

Galactic Observer

John J. McCarthy Observatory

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Messenger to Mercury

NASA's MESSENGER spacecraft (MErcury Surface, Space ENvironment, GEochemistry and Ranging) was launched on August 2004 on a mission of discovery to our innermost planet. After two velocity adjusting flybys of Earth, one of Venus and three of Mercury, it became the first spacecraft to orbit Mercury on March 24, 2011.

In Roman mythology, Mercury was the god of commerce, transported on winged sandals. The British composer Gustav Holst characterized him as the winged messenger in his famous orchestral suite, The Planets, in 1916.

For more information on Mercury and the Messenger mission, come to McCarthy Observatory's Second Saturday Stars on January 14.

Credit: NASA/Johns Hopkins University Applied Physics
Laboratory/Carnegie Institution of Washington

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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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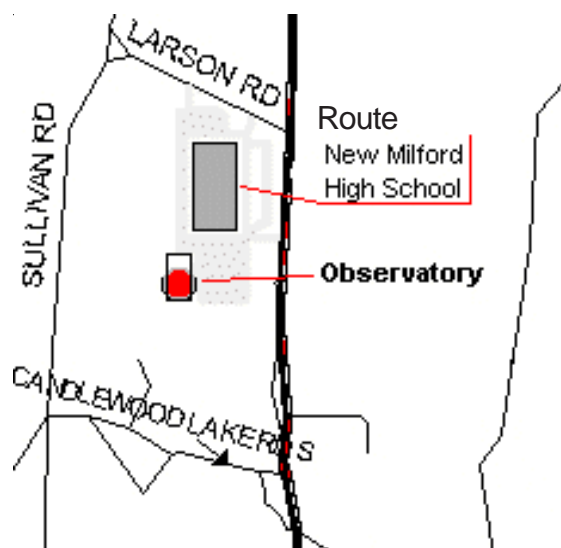
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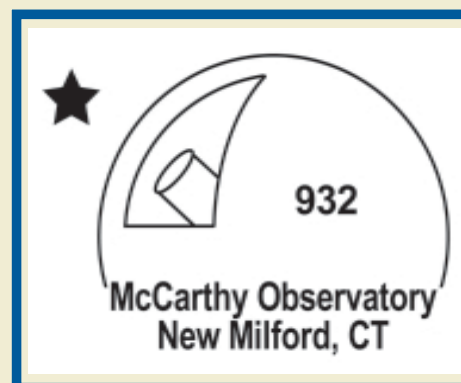
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January Astronomy Calendar and Space Exploration Almanac



Orion Rules the Winter Sky

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
04 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		4+ more years to Pluto; see http://pluto.jhuapl.edu/
16 Jul 2011	Dawn spacecraft arrives at the asteroid Vesta		Orbit achieved; see http://dawn.jpl.nasa.gov/
05 Aug 2011	Launch of the Juno spacecraft to Jupiter		Successful launch/deployment; see http://solarsystem.nasa.gov/grail/
10 Sep 2011	Launch of twin GRAIL spacecraft to map Moon's gravitational field		Successful launch/deployment; see http://missionjuno.swri.edu/
08 Nov 2011	Launch of the Phobos-Grunt sample-return mission		Successful launch/failure to leave low-Earth orbit/expected to fall back to Earth in the next few months
26 Nov 2011	Launch of Mars Science Laboratory (MSL)		Successful launch/deployment: see http://www.marsprogram.jpl.nasa.gov/msl/
05 Aug 2012	MSL lands on Mars		

Other notable events:

- August 9, 2011 Opportunity reached the rim of Endeavour crater
- March 3, 2012 Mars at Opposition
- May 20, 2012 Annular Solar Eclipse (visible in southwest U.S.)
- June 6, 2012 Venus Transit (visible before sunset on the east coast)

"Out the Window on Your Left"

It's been 39 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 northern reaches of Mare Humorum (Sea of Moisture) and the magnificent impact crater Gassendi. Large enough to be classified as a walled plain, Gassendi is 55 miles in diameter. The walls of the crater appear as segments of an arc or polygon rather than a continuous ring. The northern segment has been breached by the impact that created Gassendi A.

The peaks along Gassendi's wall rise over 9,000 feet on the western rim, while only 500 feet above the surface along the southern portion. The floor of the crater is inclined and elevated, with the northern portion rising 2,000 feet above the mare. The uplift is believed to have been caused by magma ponding under the crater floor. The magma not only lifted the floor, but caused the floor to fracture in multiple locations.

There are two different photos of the area included this month. The first shows the crater in shadows with the terminator hugging the western rim. The central peaks, catching the rising sun, rise 4,000 above the darkened fractured floor. The second photo shows the entire crater bathed in sunlight with the terminator advanced further to the west.

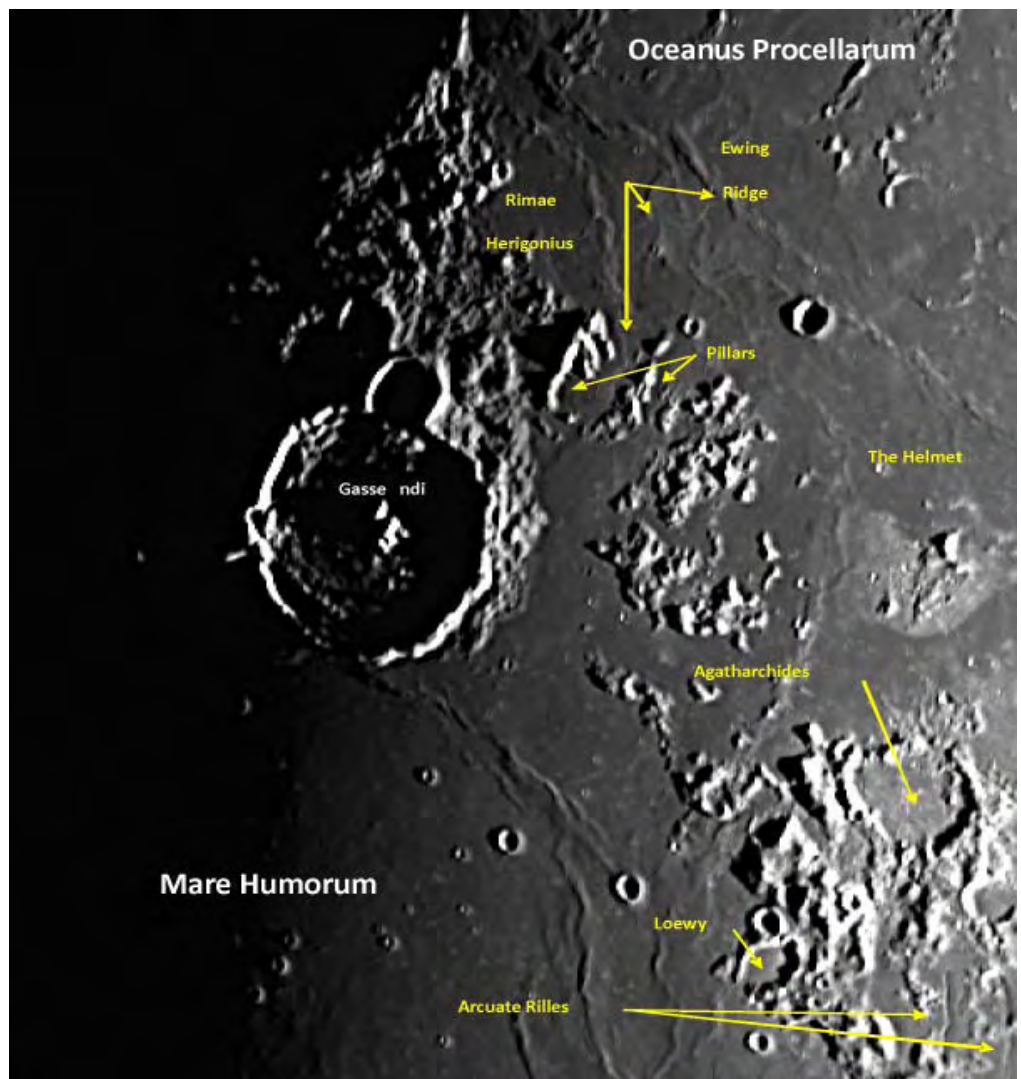
Mare Humorum is approximately 275 miles across and fills an ancient impact basin created 3.9 billion years ago. Mare lavas are estimated to be over a mile and one-half

deep near the center of the basin. One potential source of the lava is a sinuous rille or winding channel located just north of the mare. Rimae Herigonius appears to start with a pit in the Ewing ridge. The 1,600 foot wide channel meanders east, then west, before heading south through the "pillars."

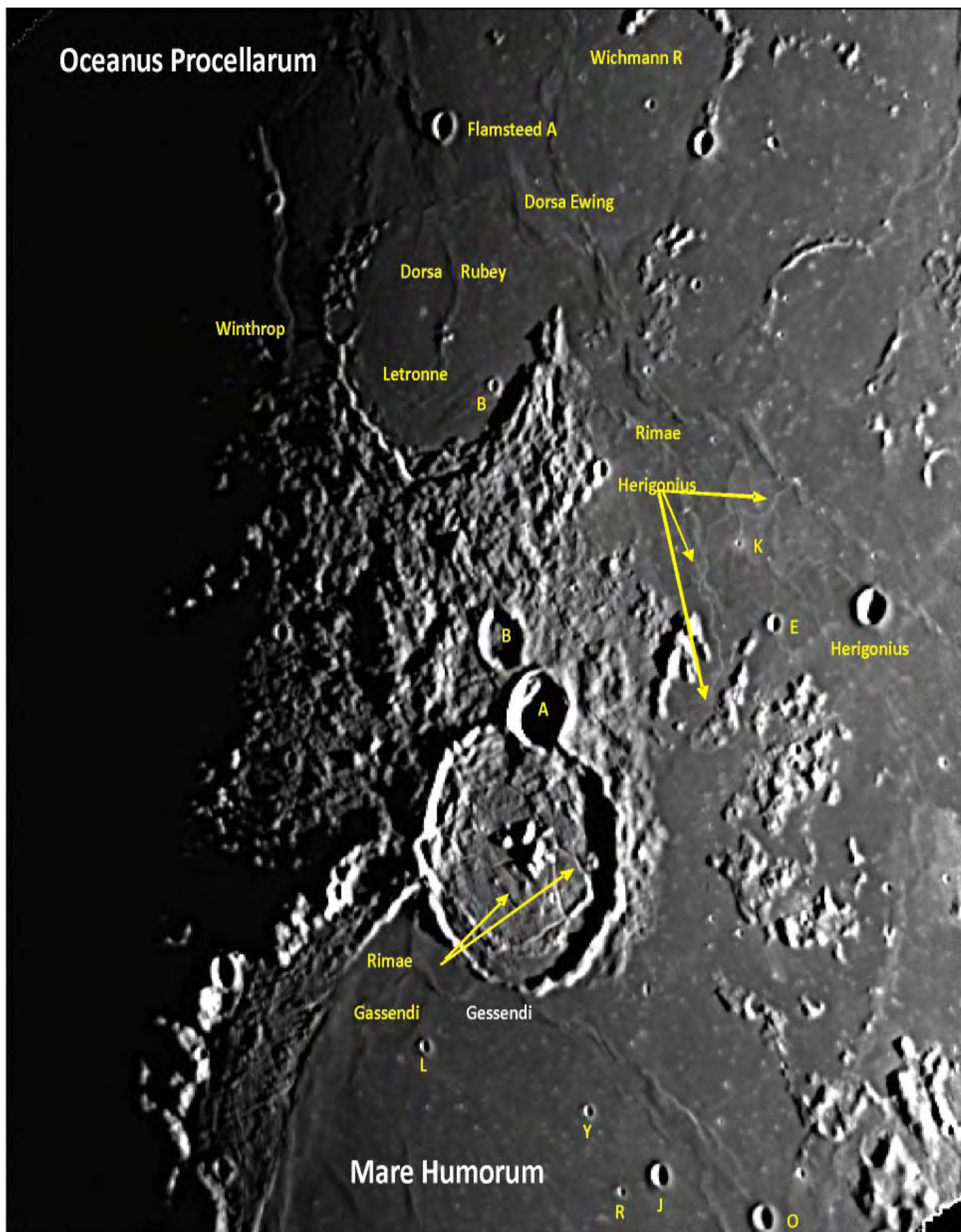
Notable in the lower right corner of the first photograph are two arcuate rilles. This type of rille is typically found on the edge of maria and are believed to have been created as the lava flows cool and contract.



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



Sunrise on Gassendi



Gassendi Illuminated

January History

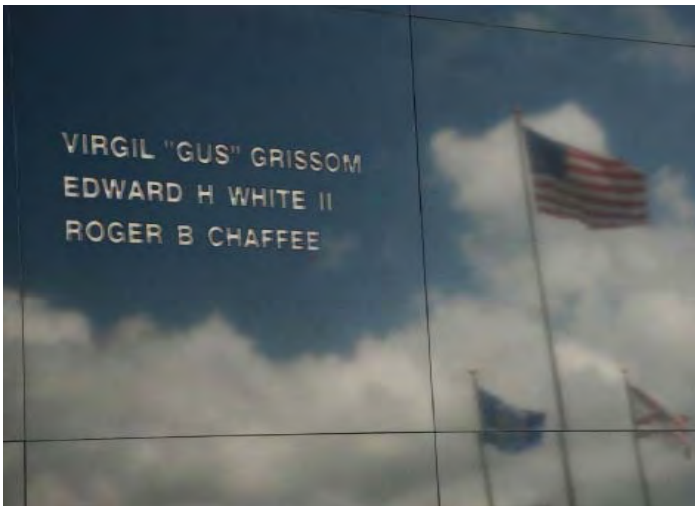
The month of January has been a difficult one for both the American and Soviet space programs. Untimely deaths set back both the American and Soviet moon programs. The two space shuttles that have been lost were also launched in January.

Sergei Korolyov, the "Chief Designer" of the Soviet space program, died on January 14, 1966 from a botched medical procedure. Korolyov co-founded the Moscow rocketry organization in the 1930s before being thrown into prison during the peak of Stalin's purges. He spent a year in the Kolyma gold mine, the most dreaded part of the Gulag in Siberia before he was recalled to Moscow to aid the Red Army in developing new weapons.



Korolyov went on to lead the Soviet space effort. Unfortunately, the Soviet Moon program died with Korolyov in 1966. While the race continued for some time after his death, his N-1 moon rocket never made a successful flight.

In January of 1967, after a successful Gemini program, NASA was moving forward with testing the new Apollo spacecraft. On the afternoon of the 27th, Gus Grissom, Ed White and Roger Chaffee were sealed inside the Apollo 1 command module sitting on top of an unfueled Saturn rocket in a simulated countdown. The command module had been plagued with problems and was in a state of constant redesign. At 6:31 pm, a spark from a damaged wire ignited the pure oxy-



gen atmosphere in the spacecraft. Within seconds the temperature reached 2,500°. The astronauts never had a chance to undo the bolts of the hatch before they were asphyxiated. Following their deaths, the spacecraft was completely redesigned. Lessons learned from

this accident served to make the spacecraft much safer and contributed to the success of the six moon landings.

Twenty-two years ago, on January 28, 1986, the United States lost its first space shuttle, the Challenger. Due to the low temperature on the launch pad, a rubber-like O-ring used to seal the joints of the solid rocket boosters failed to seat and stop the hot gasses from escaping. The gas produced a blowtorch-like flame that penetrated the external tank filled with liquid oxygen and hydrogen. The tank exploded 73 seconds after liftoff, destroying the shuttle and killing all seven crew members. Among the crew was Christa McAuliffe, a New Hampshire teacher.

Christa graduated from Framingham State College (Framingham, Massachusetts) in 1970. Following her death, the college established *The Christa McAuliffe Center* on the campus as a means to continue the educational mission which was Christa's life's work.



On February 1, 2003, a second space shuttle, the Columbia, was lost. The Columbia was the oldest shuttle in the fleet, having been first flown in 1981 by astronauts John Young and Robert Crippen. On its 28th flight, Columbia broke apart during reentry at an altitude of some 200,000 feet and a speed of 12,500 miles per hour. The shuttle and its crew of seven had just completed a 16 day science mission. The most likely cause of the accident was damage to a seal on the left wing from a piece of insulating foam that broke loose from the external fuel tank at launch, striking the wing. The resulting gap in the wing allowed the superheated atmosphere to penetrate the wing during reentry and destroy the spacecraft.

The Columbia accident ultimately led to the decision to stop flying the space shuttle once the International Space Station was complete and to develop a safer manned vehicle.

Goldilocks Planet

NASA confirmed on December 5th that the Kepler telescope had discovered its first planet located within the habitable zone (also known as the Goldilocks zone) around a star similar to our sun. The habitable zone is the region around a star where liquid water can exist.

The planet, known as Kepler-22b, is the first of ten near Earth-sized candidates that are located in a habitable zone to be confirmed.

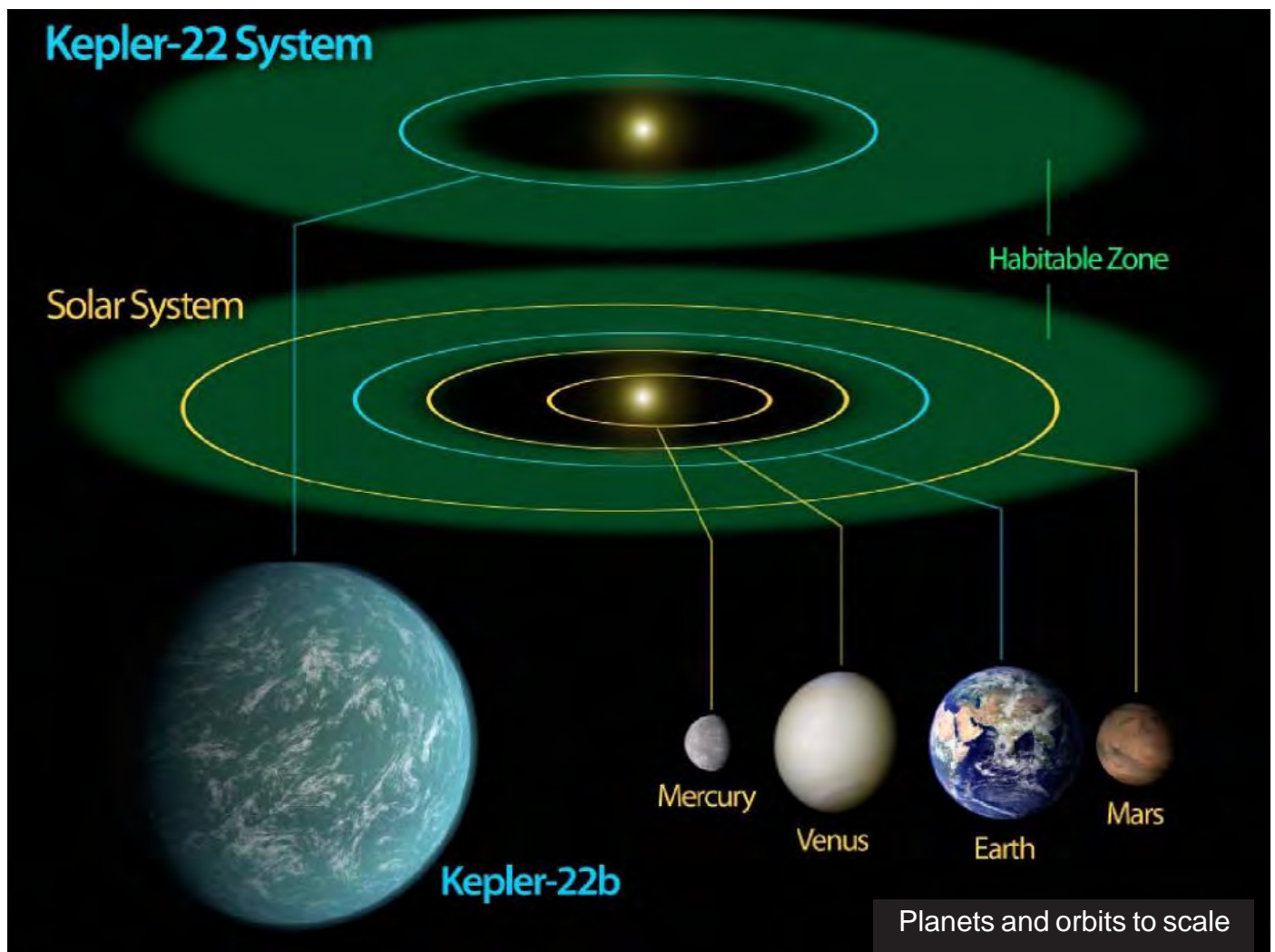


Image Credit: NASA/Ames/JPL-Caltech

Kepler-22b is 2.4 times larger than the Earth. The planet orbits its star in 289 days. Its star is slightly smaller and cooler than our sun.

The Kepler telescope discovers planets by the transit method: measuring the small dip in brightness as the planet crosses in front of the star. Three transits are required for confirmation.

Private Progress

With the retirement of the space shuttle, NASA is relying upon private industry to develop the capabilities to supply the International Space Station with cargo and replacement crews. Two of the contenders are Space Exploration Technologies or Space X and Orbital Sciences Corporation. The companies are expected to launch demonstrations in the next few months.

Space X

Space X is developing the Dragon spacecraft to carry both crew and cargo into low Earth orbit. The reusable capsule is launched aboard its Falcon 9 rocket.

Space X is scheduled to launch its second Dragon spacecraft in February from the Cape Canaveral Air Force Station. However, the mission is still pending final approval by NASA and the other ISS partners (most notably Russia) that are concerned with untested space-



Image Credit: Space Exploration Technologies

craft conducting maneuvers in the vicinity of the ISS. The mission is designed to demonstrate rendezvous techniques with the ISS, and the Dragon spacecraft could dock with the ISS with the assistance of the ISS's robotic arm.

Orbital Sciences

Orbital Sciences is also scheduled to launch a demonstration of its Cygnus spacecraft in February. The cargo carrying spacecraft will be carried into low-Earth orbit by the company's Taurus II rocket (recently renamed Antares) from its launch facility on Wallops Island, Virginia.



Image Credit: Orbital Sciences Corporation

The Taurus II is an expendable, two stage rocket. The first stage is powered by two NK-33 rocket engines. The kerosene and liquid oxygen powered engines were originally designed and built by the Kuznetsov Design Bureau for the Soviet N-1 moon rocket and refurbished/updated by GenCorp Aerojet.

January Nights

January nights can be clear and cold with frigid blasts of polar wind. They also present an opportunity to see stars at every stage in their life cycle, from birth (Orion Nebula) to fiery demise (Crab supernova remnant).

If you are out observing the open star clusters Pleiades or Hyades in the constellation Taurus, don't overlook the red giant Aldebaran. This star is receding from us more rapidly than any other 1st magnitude star in the sky. It was the brightest star in the sky some 320,000 years ago when it was 21½ light years from Earth. Moving away, Aldebaran is currently 65 light years in distance and the thirteenth brightest star in the sky.

Sunrise and Sunset

<u>Sun</u>	<u>Sunrise</u>	<u>Sunset</u>
January 1 st (EST)	07:20	16:34
January 15 th	07:18	16:48
January 31 st	07:07 17:08	

Astronomical and Historical Events

- 1st First Quarter Moon
- 1st GRAIL-B spacecraft enters lunar orbit
- 1st History: Giuseppe Piazzi discovers the first asteroid, now dwarf planet, Ceres (1801)
- 2nd Flyby of Saturn's largest moon Titan by the Cassini spacecraft
- 2nd History: flyby of Comet Wild 2 by the Stardust spacecraft (2004)
- 2nd History: launch of the Soviet spacecraft Luna 1; first probe to fly by the Moon (1959)
- 3rd Quadrantids meteor shower peaks; radiates from the constellation Boötes (name from an obsolete constellation called Quadrans Muralis)
- 3rd History: exploration rover Spirit lands on Mars in Gusev Crater; operational for six years before getting bogged down in loose soil at a winter haven called Troy (2004)
- 3rd History: Stephen Synnott discovers Uranus' moons Juliet and Portia (1986)
- 4th Earth at Perihelion; closest approach to the Sun (0.983 AU)
- 4th Distant flyby of Saturn's moons Helene, Mimas and Janus by the Cassini spacecraft
- 4th History: Isaac Newton born; inventor of the reflecting telescope, described universal gravitation, compiled the laws of motion, and invented calculus (1643)
- 5th Moon at Apogee (furthest distance from Earth)
- 5th History: discovery of Jupiter's moon Elara by Charles Perrine (1905)
- 6th History: La Criolla (Argentina) meteorite fall (1985)
- 7th History: discovery and first recorded observations of Jupiter's four largest moons by Galileo Galilei (1610)
- 8th History: launch of Japanese spacecraft Sakigake with mission to rendezvous with Comet Halley; measured the solar wind and magnetic field (1985)

Astronomical and Historical Events (continued)

- 8th History: launch of Luna 21 and the Lunokhod 2 moon rover (1973)
- 8th History: Stephen Hawking born (exactly 300 years after the death of Galileo); discovered that black holes could emit radiation - subsequently known as Hawking radiation (1942)
- 9th Full Moon
- 10th History: Surveyor 7, the seventh and last lunar lander of the Surveyor program, lands on the outer rim of the crater Tycho (1968)
- 10th History: U.S. Army first bounces radio waves off the Moon (1946)
- 11th History: the Lunar Prospector spacecraft enters lunar orbit for a nineteen month chemical mapping mission (1998)
- 11th History: William Herschell discovers Uranus' moons Titania and Oberon (1787)
- 12th History: launch of the Deep Impact spacecraft for a flyby of Comet Tempel 1; a small "impactor" was later released from the main spacecraft for a July 4th collision with the comet's nucleus (2005)
- 12th History: Sergei Pavlovich Korolyov born, Chief Designer of the Soviet space program (1907)
- 13th History: Stephen Synnott discovers Uranus' moons Desdemona, Rosalind and Belinda (1986)
- 13th History: discovery of the Martian meteorite EETA 79001 in Antarctica; second largest Martian meteorite recovered after Zagami (1980)
- 14th Second Saturday Stars – Open House at the McCarthy Observatory
- 14th Kuiper Belt Object 20000 Varuna at Opposition (42.618 AU)
- 14th History: first of three flybys of the planet Mercury by the Messenger spacecraft (2008)
- 14th History: landing of the Huygens probe on Saturn's largest moon Titan (2005)
- 15th History: Stardust spacecraft returns samples of Comet P/Wild 2 (2006)
- 15th History: launch of the spacecraft Helios 2, solar orbiter (1976)
- 15th History: Lunokhod 2, the second of two Soviet unmanned lunar rovers, lands in Le Monnier crater; covered a total distance of 23 miles in almost five months of exploring the floor of the crater and its southern rim (1973)
- 16th Last Quarter Moon
- 16th History: final launch of space shuttle Columbia (STS-107); lost on re-entry (2003)
- 17th Kuiper Belt Object 208996 (2003 AZ84) at Opposition (44.218 AU)
- 19th History: launch of the New Horizons spacecraft to Pluto; due to arrive in July 2015 (2006)
- 19th History: discovery of the Martian meteorite SAU 090, a basaltic shergottite, in Oman (2002)
- 19th History: discovery of Saturn's moon Janus by the Voyager 1 spacecraft (1980)
- 19th History: Johann Bode born, popularized an empirical law on planetary distances originally developed by J.D. Titius, known as "Bode's Law" or "Titius-Bode Law" (1747)
- 20th History: Rich Terrile discovers Uranus' moons Cordelia and Ophelia (1986)
- 21st Moon at perigee (closest distance from Earth)
- 21st History: launch of the rocket Little Joe-1B and a rhesus monkey named "Miss Sam" in a successful test of the Mercury capsule's escape system (1960)
- 21st History: John Couch Adams born, astronomer and mathematician who was the first person to predict the position of a planet beyond Uranus (1792)
- 22nd History: launch of Apollo 5, the first Lunar Module flight (1968)
- 23rd New Moon
- 23rd History: Brad Smith discovers Uranus' moon Bianca (1986)
- 24th History: discovery of the Martian meteorite Dhofar 019 in Oman (2000)
- 24th History: launch of Japan's Hiten spacecraft; first use of a low-energy transfer to modify an orbit and the first demonstration of a transfer to the Moon requiring no change in velocity for capture (1990)
- 24th History: exploration rover Opportunity lands on Mars at Meridiani Planum; still operational and currently exploring Endeavour Crater (2004)
- 24th History: flyby of Uranus by the Voyager 2 spacecraft (1986)
- 25th Scheduled launch of a Progress cargo carrying spacecraft from the Baikonur Cosmodrome in Kazakhstan to the International Space Station

Astronomical and Historical Events (continued)

25th History: launch of the U.S. Moon orbiter Clementine (1994)

25th History: Joseph Lagrange born; mathematician who discovered five special points in the vicinity of two orbiting masses where a third, smaller mass can orbit at a fixed distance from the larger masses. The L1 Lagrange Point of the Earth-Sun system is the current home of the Solar and Heliospheric Observatory Satellite (SOHO).

26th History: discovery of Saturn's moon Epimetheus by the Voyager 1 spacecraft (1980)

27th History: fire in the Apollo 1 spacecraft kills astronauts Gus Grissom, Edward White and Roger Chaffee (1967)

27th History: Philibert Melotte discovers Jupiter's moon Pasiphae (1908)

28th History: final launch of the space shuttle Challenger (STS-51L); lost on lift-off (1986)

28th History: Johannes Hevelius born; leading observational astronomer of the 17th century, published detailed maps of the moon and determined the rotational period of the sun (1611)

30th First Quarter Moon

30th Scheduled flyby of Saturn's largest moon Titan by the Cassini spacecraft

31st History: launch of Apollo 14; third manned moon landing with astronauts Alan Shepard, Stuart Roosa and Edgar Mitchell (1971)

31st History: launch of Soviet Moon lander Luna 9; first spacecraft to land and to transmit photographs from the Moon's surface (1966)

31st History: launch of Mercury-Redstone 2 rocket with Ham the chimpanzee (1961)

31st History: launch of the first U.S. satellite, Explorer 1; detected inner radiation belt encircling the Earth (1958)



The Apollo 14 landing site (star), located about 30 miles north of the 57 mile diameter Fra Mauro crater

References on Distances

- The apparent width of the Moon (and Sun) is approximately one-half a degree ($\frac{1}{2}^\circ$), less than the width of your little finger at arm's length which covers approximately one degree (1°); 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 3: **Orion**. Orion, one of the most easily recognized constellations, is on prominent display in the winter sky.

All non-credited photos were taken by the author: Bill Cloutier






7:00 - 9:00 pm

10 CENTS

<http://www.mccarthyobservatory.org>

January 2012

Celestial Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1  Giuseppe Piazzi discovers Ceres, 1 st asteroid, now dwarf planet (1801)  GRAIL-B spacecraft enters lunar orbit	2  Soviet spacecraft Luna 1 circles Moon (1959)  Flyby of comet Wild 2 by Stardust spacecraft (2004)	3  Rover Spirit on Mars (2004)  Quadrantids meteor shower peak	4 Earth at Perihelion: closest approach to Sun (0.983 AU)  Isaac Newton born (1643)	5 Moon at apogee (furthest from the Earth)  Discovery of Jupiter's moon Elara by Charles Dillon Perrine (1905)	6  La Criolla (Argentina) meteorite fall (1985)	7 Launch of Lunar Orbiter - Moon Prospector (1998)  Discovery and first recorded observations of Jupiter's four largest moons by Galileo Galilei (1610)
8 launch of Luna 21 and the Lunokhod 2 moon rover (1973)  Launch of Japanese spacecraft Sakigake to Comet Halley (1985)  Stephen Hawking born (1942)	9  Full Moon	10  U.S. Army bounces radio waves off the Moon (1946)  Surveyor 7 lands on Moon (1968)	11  William Herschel discovers Uranus moons Titania and Oberon (1787)	12 Launch of Deep Impact spacecraft for flyby of Comet Tempel 1 (2005)  Sergei Pavlovich Korolyov born, designer of Soviet space program (1907)	13 Discovery of Uranus moons Desdemona, Rosalind and Belinda by Stephen Synnott (1986)  Discovery of Martian meteorite EETA 79001 in Antarctica (1980)	14 Landing of the Huygens probe on Saturn's largest moon Titan (2005)  Messenger spacecraft flyby of Mercury (2008)  2nd Saturday Stars Open House McCarthy Observatory
15 Stardust spacecraft returns with samples of comet P Wild 2 (2006)  Launch of Helios 2, solar orbiter (1976)	16  Final launch of space shuttle Columbia (2003)	17  Harvey H. Nininger born, American meteoriticist and founder of the American Meteorite Museum near Meteor Crater, Arizona (1887)	18  Astronomers discover a pulsar in remnants of Supernova 1987A, but observation not later confirmed (1989)	19 Launch of New Horizons spacecraft to Pluto (2006)  Johann Bode born, developed law on planetary distances (1747)	20  Rich Terrile discovers Uranus' moons Cordelia and Ophelia (1986)	21 Moon at perigee (closest to Earth)  Launch of the rocket Little Joe-1B and a rhesus monkey "Miss Sam" (1960)  John Couch Adams born, predicted planet beyond Uranus (1792)
22  Apollo 5 launch to Moon (1968)	23  Discovery of Uranus' moon Bianca by Brad Smith (1986)	24 Rover Opportunity arrives on Mars (2004)  Flyby of Uranus by Voyager 2 (1986)	25 Launch of U.S. Moon orbiter Clementine (1994)  Joseph Louis Lagrange born (1736)	26  Discovery of Saturn's moon Epimetheus by the Voyager 1 spacecraft (1980)	27  Fire in Apollo 1 spacecraft (1967)	28 Johannes Hevelius born (1611)  Space shuttle Challenger lost on lift-off (1986)
29  Phobos 2, Soviet spacecraft enters Mars orbit in study of solar environment. Mission, with cooperation of U.S and 3 others (1989)	30  John Herschel uses camera obscura and hyposulphite to fix "snapshot" images from 48" (120cm) telescope (1839)	31 Apollo 14, 3 rd Moon mission (1971)  Explorer 1, first U.S. satellite (1958)  Launch of Mercury-Redstone 2 rocket with Ham, the astrochimp (1961)	Phases of the Moon  First Quarter Jan 1  Waxing Gibbous Jan 9  Full Moon  Waning Gibbous  Last Quarter Jan 16  Waning Crescent Jan 23  New Moon Jan 30  First Quarter			