

# Space News Update – January 2016

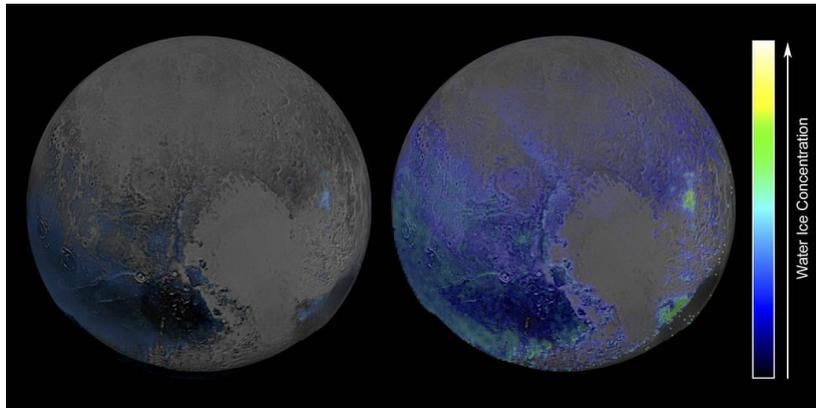
*By Pat Williams*

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*Disclaimer - I claim no authorship for the printed material; except where noted (PW).*

## PLUTO'S WIDESPREAD WATER ICE.



*Credits: NASA/JHUIAPL/SwRI*

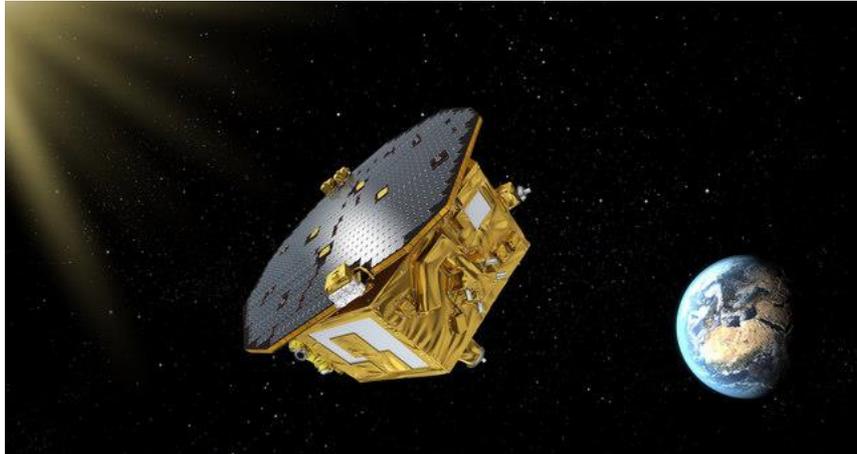
New data from NASA's New Horizons spacecraft point to more prevalent water ice on Pluto's surface than previously thought. This false-color image, derived from observations in infrared light by the Ralph/Linear Etalon Imaging Spectral Array (LEISA) instrument, shows where the spectral features of water ice are abundant on Pluto's surface. It is based on two LEISA scans of Pluto obtained on July 14, 2015, from a range of about 67,000 miles (108,000 kilometers). The scans, taken about 15 minutes apart, were stitched into a combined multispectral Pluto "data cube" covering the full hemisphere visible to New Horizons as it flew past Pluto. A data cube like this is a three-dimensional array in which an image of Pluto is formed at each LEISA-sensitive wavelength.

Water ice is Pluto's crustal "bedrock," the canvas on which its more volatile ices paint their seasonally changing patterns. Initial New Horizons maps of Pluto's water ice bedrock compared LEISA spectra with a pure water ice template spectrum, resulting in the map at left. A disadvantage of that technique is that water ice's spectral signature is easily masked by methane ice, so that map was only sensitive to areas that were especially rich in water ice and/or depleted in methane. The much more sensitive method used on the right involves modeling the contributions of Pluto's various ices all together. This method, too, has limitations in that it can only map ices included in the model, but the team is continually adding more data and improving the model.

The new map shows exposed water ice to be considerably more widespread across Pluto's surface than was previously known — an important discovery. But despite its much greater sensitivity, the map still shows little or no water ice in the informally named places called Sputnik Planum (the left or

western region of Pluto's "heart") and Lowell Regio (far north on the encounter hemisphere). This indicates that at least in these regions, Pluto's icy bedrock is well hidden beneath a thick blanket of other ices such as methane, nitrogen and carbon monoxide.  
[Pluto's widespread water ice](#) (29 January 2016)

### **EINSTEIN PUT TO THE TEST.**



*An artist's impression of the LISA Pathfinder. (AFP Photo)*

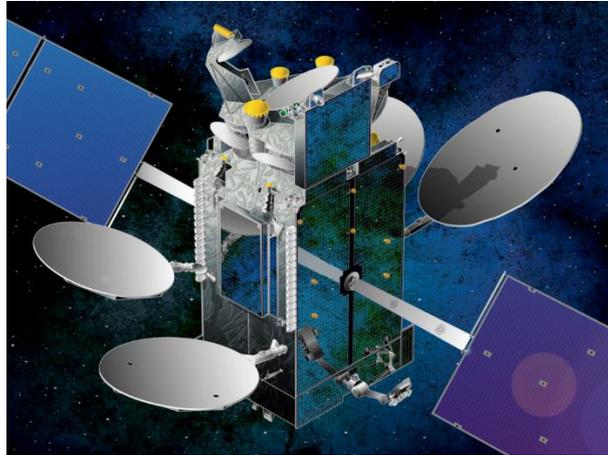
According to Albert Einstein's theory of relativity, all bodies in a vacuum regardless of their properties are accelerated by the Earth's gravity at the same rate. The European Space Agency launched a rocket Thursday to carry two cubes of gold and platinum almost a million miles from Earth so scientists can see how they'll behave in a freefall at a cost of more than \$450 million. What may sound like a frivolous enterprise is actually the prelude to a far more ambitious mission that hopes to measure ripples in space time caused by black holes and other massive objects lurking unseen in dark corners of the galaxy. Also known as gravitational waves, these ripples were predicted by Albert Einstein a century ago but have never been directly detected.

In order for that mission tentatively scheduled for launch in 2034 to succeed, the European Space Agency first has to test whether it can shield objects from external influences well enough to measure the minute effects of gravitational waves. "We want to see whether we can create an environment in orbit that's free of interference, and where we can conduct these high-precision measurements." By mid-January, the probe will have reached an orbit about 1.5 million kilometers (930,000 miles) from Earth, where the pull from the planet's gravity is balanced by that of the sun. The cubes made from gold and platinum to reduce their susceptibility to magnetic fields are then carefully released inside a box that shields them from cosmic particles and other interference that might affect the measurements performed by a sensitive laser. The laser is capable of detecting movements of less than 10 millionths of a millionth of a meter. "Our biggest enemy is the light from the sun that hits the satellite and pushes it around." To counter this, the satellite uses NASA-supplied thrusters capable of making tiny corrections to the probe's position to keep it in the right orbit and prevent the free-falling cubes from crashing into the inside of the box. This should provide a near-perfect cosmic isolation chamber to measure the effect of gravitational waves, said Jennrich.

The LISA Pathfinder mission itself won't detect any gravitational waves, though. Because the two 2-kilogram (4.4-pound) cubes are only 38 centimetres apart, any object big enough to affect their relative position would have to be so huge it would be visible with the naked eye, said Jennrich. Instead, the real measurements will likely have to wait almost two decades for the follow-up mission, provisionally called LISA. It will involve three satellites positioned in a triangle 5 million kilometers apart from each other. Together they should be able to detect gravitational waves caused by enormous objects such as supermassive black holes, like the one that's thought to sit at the centre of the Milky Way. [Einstein put to the test](#) (25 January 2016)

## DATA RATES DEMAND NEW TECHNOLOGY.

A NASA team has been tapped to build a new type of communications modem that will employ an emerging, potentially revolutionary technology that could transform everything from telecommunications, medical imaging, advanced manufacturing to national defence.



*A new-fangled modem that will employ an emerging technology called **integrated photonics** will be tested as part of NASA's Laser Communications Relay Demonstration mission. Credits: NASA*

The space agency's first-ever integrated-photonics modem will be tested aboard the International Space Station beginning in 2020 as part of NASA's multi-year Laser Communications Relay Demonstration, or LCRD. The cell phone-sized device incorporates optics-based functions, such as lasers, switches, and wires, onto a microchip — much like an integrated circuit found in all electronics hardware. Once aboard the space station, the so-called Integrated LCRD LEO (Low-Earth Orbit) User Modem and Amplifier (ILLUMA) will serve as a low-Earth orbit terminal for NASA's LCRD, demonstrating yet another capability for high-speed, laser-based communications.

Since its inception in 1958, NASA has relied exclusively on radio frequency (RF)-based communications. Today, with missions demanding higher data rates than ever before, the need for LCRD has become more critical. LCRD promises to transform the way NASA sends and receives data, video and other information. It will use lasers to encode and transmit data at rates 10 to 100 times faster than today's communications equipment, requiring significantly less mass and power. Such a leap in technology could deliver video and high-resolution measurements from spacecraft over planets across the solar system — permitting researchers to make detailed studies of conditions on other worlds, much as scientists today track hurricanes and other climate and environmental changes here on Earth. The project is expected to begin operations in 2019. LCRD is designed to be an operational system after an initial two-year demonstration period. It involves a hosted payload and two specially equipped ground stations. The mission will dedicate the first two years to demonstrating a fully operational system, from geosynchronous orbit to ground stations. Once NASA demonstrates that capability, it plans to use ILLUMA to test communications between geosynchronous and low-Earth-orbit spacecraft.

ILLUMA incorporates an emerging technology — integrated photonics — that is expected to transform any technology that employs light. This includes everything from Internet communications over fiber optic cable to spectrometers, chemical detectors, and surveillance systems, to name just a few. Under the NASA project, the team will reduce the size of the terminal, now about the size of two toaster ovens — a challenge made easier because all light-related functions will be squeezed onto a microchip. Although the modem is expected to use some optic fiber, ILLUMA is the first step in building and demonstrating an integrated photonics circuit that ultimately will embed these functions onto a chip.

Future satellites will require the ability to communicate with one another. Google, Facebook etc, they're all starting to look at this technology.

[NASA engineers to build first integrated-photonics modem](#) (29 January 20)

## LAUNCH. LAND. REPEAT.

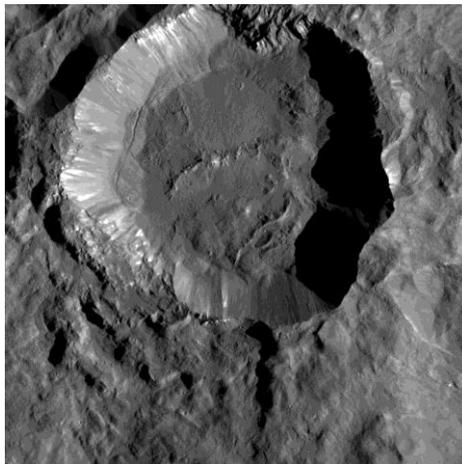


*The very same New Shepard booster that flew above the Karman line and then landed vertically at its launch site last November has now flown and landed again, demonstrating reuse. Credit: Blue Origin*

This time, *New Shepard* reached an apogee of 333,582 feet (101.7 kilometers) before both capsule and booster gently returned to Earth for recovery and reuse.

[Launch. Land. Repeat.](#) (22 January 2016)

## NEW DETAILS ON CERES SEEN IN DAWN IMAGES.



*This image from NASA's Dawn spacecraft shows Kupalo Crater, one of the youngest craters on Ceres. The crater has bright material exposed on its rim and walls, which could be salts. Its flat floor likely formed from impact melt and debris. Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA*

Features on dwarf planet Ceres that piqued the interest of scientists throughout 2015 stand out in exquisite detail in the latest images from NASA's Dawn spacecraft, which recently reached its lowest-ever altitude at Ceres. Dawn took these images near its current altitude of 240 miles (385 kilometers) from Ceres, between Dec. 19 and 23, 2015. Kupalo Crater shows off many fascinating attributes at the high image resolution of 120 feet (35 meters) per pixel. The crater has bright material exposed on its rim, which could be salts, and its flat floor likely formed from impact melt and debris. Researchers will be looking closely at whether this material is related to the "bright spots" of Occator Crater. Kupalo, which measures 16 miles (26 kilometers) across and is located at southern mid-latitudes, is named for the Slavic god of vegetation and harvest.

[New details on Ceres seen in Dawn images](#) (12 January 2016)

## **HOW MOULD ON SPACE STATION FLOWERS HELPS MICROGRAVITY GARDENING.**



*Mold growth initially grew on the plant in pillow E in the bottom left corner of the plant mat. Credits: NASA*

When Scott Kelly tweeted a picture of mouldy leaves on the current crop of zinnia flowers aboard the International Space Station, it could have looked like the science was doomed. In fact, science was blooming stronger than ever. What may seem like a failure in systems is actually an exceptional opportunity for scientists back on Earth to better understand how plants grow in microgravity, and for astronauts to practice doing what they'll be tasked with on a deep space mission: autonomous gardening. Contrary to seeming like a dead end for the crop, the issues faced by the zinnias offered a multitude of learning opportunities for scientists back on Earth. In fact the experience drives home what science experiments are all about: finding out what doesn't work, and figuring out how to solve it. For crews on the way to Mars scientists need to know what would happen if crops experienced drought, flooding, mold growth or other challenges. Would the practices of cutting away dead tissue and sanitizing plants work? How does changing the watering schedule affect the growth? How can crew members be given more opportunities to take charge in the gardening process? [How mould on space station flowers helps microgravity gardening](#) (16 January 2016)

## **LINKS TO OTHER SPACE AND ASTRONOMY NEWS PUBLISHED IN JANUARY 2016**

### **ASTEROIDS**

[NASA office to coordinate asteroid detection, hazard mitigation](#) (7 January 2016)

NASA has formalized its ongoing program for detecting and tracking near-Earth objects (NEOs) as the Planetary Defense Coordination Office (PDCO).

[Airborne asteroid impact chasers release findings on space junk object WT1190F](#) (29 January 2016)

The dramatic fall re-entry of a piece of space debris has served as a dress rehearsal for researchers who observe small asteroid entries and impacts

### **BLACK HOLES**

[Black hole affects galactic climate](#) (6 January 2016)

A team of researchers led by Eric Schlegel, Vaughn Family Endowed Professor in Physics at The University of Texas at San Antonio (UTSA), has discovered a powerful galactic blast produced by a giant black hole about 26 million light years from Earth.

[Seeing black holes with amateur telescopes](#) (7 January 2016)

All you need is a 20 cm telescope to observe a nearby, active black hole.

[First light for future black hole probe](#) (13 January 2016)

Zooming in on black holes is the main mission for the newly installed instrument GRAVITY at ESO's

Very Large Telescope in Chile. During its first observations, GRAVITY successfully combined starlight using all four Auxiliary Telescopes.

[Signs of second largest black hole in the Milky Way](#) (15 January 2016)

A team of astronomers led by Tomoharu Oka, a professor at Keio University in Japan, has found an enigmatic gas cloud, called CO-0.40-0.22, only 200 light years away from the centre of the Milky Way.

## COMET

[New command for Philae](#) (8 January 2016)

The last clear sign of life was received from Philae, the Rosetta mission's comet lander, on 9 July 2015; since then, it has remained silent.

[Exposed ice on Rosetta's comet confirmed as water](#) (13 January 2016)

Observations made shortly after Rosetta's arrival at its target comet in 2014 have provided definitive confirmation of the presence of water ice.

## DARK MATTER

[Galaxy clusters reveal new dark matter insights](#) (25 January 2016)

Dark matter is a mysterious cosmic phenomenon that accounts for 27 percent of all matter and energy.

[In galaxy clustering, mass may not be the only thing that matters](#) (25 January 2016)

An international team of researchers, including Carnegie Mellon University's Rachel Mandelbaum, has shown that the relationship between galaxy clusters and their surrounding dark matter halo is more complex than previously thought.

## EARTH

[NOAA's GOES-S, T and U satellites are shaping up](#) (8 January 2016)

As NOAA's GOES-R satellite goes through mechanical testing in preparation for launch in October 2016, the remaining satellites in the series (GOES-S, T, and U) are also making significant progress.

[Lockheed Martin team delivers second lightning tracker for NOAA weather satellite](#) (12 January 2016)

Lockheed Martin delivered the second Geostationary Lightning Mapper (GLM) instrument that will provide earlier alerts of severe storms and contribute to more accurate tornado warnings.

[DORIS the space surveyor serving the ITRF](#) (13 January 2016)

First conceived 25 years ago, DORIS enables highly precise measurement of the host satellite's position and the data acquired by its altimetry instruments.

[Van Allen probes revolutionize view of radiation belts](#) (19 January 2016)

About 600 miles from Earth's surface is the first of two donut-shaped electron swarms, known as the Van Allen Belts, or the radiation belts **EXOPLANETS**

[Jason-3 delivers first data and products four days after launch](#) (21 January 2016)

Four days after its launch on 17 January, the Jason-3 high-precision ocean altimetry satellite is delivering its first sea surface height measurement data in near-real time for evaluation by engineers from the Centre National d'Etudes Spatiales (CNES), EUMETSAT, the US National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) and scientists from the international Ocean Surface Topography Science Team.

[Integral x-rays Earth's aurora](#) (26 January 2016)

Normally busy with observing high-energy black holes, supernovas and neutron stars, ESA's Integral space observatory recently had the chance to look back at our own planet's aurora.

[SMOS gets help from Tibet](#) (29 January 2016)

Ground measurements are essential for making sure that satellites deliver accurate information about our changing world.

[Damage maps may help in future quakes](#) (29 January 2016)

Nepal's magnitude 7.8 Gorkha earthquake caused significant damage and loss of life in 2015. In natural disasters like this, it is critical to locate areas that are in the most need of assistance as fast as possible.

## EXOPLANETS

[1 trillion kilometres apart: a lonely planet and its distant star](#) (26 January 2016)

A team of astronomers in the UK, USA and Australia have found a lonely planet, until now thought to be a free floating or lonely planet, in a huge orbit around its star.

## GALAXIES

[NASA's great observatories weigh massive young galaxy cluster](#) (7 January 2016)

Astronomers have used data from three of NASA's Great Observatories to make the most detailed study yet of an extremely massive young galaxy cluster.

[Ripples in galaxy help locate dark-matter satellites of Milky Way](#) (7 January 2016)

Three bright pulsating stars on the outskirts of the Milky Way galaxy could be beacons from an invisible dwarf galaxy that astronomers predicted was there based on its effects on the gas in our galaxy.

[Milky Way twin swept by an ultra-fast x-ray wind](#) (14 January 2016)

ESA's XMM-Newton has found a wind of high-speed gas streaming from the centre of a bright spiral galaxy like our own that may be reducing its ability to produce new stars.

[Dark 'nodules' may lurk in the Milky Way](#) (21 January 2016)

Invisible structures shaped like noodles, lasagne sheets or hazelnuts could be floating around in our Galaxy radically challenging our understanding of gas conditions in the Milky Way.

## GRAVITATIONAL WAVES

[Lights on for LISA Pathfinder](#) (11 January 2016)

While LISA Pathfinder is en route to its operational orbit, the science and engineering teams are testing the systems on the spacecraft.

[LISA Pathfinder thrusters operated successfully](#) (21 January 2016)

While some technologies were created to make spacecraft move billions of miles, the Disturbance Reduction System has the opposite goal: To keep a spacecraft as still as possible.

[LISA Pathfinder arrives at its worksite](#) (22 January 2016)

After a six-week journey, LISA Pathfinder arrived at its destination today, an orbit around a point of balance in space where it will soon start testing technologies crucial for exploring the gravitational Universe.

## INTERNATIONAL SPACE STATION

[NASA awards International Space Station cargo transport contracts](#) (14 January 2016)

NASA has awarded three cargo contracts to ensure the critical science, research and technology demonstrations that are informing the agency's journey to Mars are delivered to the International Space Station (ISS) from 2019 through 2024.

## **JUPITER AND MOONS**

[Juno spacecraft breaks solar power distance record](#) (13 January 2016)

NASA's Juno mission to Jupiter has broken the record to become humanity's most distant solar-powered emissary.

## **MANNED SPACE**

[Biological clock misalignment affects astronaut sleep](#) (7 January 2016)

Since the beginning of the space program, astronauts have dealt with the realities of spaceflight from microgravity in weak muscles and space radiation, to sleep deprivation and disorientation.

## **MARS**

[Mars rover Curiosity tastes scooped, sieved sand](#) (21 January 2016)

At its current location for inspecting an active sand dune, NASA's Curiosity Mars rover is adding some sample-processing moves not previously used on Mars.

[Mars Rover Opportunity busy through depth of winter](#) (25 January 2016)

NASA's senior Mars rover, Opportunity, worked through the lowest-solar-energy days of the mission's seventh Martian winter, while using a diamond-toothed rock grinder and other tools in recent weeks to investigate clues about the Red Planet's environmental history.

## **QUASARS**

[Quiet quasar has apparently eaten its fill](#) (8 January 2016)

Astronomers with the Sloan Digital Sky Survey (SDSS) announced that a distant quasar ran out of gas.

[Turbulent birth of a quasar](#) (15 January 2016)

The most luminous galaxy known in the Universe — the quasar W2246-0526, seen when the Universe was less than 10% of its current age — is so turbulent that it is in the process of ejecting its entire supply of star-forming gas, according to new observations with the Atacama Large Millimeter/submillimeter Array (ALMA).

## **SATURN AND MOONS**

[Cassini heads for 'higher ground' at Saturn](#) (25 January 2016)

NASA's Cassini mission is entering its next chapter with an orbital choreography meant to tilt the spacecraft's orbit out of Saturn's ring plane

## **SOLAR SYSTEM**

[Cosmic glasses for space exploration](#) (4 January 2016)

How are asteroids and planets formed from stony particles? This question is being explored in an experiment by scientists from the universities of Münster and Braunschweig.

[Caltech researchers find evidence of a real ninth planet](#) (20 January 2016)

Caltech researchers have found evidence of a giant planet tracing a bizarre, highly elongated orbit in the outer solar system.

## **STARS AND STAR CLUSTERS**

[Strong magnetic fields discovered in majority of stars](#) (5 January 2015)

An international group of astronomers led by the University of Sydney has discovered strong magnetic fields are common in stars, not rare as previously thought, which will dramatically impact our understanding of how stars evolve.

[Rotational clock for stars needs recalibration](#) (3 January 2016)

New work from a team of astronomers led by Carnegie's Jennifer van Saders indicates that one recently developed method for determining a star's age needs to be recalibrated for stars that are older than our Sun.

[Runaway stars leave infrared waves in space](#) (5 January 2016)

Astronomers are finding dozens of the fastest stars in our galaxy with the help of images from NASA's Spitzer Space Telescope and Wide-field Infrared Survey Explorer, or WISE.

[Spitzer, Hubble find twins of superstar Eta Carinae in other galaxies](#) (6 January 2016)

Eta Carinae, the most luminous and massive stellar system within 10,000 light-years, is best known for an enormous eruption seen in the mid-19th century that hurled an amount of material at least 10 times the sun's mass into space.

[Dramatic new evidence about star, planet formation](#) (5 January 2016)

A detailed study of young stars and their surroundings has produced dramatic new evidence about how multiple-star systems form and how the dusty disks that are the raw material for planets grow around young stars.

[Ancient gas cloud may be a relic from the death of first stars](#) (8 January 2016)

Researchers from Australia and the USA have discovered a distant, ancient cloud of gas that may contain the signature of the very first stars that formed in the Universe, in research to be published next week in Monthly Notices of the Royal Astronomical Society.

[Most energetic light ever observed from a neutron star](#) (12 January 2016)

Scientists working with the Major Atmospheric Gamma-ray Imaging Cherenkov (MAGIC) observatory have reported the discovery of the most energetic pulsed emission radiation ever detected from the neutron star in the centre of the supernova of 1054 A.D., known as the Crab pulsar.

[Newly discovered star offers opportunity to explore origins of first stars](#) (22 January 2016)

A team of researchers has observed the brightest ultra metal-poor star ever discovered.

[Globular clusters gain star-making fuel from outside cluster itself](#) (27 January 2016)

Among the most striking objects in the universe are glittering, dense swarms of stars known as globular clusters.

[Astronomers study what may be the most powerful supernova ever seen](#) (14 January 2016)

Astronomers are viewing a ball of hot gas billions of light years away that is radiating the energy of hundreds of billions of suns. At its heart is an object a little larger than 10 miles across.

## **SUN**

[NASA-funded balloon launches to study sun](#) (19 January 2016)

On Jan. 18, 2016, the GRIPS balloon team sent their instrument soaring towards the stratosphere above Antarctica, suspended underneath a helium-filled, football-field sized scientific balloon.

## **TECHNOLOGY**

[Fermi space telescope sharpens its high-energy vision](#) (7 January 2016)

Major improvements to methods used to process observations from NASA's Fermi Gamma-ray Space Telescope have yielded an expanded, higher-quality set of data that allows astronomers to produce the most detailed census of the sky yet made at extreme energies.

[By the dozen: James Webb Space Telescope mirrors](#) (7 January 2016)

One dozen flight mirrors are now installed on NASA's James Webb Space Telescope, out of the eighteen mirror segments that make up the primary mirror.

[Kymeta and Intelsat bring terabyte connectivity to the cars of the future](#) (12 January 2016)  
Kymeta and Intelsat are making the next evolution of connected car a reality.

[Launch of the first satellite in the "SpaceDataHighway" programme](#) (15 January 2016)  
SpaceDataHighway will provide high speed laser communication in space of extremely high volumes of data transfer, up to 50 terabytes per day

[Step aside, humans](#) (19 January 2016)  
Satellites are carrying increasingly diverse payloads into orbit, and resolving their often-conflicting onboard schedules requires programming wizardry and a little help from artificial intelligence.

[DSI teams with SFL to demonstrate autonomous spacecraft manoeuvring](#) (26 January 2016)  
The world's first demonstration of autonomous spacecraft manoeuvring was recently completed by Silicon Valley-based Deep Space Industries (DSI) and the Space Flight Laboratory (SFL) of Toronto, Canada.

[Webb Telescope mirrors installed with robotic arm precision](#) (27 January 2016)  
Inside a massive clean room at NASA's Goddard Space Flight Center in Greenbelt, Maryland the James Webb Space Telescope team is steadily installing the largest space telescope mirror ever.

[Clyde Space forms US company and reveals UK expansion](#) (27 January 2016)  
Clyde Space, the pioneering company which designed and manufactured Scotland's first satellite, today announced it is opening its first subsidiary company in the United States.

[Novel calibration tool will help astronomers look for habitable exoplanets](#) (29 January 2016)  
Promising new calibration tools, called laser frequency combs, could allow astronomers to take a major step in discovering and characterizing earthlike planets around other stars.

## **UNIVERSE**

[Green pea galaxy provides insights to early universe evolution](#) (13 January 2016)  
Newly formed dwarf galaxies were likely the reason that the universe heated up about 13 billion years ago, according to new work by an international team of scientists that included a University of Virginia researcher.

*Pat Williams. January 2016*