# Space News Update

## — January 26, 2018 —

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### In the News



### Departments

## 1. Hold-down firing nudges Falcon Heavy rocket closer to first liftoff

SpaceX's first Falcon Heavy rocket fired up 27 main engines Wednesday on launch pad 39A at NASA's Kennedy Space Center in Florida, sending a crackling rumble across the swampy spaceport and moving the heavy-lifter a step closer to its oft-delayed maiden flight as soon as next week.

Ramping up to approximately 5 million pounds of ground-shaking thrust, the Falcon Heavy's 27 Merlin 1D main engines ignited at 12:30 p.m. EST (1730 GMT), running more than 10 seconds as a billowing cloud of exhaust and steam erupted from the flame trench at pad 39A.

"First static fire test of Falcon Heavy complete — one step closer to first test flight!" SpaceX tweeted shortly after the hold-down firing.

SpaceX founder and chief executive Elon Musk tweeted: "Falcon Heavy hold-down firing this morning was good. Generated quite a thunderhead of steam. Launching in a week or so."

The 229-foot-tall (70-meter) Falcon Heavy is expected to be lowered from pad 39A and rolled back into SpaceX's hangar for final checks. It will return to the seaside launch complex, the former departure point for NASA's Saturn 5 moon rocket and space shuttle missions, ahead of the target launch date.

The test flight's launch date has not been announced, and SpaceX already has a launch of a Falcon 9 rocket scheduled for Jan. 30 from Cape Canaveral's Complex 40 launch pad, a few miles to the south of pad 39A.

It was not clear Wednesday how much time SpaceX needs between a Falcon 9 and Falcon Heavy launch from different pads, but at least a day or two of separation will likely be required because the missions share personnel and infrastructure, including the U.S. Air Force's Eastern Range, a network of communications, tracking and safety assets.

Wednesday's static fire test was the culmination of a month-long series of fit checks, fueling tests and other preparatory work at pad 39A since the Falcon Heavy was first raised vertical at the facility Dec. 28.

SpaceX's launch team fueled the Falcon Heavy several times, and ended the rehearsals before the engines would ignite in a normal countdown.

The Falcon Heavy is made up of three Falcon 9 first stage boosters bolted together — two side boosters with nose cones and a central core with structural stiffeners to take the extra load the heavy-lifter will produce during launch.

For the inaugural Falcon Heavy test launch, the rocket will be powered by a newly-manufactured core stage and two side-mounted boosters recovered and refurbished after past Falcon 9 missions.

The side boosters will jettison from the Falcon Heavy's core around two-and-a-half minutes after liftoff, then return to land at Cape Canaveral Air Force Station, where SpaceX has upgraded its rocket landing zone for two simultaneous touchdowns.

Meanwhile, the center booster will continue firing a bit longer before switching off its nine Merlin engines and dropping back through the atmosphere for a landing on SpaceX's rocket recovery barge in the Atlantic Ocean.

An upper stage similar to the Falcon 9's will take over to drive into orbit.

The hotfire test Wednesday was the first time all 27 of the Falcon Heavy's engines have ignited together. The test-firing produced more thrust than any rocket has generated at the Florida spaceport since the retirement of the space shuttle in 2011.

The Falcon Heavy will weigh more than 3.1 million pounds (1.4 million kilograms) fully loaded with kerosene and liquid oxygen propellants.

On its first flight, the Falcon Heavy will generate about 4.7 million pounds of thrust at launch. Musk said the first Falcon Heavy's engines will be throttled to 92 percent of full power.

That will make the Falcon Heavy the most powerful rocket flying today, exceeding the European Ariane 5 launcher, the world's leader in liftoff power at 2.9 million pound of thrust from two segmented solid rocket boosters and a core engine. SpaceX's new rocket will produce more thrust than any launch vehicle since the space shuttle.

The Falcon Heavy will also be able to carry more payload into orbit than any other rocket in the world — and the most by any launcher since the Saturn 5 — a more important measure of the rocket's lifting capacity.

The Delta 4-Heavy rocket, operated by SpaceX rival United Launch Alliance, can haul up to 63,471 pounds (28,790 kilograms) to a low-altitude orbit approximately 120 miles (200 kilometers) above Earth when launched to the east from Cape Canaveral, according to a launch vehicle data sheet published by ULA.

When its first stage boosters are not recovered, SpaceX's Falcon Heavy will be capable of delivering up to 140,660 pounds (63,800 kilograms) to low Earth orbit when launched to the east from Florida's Space Coast, where rockets get a velocity boost from Earth's rotation.

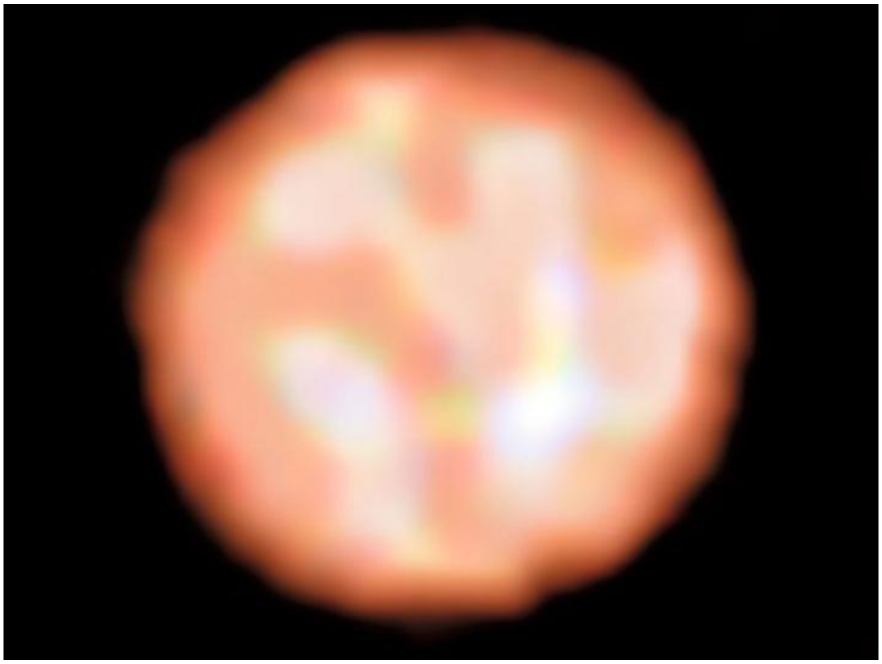
But SpaceX intends to land all three first stage boosters on the Falcon Heavy, eating into the rocket's propellant reserves and reducing the weight it can loft into orbit.

For the Falcon Heavy's first payload, Musk picked one of his used Tesla Roadsters to shoot into space, not the more typical dummy satellite often carried on test flights.

The Falcon Heavy will attempt to give the automobile enough speed to escape the grasp of Earth's gravity, sending it into a heliocentric solar orbit that will take it to the approximate distance of Mars from the sun.

Source: Spaceflight Now Return to Contents

## 2. This is the Surface of a Giant Star, 350 Times Larger than the Sun



When it comes to looking beyond our Solar System, astronomers are often forced to theorize about what they don't know based on what they do. In short, they have to rely on what we have learned studying the Sun and the planets from our own Solar System in order to make educated guesses about how other star systems and their respective bodies formed and evolved.

For example, astronomers have learned much from our Sun about how convection plays a major role in the life of stars. Until now, they have not been able to conduct detailed studies of the surfaces of other stars because of their distances and obscuring factors. However, in a historic first, an international team of scientists recently created the first detailed images of the surface of a red giant star located roughly 530 light-years away.

The study recently appeared in the scientific journal *Nature* under the title "Large Granulation cells on the surface of the giant star Π¹ Gruis". The study was led by Claudia Paladini of the Université libre de Bruxelles and included members from the European Southern Observatory, the Université de Nice Sophia-Antipolis, Georgia State University, the Université Grenoble Alpes, Uppsala University, the University of Vienna, and the University of Exeter.

For the sake of their study, the team used the Precision Integrated-Optics Near-infrared Imaging ExpeRiment (PIONIER) instrument on the ESO's Very Large Telescope Interferometer (VLTI) to observe the star known as Π¹ Gruis. Located 530 light-years from Earth in the constellation of Grus (The Crane), Π¹ Gruis is a cool red giant. While it is the same mass as our Sun, it is 350 times larger and several thousand times as bright.

For decades, astronomers have sought to learn more about the convection properties and evolution of stars by studying red giants. These are what become of main sequence stars once they have exhausted their hydrogen fuel and expand to becomes hundreds of times their normal diameter. Unfortunately, studying the convection properties of most supergiant stars has been challenging because their surfaces are frequently obscured by dust.

After obtaining interferometric data on Π¹ Gruis in September of 2014, the team then relied on image reconstruction software and algorithms to compose images of the star's surface. These allowed the team to determine the convection patterns of the star by picking out its "granules", the large grainy spots on the surface that indicate the top of a convective cell.

This was the first time that such images have been created, and represent a major breakthrough when it comes to our understanding of how stars age and evolve. As Dr. Fabien Baron, an assistant professor at Georgia State University and a co-author on the study, explained:

*"This is the first time that we have such a giant star that is unambiguously imaged with that level of details. The reason is there's a limit to the details we can see based on the size of the telescope used for the observations. For this paper, we used an interferometer. The light from several telescopes is combined to overcome the limit of each telescope, thus achieving a resolution equivalent to that of a much larger telescope."*

This study is especially significant because $\Pi^1$ Gruis in the last major phase of life and resembles what our Sun will look like when it is at the end of its lifespan. In other words, when our Sun exhausts its hydrogen fuel in roughly five billion years, it will expand significantly to become a red giant star. At this point, it will be large enough to encompass Mercury, Venus, and maybe even Earth.

As a result, studying this star will give scientists insight into the future activity, characteristics and appearance of our Sun. For instance, our Sun has about two million convective cells that typically measure 2,000 km (1243 mi) in diameter. Based on their study, the team estimates that the surface of $\Pi^1$ Gruis has a complex convective pattern, with granules measuring about 1.2 x 10^8 km (62,137,119 mi) horizontally or 27 percent of the diameter of the star.

This is consistent with what astronomers have predicted, which was that giant and supergiant stars should only have a few large convective cells because of their low surface gravity. As Baron indicated:

*"These images are important because the size and number of granules on the surface actually fit very well with models that predict what we should be seeing. That tells us that our models of stars are not far from reality. We're probably on the right track to understand these kinds of stars."*

The detailed map also indicated differences in surface temperature, which were apparent from the different colors on the star's surface. This are also consistent with what we know about stars, where temperature variations are indicative of processes that are taking place inside. As temperatures rise and fall, the hotter, more fluid areas become brighter (appearing white) while the cooler, denser areas become darker (red).

Looking ahead, Paladini and her team want to create even more detailed images of the surface of giant stars. The main aim of this is to be able to follow the evolution of these granules continuously, rather than merely getting snapshots of different points in time.

From these and similar studies, we are not only likely to learn more about the formation and evolution of different types of stars in our Universe; we're also sure to get a better understanding of what our Solar System is in for.

Source: Universe Today Return to Contents

## 3. NASA's Next Mars Lander Spreads its Solar Wings

NASA's next mission to Mars passed a key test Tuesday, extending the solar arrays that will power the InSight spacecraft once it lands on the Red Planet this November.

The test took place at Lockheed Martin Space just outside of Denver, where InSight was built and has been undergoing testing ahead of its launch. The mission is led by NASA's Jet Propulsion Laboratory in Pasadena, California.

"This is the last time we will see the spacecraft in landed configuration before it arrives at the Red Planet," said Scott Daniels, Lockheed Martin InSight Assembly, Test and Launch Operations (ATLO) Manager. "There are still many steps we have to take before launch, but this is a critical milestone before shipping to Vandenberg Air Force Base in California." The InSight launch window opens in May.

The fan-like solar panels are specially designed for Mars' weak sunlight, caused by the planet's distance from the Sun and its dusty, thin atmosphere. The panels will power InSight for at least one Martian year (two Earth years) for the first mission dedicated to studying Mars' deep interior. InSight's full name is Interior Exploration using Seismic Investigations, Geodesy and Heat Transport.

"Think of InSight as Mars' first health checkup in more than 4.5 billion years," said Bruce Banerdt of JPL, the mission's principal investigator. "We'll study its pulse by 'listening' for marsquakes with a seismometer. We'll take its temperature with a heat probe. And we'll check its reflexes with a radio experiment."

In addition to the solar panel test, engineers added a final touch: a microchip inscribed with more than 1.6 million names submitted by the public. It joins a chip containing almost 827,000 names that was glued to the top of InSight back in 2015, adding up to a total of about 2.4 million names going to Mars. "It's a fun way for the public to feel personally invested in the mission," Banerdt said. "We're happy to have them along for the ride."

The chips were inscribed at JPL's Microdevices Laboratory, which has added names and images to a number of spacecraft, including the Mars Spirit, Opportunity and Curiosity rovers. Each character on the InSight microchips is just 400 nanometers wide. Compare that to a human hair, 100,000 nanometers wide, or a red blood cell, 8,000 nanometers wide.

For more information on InSight, visit: **https://mars.nasa.gov/insight/**

Source: JPL

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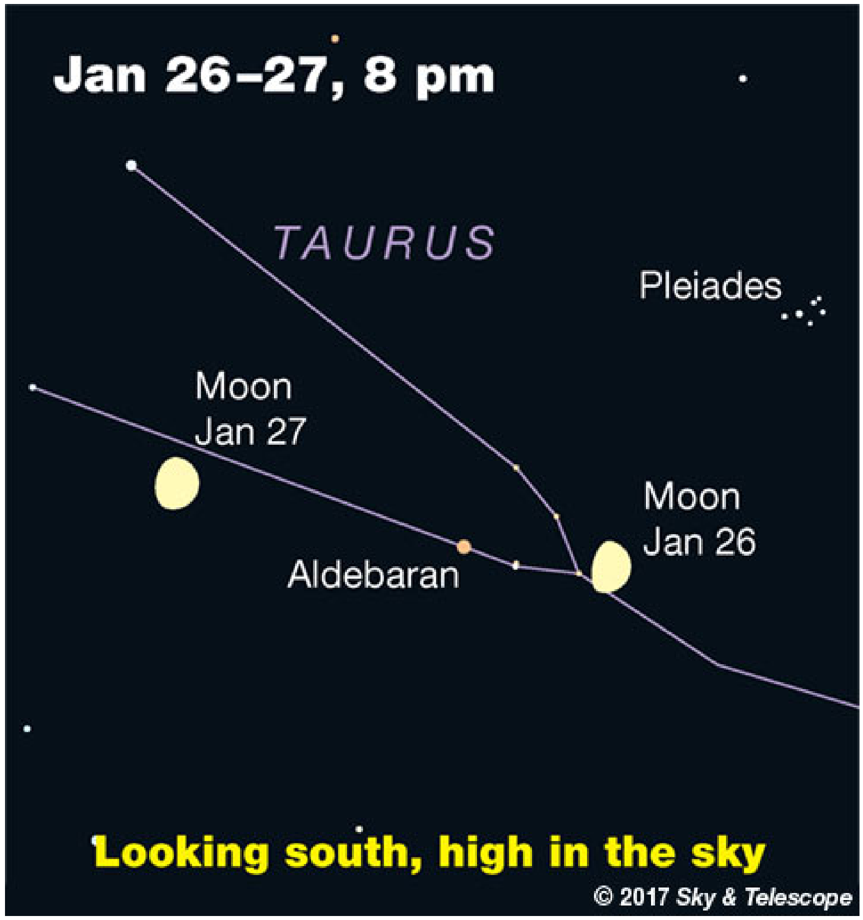
# The Night Sky

**Friday, January 26**
• The Moon, two days past first quarter, shines to the right of Aldebaran and lower left of the Pleiades this evening, as shown here (for the middle of North America).




• Later, the Moon's dark limb *occults* Aldebaran as seen from far northwestern North America during the early-morning hours of Saturday. Map and timetables.

**Saturday, January 27**
• After dark you'll find the Great Square of Pegasus sinking in the west, tipped onto one corner. Meanwhile the Big Dipper is creeping up in the north-northeast, tipped up on its handle.

**Sunday, January 28**
• As soon as it's fully dark, spot the big, equilateral Winter Triangle high in the southeast under the Moon. Sirius is its brightest and lowest star. Betelgeuse stands above Sirius by about two fists at arm's length. To the left of their midpoint is Procyon.

And, standing directly above Procyon now (depending on your latitude) is 3rd-magnitude Gomeisa, or Beta Canis Minoris, the only other easy naked-eye star of Canis Minor.

**Monday, January 29**
• Look left of the Moon this evening for Pollux with Castor over it. Farther to the Moon's lower right is brighter Procyon. Far lower right of Procyon is Sirius, brightest of all.

• Orion, high to the upper right of Sirius, is the brightest of the 88 constellations. But his main pattern is surprisingly small compared to some of his dimmer neighbors. The biggest of these is Eridanus the River to his west, enormous but hard to trace. Dimmer Fornax the Furnace, to Eridanus's lower right, is almost as big as Orion! Even the main pattern of Lepus, the Hare cowering under Orion's feet, isn't much smaller than he is.

**Tuesday, January 30**
• Now Pollux and Castor are high above the Moon. Procyon shines to the Moon's left.

• **Total eclipse of the Moon** before or during dawn Wednesday morning the 31st for western North America and Hawaii. Farther east, in the Central and Eastern time zones, the eclipse is still only partial by the time the Moon sets (and the Sun rises). The eclipse will be seen on the evening of the 31st for Australia and eastern Asia local date. For all the details see the January *Sky & Telescope*, page 48, or as the date draws near, SkyandTelescope.com.

Source: Sky & Telescope

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# ISS Sighting Opportunities

## For Denver:

| Date | Visible | Max Height | Appears | Disappears |
|---|---|---|---|---|
| Fri Jan 26, 6:37 PM | 2 min | 69° | 28° above WSW | 44° above NNE |
| Sat Jan 27, 5:44 PM | 5 min | 58° | 19° above SSW | 11° above ENE |
| Sat Jan 27, 7:21 PM | 1 min | 19° | 14° above WNW | 19° above NW |
| Sun Jan 28, 6:29 PM | 3 min | 31° | 22° above WNW | 19° above NNE |
| Mon Jan 29, 5:38 PM | 3 min | 54° | 54° above NW | 10° above NE |
| Mon Jan 29, 7:13 PM | 1 min | 13° | 10° above NW | 13° above NNW |
| Tue Jan 30, 6:20 PM | 4 min | 18° | 11° above WNW | 11° above NNE |

Sighting information for other cities can be found at NASA's Satellite Sighting Information

# NASA-TV Highlights

**(all times Eastern Daylight Time)**

**6 p.m., 10 p.m., Friday, January 26** - Replay of SpaceCast Weekly (all channels)

**9 a.m., 2 p.m., 6 p.m., Saturday, January 27** - Replay of the Launch Coverage of the Global-scale Observations of the Limb and Disk (GOLD) Mission from Guiana Space Centre in Kourou, French Guiana (all channels)

**10 a.m., 5 p.m., 8 p.m., Saturday, January 27 -** Replay of SpaceCast Weekly (all channels)

**8 a.m., 4 p.m., 8 p.m., Sunday, January 28** - Replay of the Launch Coverage of the Global-scale Observations of the Limb and Disk (GOLD) Mission from Guiana Space Centre in Kourou, French Guiana (all channels)

**2 p.m., 6 p.m., 10 p.m., Sunday, January 28 -** Replay of SpaceCast Weekly (all channels)

**5:30 a.m., Monday, January 29 -** ISS U.S. Spacewalk 48 Coverage (Spacewalk begins at appx. 7:10 a.m. EST; expected to last about 6 ½ hours) (all channels)

Watch NASA TV on the Net by going to the NASA website.

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# Space Calendar

- Jan 26 - Comet 238P/Read At Opposition (2.250 AU)
- Jan 26 - Comet 343P/NEAT-LONEOS At Opposition (2.685 AU)
- Jan 26 - [Jan 26] Aten Asteroid 2018 BM5 Near-Earth Flyby (0.012 AU)
- Jan 26 - Apollo Asteroid 2018 AL12 Near-Earth Flyby (0.021 AU)
- Jan 26 - Aten Asteroid 2011 CD66 Near-Earth Flyby (0.079 AU)
- Jan 26 - Asteroid 19019 Sunflower Closest Approach To Earth (1.637 AU)
- Jan 26 - Asteroid 1140 Crimea Closest Approach To Earth (1.883 AU)
- Jan 26 - Asteroid 1913 Sekanina Closest Approach To Earth (1.890 AU)
- Jan 26 - 40th Anniversary (1978), IUE Launch
- Jan 26 - Leo Goldberg's 105th Birthday (1913)
- Jan 27 - Moon Occults Aldebaran
- Jan 27 - Comet 74P/Smirnova-Chernykh Perihelion (3.536 AU)
- Jan 27 - Asteroid 4 Vesta Occults TYC 6202-01212-1 (11.3 Magnitude Star)
- Jan 27 - [Jan 21] Apollo Asteroid 2018 BU1 Near-Earth Flyby (0.008 AU)
- Jan 27 - [Jan 19] Apollo Asteroid 2018 BQ Near-Earth Flyby (0.024 AU)
- Jan 27 - Asteroid 2636 Lassell Closest Approach To Earth (2.154 AU)
- Jan 27 - Asteroid 2866 Hardy Closest Approach To Earth (2.379 AU)
- Jan 27 - Antonin Mrkos' 100th Birthday (1918)
- Jan 28 - Comet 185P/Petriew Perihelion (0.934 AU)
- Jan 28 - Comet P/2017 S8 (PANSTARRS) Perihelion (1.683 AU)
- Jan 28 - Comet 197P/LINEAR Closest Approach To Earth (1.818 AU)
- Jan 28 - Comet P/1999 XN120 (Catalina) At Opposition (2.456 AU)
- Jan 28 - Comet C/2016 Q4 (Kowalski) Perihelion (7.084 AU)
- Jan 28 - Comet 1P/Halley At Opposition (33.683 AU)
- Jan 28 - Asteroid 4628 Laplace Closest Approach To Earth (1.417 AU)
- Jan 28 - Asteroid 9619 Terrygilliam Closest Approach To Earth (1.852 AU)
- Jan 28 - Asteroid 4999 MPC Closest Approach To Earth (1.917 AU)
- Jan 28 - Amor Asteroid 4957 Brucemurray Closest Approach To Earth (2.008 AU)
- Jan 28 - Asteroid 11814 Schwamb Closest Approach To Earth (2.266 AU)
- Jan 28 - James Watson's 180th Birthday (1838)
- Jan 28 - Giovanni Borelli's 410th Birthday (1608)
- Jan 29 - Yaogan 30-04-01, 30-04-02, 30-04-03 CZ-2C Launch
- Jan 29 - Comet 197P/LINEAR Perihelion (1.060 AU)
- Jan 29 - Comet C/2016 T3 (PANSTARRS) Closest Approach To Earth (2.193 AU)
- Jan 29 - Comet C/2017 W2 (Leonard) Closest Approach To Earth (3.030 AU)
- Jan 29 - Atira Asteroid 2006 WE4 Closest Approach To Earth (0.105 AU)
- Jan 30 - [Jan 23] SES-16/GovSat Falcon 9 Launch
- Jan 30 - Comet 18D/Perrine-Mrkos Closest Approach To Earth (2.472 AU)
- Jan 30 - Comet 128P-B/Shoemaker-Holt Closest Approach To Earth (2.691 AU)
- Jan 30 - Comet 128P/Shoemaker-Holt Closest Approach To Earth (2.693 AU)
- Jan 30 - Comet 350P/McNaught Perihelion (3.751 AU)
- Jan 30 - Comet C/2015 D3 (PANSTARRS) At Opposition (8.153 AU)
- Jan 30 - Aten Asteroid 2017 BG136 Near-Earth Flyby (0.078 AU)
- Jan 30 - Asteroid 3353 Jarvis Closest Approach To Earth (1.119 AU)
- Jan 30 - Apollo Asteroid 410777 (2009 FD) Closest Approach To Earth (1.198 AU)
- Jan 30 - Asteroid 6470 Aldrin Closest Approach To Earth (1.326 AU)
- Jan 30 - Asteroid 9965 GNU Closest Approach To Earth (1.568 AU)
- Jan 30 - Asteroid 9618 Johncleese Closest Approach To Earth (1.651 AU)
- Jan 30 - Asteroid 19148 Alaska Closest Approach To Earth (1.829 AU)

- Jan 30 - Robert Jedicke's 55th Birthday (1963)
- Jan 30 - 150th Anniversary (1868), Pultusk Meteorite Shower (Hit Houses)

Source: JPL Space Calendar Return to Contents

# Food for Thought

## America's First Satellite Established 'Foothold in Space'

On the evening of Jan. 31, 1958, the United States orbited its first satellite -- Explorer 1. The effort was part of the nation's participation in the International Geophysical Year (IGY), a peaceful scientific endeavor. It also marked America's first step in the Space Race of the Cold War.

Dr. Wernher von Braun led the Army Ballistic Missile Agency (ABMA) team at Redstone Arsenal in Huntsville, Alabama, that designed the rocket that launched Explorer 1. After the satellite was confirmed to be in orbit, he characterized the event as a crucial beginning for the nation's space program.

“We have firmly established our foothold in space," von Braun said. "We will never give it up."

Plans to orbit a satellite were part of IGY, a scientific collaboration of 67 nations taking place from July 1, 1957, to Dec. 31, 1958. Both the U.S. and Soviet Union announced that their participation would include launching satellites to orbit the Earth.

Even with the advance declaration, many Americans were stunned when the Soviets launched the world's first satellite, Sputnik, on Oct. 4, 1957. A month later, Sputnik 2 orbited with a dog as a passenger.

Plans to launch an American satellite began in 1954 and despite strong advocacy from the ABMA, the Eisenhower Administration chose the U.S. Navy’s Vanguard project to lead the nation's efforts for the IGY. However, the first attempt to orbit a Vanguard satellite ended in a launch pad explosion on Dec. 6, 1957.

The job of launching America's first satellite then was given to ABMA, which had been waiting for just such an opportunity. Taking on the task of designing and building the Explorer 1 satellite was the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California, directed by Dr. William Pickering.

The Explorer 1 effort included the work of the satellite's principal investigator, Dr. James Van Allen, professor of physics and astronomy at the University of Iowa. He had been studying cosmic rays around the Earth. Van Allen developed instrumentation to measure the concentration of ions and electrons in space and to detect cosmic rays. By Jan. 11, 1958, the work of assembling and testing the 30.8-pound, 6-foot, 9-inch Explorer 1 satellite was complete.

The Jupiter C’s first stage was positioned at Launch Complex 26 at the Cape Canaveral Missile Annex (now Cape Canaveral Air Force Station), on Jan. 16. The rocket’s upper stages arrived at the pad on Jan. 24, and were attached to the top the rocket.

On the evening of Jan. 31, a group of 57 engineers, technicians and managers monitored the countdown from the pad 26 blockhouse. Pickering, von Braun and Van Allen waited at the Pentagon. Plans called for the trio to travel to the National Academy of Sciences, where they would announce either success or failure.

At 10:48 p.m. EST, the rocket roared to life and blazed a trail into the night sky. Soon it was out of sight and contact was lost as there was not yet a far-flung network of tracking stations.

Pickering stayed on the telephone with his team at JPL waiting for confirmation that Explorer 1 was successfully in orbit. If so, it would pass over a California tracking station no later than 12:30 a.m. EST early on Feb. 1.

That time passed with no signal.

But at 12:45 p.m. came the report, "California has the bird."

At the news conference, Pickering, von Braun and Van Allen reported that America's first satellite was in an elliptical orbit slightly higher than planned accounting for the 15-minute delay in receiving a signal from Explorer 1. The spacecraft was circling the Earth every 114 minutes, 1,594 miles high, with a low point of 225 miles.

During operation, the satellite's cosmic ray detector discovered radiation belts around Earth which were named for Van Allen.

In the 60 years since liftoff of Explorer 1, the eyes of the world often focuses on The Cape as additional spacecraft are launched to Earth orbit, the Moon and planets. In 1961, Alan Shepard became the first American in space lifting off only a few hundred yards from where the nation's first satellite began its mission.

With construction of the Kennedy Space Center on adjacent Merritt Island, astronauts traveled to the lunar surface. For 30 years, space shuttles took crews to Earth orbit, culminating in construction of the International Space Station.

Today, Kennedy is a premier, multi-user spaceport where NASA and its partners continue to launch spacecraft, and soon will send crews on missions well beyond low-Earth orbit.

Source: NASA

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# Space Image of the Week


**The Tadpoles of IC 410**
**Image Credit:** Juan Ignacio Jimenez

**Explanation:** This telescopic close-up shows off the otherwise faint emission nebula IC 410. It also features two remarkable inhabitants of the cosmic pond of gas and dust below and left of center, the tadpoles of IC 410. Partly obscured by foreground dust, the nebula itself surrounds NGC 1893, a young galactic cluster of stars. Formed in the interstellar cloud a mere 4 million years ago, the intensely hot, bright cluster stars energize the glowing gas. Composed of denser cooler gas and dust, the tadpoles are around 10 light-years long and are likely sites of ongoing star formation.Sculpted by winds and radiation from the cluster stars, their heads are outlined by bright ridges of ionized gas while their tails trail away from the cluster's central region. IC 410 lies some 10,000 light-years away, toward the nebula-rich constellation Auriga.

Source: APOD

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