch of Surveyor 3, Moon lander, first to experience a lunar eclipse from the Moon's surface during which the temperature fell 250° F; Apollo 12 would later land near Surveyor 3 in 1969, retrieving pieces of the lander for return to Earth and analysis of the effects of the harsh lunar environment (1967)
18th Mercury at its greatest western elongation – apparent separation from the Sun in the early morning sky (27°)
19th History: launch of the last Soviet Salyut space station, Salyut 7 (1982)
19th History: launch of the Soviet spacecraft Salyut 1, first space station (1971)
20th Scheduled launch of a cargo-carrying Progress spacecraft from the Baikonur Cosmodrome in Kazakhstan to the International Space Station
21st New Moon
22nd Moon at apogee (furthest distance from Earth)
22nd Lyrids Meteor Shower peak
22nd History: launch of the Air Force's X-37B prototype space plane from Cape Canaveral, Florida; first orbital mission (2010)
24th History: launch of space shuttle Discovery (STS-31) and deployment of the Hubble Space Telescope (1990)
24th History: launch of Mao 1, first Chinese satellite (1970)
24th History: cosmonaut Vladimir Komarov dies during re-entry of a prototype Soviet lunar spacecraft (Soyuz 1) when parachute lines become entangled (1967)

Astronomical and Historical Events (continued)

26th History: flyby of Venus (gravitational assist) by the Cassini spacecraft (1998)
26th History: launch of Sputnik 14 (Cosmos 4), first successful Soviet reconnaissance satellite – designed to study upper layers of atmosphere and monitor U.S. nuclear tests (1962)
26th History: discovery of Asteroid 9 *Metis* by Andrew Graham (1848)
28th Northeast Astronomy Forum and Telescope Show (NEAF), Rockland Community College, Suffern, NY (28th and 29th)
28th History: launch of the Cloudsat/Calipso cloud imaging and profiling satellites (2006)
28th History: Isaac Newton publishes his Principia, describing universal gravitation and the three laws of motion (1686)
29th First Quarter Moon
30th Kuiper Belt Object 90568 (2004 GV9) at Opposition (38.273 AU)
30th Scheduled return of three members of the Expedition 30 crew from the International Space Station aboard a Soyuz spacecraft
30th Scheduled launch of an unmanned Dragon spacecraft from the Cape Canaveral Air Force Station to the International Space Station by Space Exploration Technologies (SpaceX)

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 and graphic calendars: Allan Ostergren

Page 1: Conor Cloutier poses in front of the model of the Moon located in the Planetary Plaza of Epcot's Mission: Space. The markers on the lunar sphere designate the 29 missions that the United States and the Soviet Union sent to the moon between 1959 and 1976. Photo by Bill Cloutier

All 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

April 14th

8:00 - 10:00 pm

TWO DAILY TIDES

How Come?

Refreshments
Family Entertainment
Activity Center
Stars & Planets
Rain or shine

S.Ross

Map

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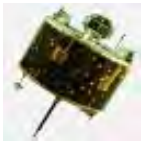
April 2012

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1  1960: First successful weather observation satellite, TIROS I (Television Infra-Red Observation Satellite), launched by NASA; operated for 78 days. (1960)	**2**  Launch of Zond 1, Soviet Venus flyby mission (1964)  Selection of the Mercury 7 astronauts (1959)	**3**  Soviet spacecraft Luna 10 first artificial satellite to orbit moon (1966)	**4**  Launch of Apollo 6, last test flight of the Saturn V rocket 1968	**5**  Launch of Pioneer 11, Jupiter and Saturn flyby mission 1973  Launch of the Compton Gamma Ray Observatory 1991	**6**  Full pink Moon  Launch of Intelsat 1, first commercial communica-tions satellite (1965)	**7**  Moon at perigee (closest to earth)  Launch of Luna 14, Soviet Moon orbiter mission (1968)
Launch of unmanned Gemini I 1964 **8**   Project OZMA, search for extraterrestrial life (1960) Discovery of Saturn's moon Telesto by Voyager 1 (1980)   Happy Easter!	**9**  NASA introduces Project Mercury astronauts: Scott Carpenter, L. Gordon Cooper Jr., John H. Glenn Jr., Virgil "Gus" Grissom, Walter Schirra Jr., Alan Shepard Jr., and Donald Slayton (1959)	**10**  Japanese lunar probe Hiten impacts Moon's surface (1993)	**11** ESA spacecraft Venus Express enters orbit around Venus (2006)   Apollo 13 launch on ill-fated moon mission (1970)	**12** Shuttle, Columbia, with John Young and Robert Crippen 1981   Yuri Gagarin first man in space on Vostok I 1961 Edward Maunder born. studied solar cycle and sunspots. 1851 	**13**  Launch of Transit 1B, first experimental navigation satellite (1960)  The 17th Annual Great Moonbuggy Race, Huntsville, Alabama, at the U.S. Space & Rocket Center	**14**  Christiaan Huygens, discoverer of Saturn's rings and moon Titan born (1629)  2nd Saturday Stars Open House McCarthy Observatory
15  Leonhardt Euler, Swiss mathematician, precisely calculated the orbits of comets and other celestial bodies and contributed to the wave theory of light (1707)	**16**  Apollo 16 launch to lunar highlands (1972) Leonardo da Vinci born (1452) 	**17**  Closest flyby of the Sun by a spacecraft, Helios 2 (1976) Launch of Surveyor 3 Moon lander (1967) 	**18**  Mercury at its greatest western elongation (at 22^0, visible just before sunset)	**19**  Launch of Salyut 1 (1971) and Salyut 7 (1982), first and last Soviet space stations	**20**  Harold Graham performs the first free flight of a rocket pack, designed by Wendell Moore of Bell Aerosystems. The 13-second flight reached an altitude of 1.2 meters, flying 35 meters at about 10 km/h. (1961)	**21**  Apollo 16 on the Moon (Young, Mattingly and Duke) - fifth manned mission and first to land in the lunar highlands (1972)
22 Moon at apogee (farthest from earth)   Lyrids meteor shower peak	**23**  Ranger 4 Lunar probe launched - failed its mission, but became first U.S. craft to impact the Moon (1962)	**24** Launch of shuttle Discovery with Hubble space telescope (1990)   Cosmonaut Valery Komarov dies on re-entry on lunar spacecraft Soyuz 1 (1967) Launch of 1st Chinese Mao 1 (*aka "the East is Red"*) satellite, (1967)	**25** Nikolai Semenovich Kardashev born, astrophysicist and deputy director of the Russian Space Research Institute, pioneered search for extraterrestrials (1932)	**26** Cassini spacecraft gets gravitational assist from Venus on way to Saturn 1998	**27** Scheduled launch of Atlas 5 for United Launch Alliance technicians carrying the second Advanced Extremely High Frequency communications spacecraft.	**28** Northeast Astronomy Forum, Rockland Comunity College, Suffern NY (Continues Saturday) Isaac Newton publishes *Principia*, describing gravitation and 3 laws of motion (1686)
29 Cornelis de Jager, Dutch astronomer born; worked on predicting solar variation, to assess the Sun's impact on future climate (1921)	**30** Plinius' Eclipse, described by Pliny the Elder, Roman naturalist in Campagnia, Italy : "Then the sun was suddenly darkened and the fourteen districts of the city were struck by lightning" (59 AD)					

Phases of the Moon

Apr 6 Apr 13 Apr 21 Apr 29