

Space News Update – July 2018

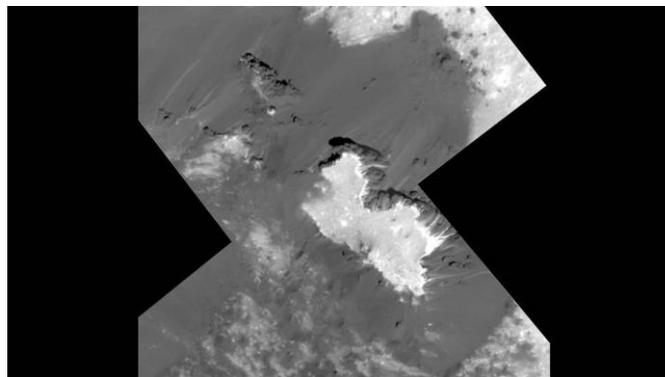
By Pat Williams

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

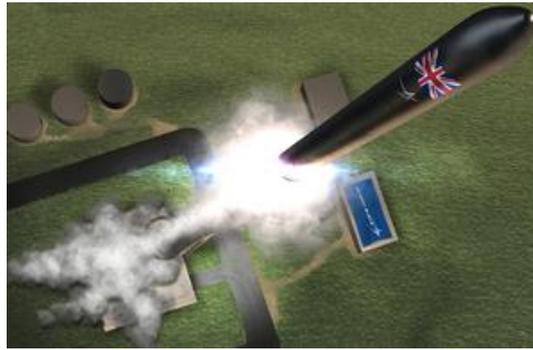
DAWN'S LATEST ORBIT REVEALS DRAMATIC NEW VIEWS OF OCCATOR CRATER



This mosaic of a prominent mound located on the western side of Cerealia Facula was obtained by NASA's Dawn spacecraft on June 22, 2018 from an altitude of about 21 miles (34 kilometers). Credits: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

NASA's Dawn spacecraft reached its lowest-ever and final orbit around dwarf planet Ceres on June 6 and has been returning thousands of stunning images and other data. The flight team maneuvered the spacecraft into an orbit that dives 22 miles (35 kilometers) above the surface of Ceres and viewed Occator Crater, site of the famous bright deposits, and other intriguing regions. In more than three years of orbiting Ceres, Dawn's lowest altitude before this month was 240 miles (385 kilometers), so the data from this current orbit bring the dwarf planet into much sharper focus. These low orbits have revealed unprecedented details of the relationships between bright and dark materials in the region of Vinalia Faculae. Dawn's visible and infrared mapping spectrometer had previously found the bright deposits to be made of sodium carbonate, a material commonly found in evaporite deposits on Earth. (JPL) [Dawn's latest orbit reveals dramatic new views of Occator crater](#) (2 July 2018)

LOCKHEED MARTIN AND ORBEX TO LAUNCH UK INTO NEW SPACE AGE



Artist's impression of vertical launch from UK spaceport. Credit: Lockheed Martin.

Lockheed Martin is to establish vertical launch operations in Sutherland, Scotland and develop innovative technologies in Reading, Berkshire with support from two UK Space Agency grants totalling £23.5 million. A further £5.5 million will go to British company Orbex to build an innovative new rocket for launch from Sutherland, as part of Government's modern Industrial Strategy.

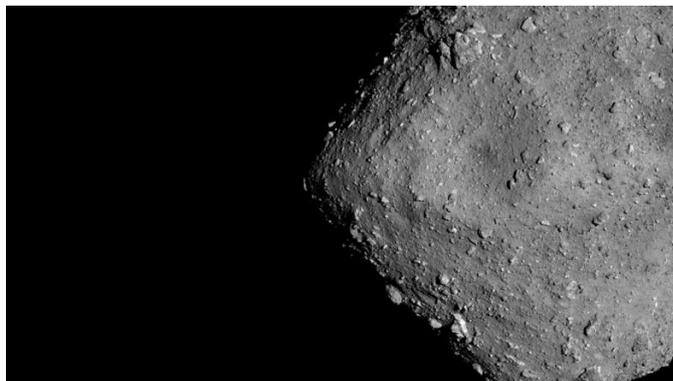


Credit: Orbex

This builds on awards of £2.5m to Highlands and Islands Enterprise to develop a vertical launch spaceport in Sutherland and a £2m development fund for horizontal spaceports such as those planned in Cornwall, Glasgow Prestwick and Snowdonia. Government support for launch is the first step towards a potential Space Sector Deal and the development of a national space programme. (UK Government)

[Lockheed Martin and Orbex to launch UK into new space age](#) (16 July 2018)

RYUGU – AN ASTEROID WITH EDGES, RIDGES AND BIG BOULDERS



Credit: JAXA

As the Japanese Hayabusa2 spacecraft closes in on asteroid Ryugu, more details become visible to the planetary scientists. On 20 July 2018, from just six kilometres, the spacecraft's Optical Navigation Camera - Telescopic (ONC-T) acquired an image of the asteroid's surface, with its largest crater. "The entire surface of Ryugu is strewn with large boulders – we have not yet seen this on an asteroid.," says the Principal Investigator for the [MASCOT \(Mobile Asteroid Surface Scout\)](#) lander aboard the Japanese spacecraft. It is anticipated that on 3 October 2018, MASCOT will land on Ryugu and examine the asteroid surface using four instruments. (DLR)

[Ryugu – An asteroid with edges, ridges and big boulders](#) (25 July 2018)

NEW ERA OF SPACE RESEARCH LAUNCHED BY ICECUBE OBSERVATORY AND GLOBAL TEAM OF ASTRONOMERS



Artist's impression of the IceCube Neutrino Observatory in Antarctica. Spherical digital optical modules (DOMs), each about 35 cm in diameter, are positioned up to 2.5 km deep in the ice. More than 5000 DOMs make up a cubic-kilometre detector weighing more than a billion tons. The DOMs detect the faint flash of light created when a high-energy neutrino interacts with the ice. See pages 115, 146, and 147. Credit: Jamie Yang and Savannah Guthrie/IceCube/NSF

An international team of scientists has found the first evidence of a source of high-energy cosmic neutrinos, ghostly subatomic particles that can travel unhindered for billions of light years from the most extreme environments in the universe to Earth. The observations, made by the IceCube Neutrino Observatory at the Amundsen–Scott South Pole Station and confirmed by telescopes around the globe and in Earth's orbit, help resolve a more than a century-old riddle about what sends subatomic particles such as neutrinos and cosmic rays speeding through the universe. For the first time there is evidence for a known blazar as a source of high-energy neutrinos detected by the National Science Foundation-supported IceCube observatory. This blazar, designated by astronomers as TXS 0506+056, was first singled out following a neutrino alert sent by IceCube on Sept. 22, 2017. A blazar is a giant elliptical galaxy with a massive, rapidly spinning black hole at its core. A signature feature of blazars is that twin jets of light and elementary particles, one of which is pointing to Earth, are emitted from the poles along the axis of the black hole's rotation. This blazar is situated in the night sky just off the left shoulder of the constellation Orion and is about 4 billion light years from Earth. (Pennsylvania State University)

[New era of space research launched by IceCube Observatory and global team of astronomers](#) (12 July 2018)

INTO THE MESOSPHERE AT MACH 2.4



Credit: Virgin Galactic

Virgin Galactic test pilots broke Mach 2, as VSS Unity took her third rocket-powered supersonic outing in less than four months. After a clean release from carrier aircraft VMS Eve at 46,500 ft, pilots Dave Mackay and Mike “Sooch” Masucci lit the spaceship’s rocket motor, before pulling up into a near vertical climb and powering towards the black sky at 2.47 times the speed of sound. The planned 42 seconds rocket burn took pilots and spaceship through the Stratosphere and, at an apogee of 170,800 ft, into the Mesosphere for the first time. This region, often referred to by scientists as the “Ignorosphere”, is an under-studied atmospheric layer because it is above the range of balloon flight. (Virgin Galactic)

[Into the mesosphere at Mach 2.4](#) (26 July 2018)

NATIONAL IN-ORBIT SERVICING CONTROL FACILITY TO BE BUILT IN UK TO HELP REMOVE SPACE DEBRIS

The National In-Orbit Servicing Control Facility will support advanced robotics activities in the very hostile environment of space, specifically enabling the provision of a commercial service for deorbiting small satellites. The new facility will initially control Astroscale’s pioneering ELSA-d mission, the first project to demonstrate the core rendezvous, capture and de-orbit technologies used by the ELSA (End-of-Life Service by Astroscale) programme. ELSA-d is comprised of two satellites, the ‘Chaser’ and the ‘Target.’ The ‘Chaser’ is equipped with optical sensing instruments and a capture mechanism which will attach to a Docking Plate on the ‘Target’ satellite. The Chaser and Target will then de-orbit together, burning up as they re-enter the Earth’s atmosphere. Over 4,500 satellites orbit the Earth, providing critical services including global communication and positioning capabilities. Upwards of 15,000 satellites are expected to be launched over the next 10 years, including into orbits that are already highly populated. There are growing concerns that a collision between uncontrolled space debris and an active satellite could cause global commercial and security risks and lead to a cascading debris effect making these orbits unsustainable. This issue was highlighted in August 2017 when the governments of Japan and the UK signed a memorandum of understanding to strengthen collaboration on mitigating space debris.

(Astroscale)

[National In-Orbit Servicing Control Facility to be built in UK to help remove space debris](#)

(24 July 2018)

LINKS TO OTHER SPACE NEWS PUBLISHED IN JULY 2018

ASTEROIDS

[Study reveals secret origins of asteroids and meteorites](#) (2 July 2018)

The study found at least 85 percent of 200,000 asteroids in the inner asteroid belt, the main source of Earth's meteorites, originate from five or six ancient minor planets. The other 15 percent may also trace their origins to the same group of primordial bodies. The discovery is important for understanding the materials that shaped our own rocky planet.

(University of Florida)

[Preparing for an asteroid landing – the MASCOT Control Center in contact with the MASCOT lander](#) (6 July 2018)

The team at the German Aerospace Center MASCOT Control Center in Cologne received the first signals from the German-French asteroid lander [MASCOT](#) upon its [arrival at the near-Earth asteroid Ryugu](#). On 27 June 2018, the lander reached the asteroid aboard the Japanese space probe Hayabusa2 after a three-and-a-half-year journey through space. For the first time this year, the researchers have contact with MASCOT and are presently checking all the on-board systems and instruments. MASCOT will only be accessible from Earth for a limited number of time windows when landing on Ryugu, with commands to the lander and a response back to Earth taking more than 30 minutes. During the approximately 16-hour-long measurement operation on the surface, MASCOT must be largely left to its own devices, and the landing exercises and tests on the ground are therefore of importance. They have subjected all the landing sequences to extensive testing using a ground model of MASCOT. (DLR)

[Observatories team up to reveal rare double asteroid](#) (12 July 2018)

New observations by three of the world's largest radio telescopes have revealed that an asteroid discovered last year is actually two objects, each about 3,000 feet (900 meters) in size, orbiting each other. (JPL)

ASTRONOMY

[Kepler spacecraft pauses science observations to download science data](#) (6 July 2018)

Earlier this week, NASA's Kepler team received an indication that the spacecraft fuel tank is running very low. NASA has placed the spacecraft in a hibernation-like state in preparation to download the science data collected in its latest observation campaign. Once the data has been downloaded, the expectation is to start observations for the next campaign with any remaining fuel. (NASA Ames)

ASTROPHYSICS

[Milky Way type dust particles discovered in a galaxy 11 billion light years from Earth](#) (3 July 2018)

An international research team has found the same type of interstellar dust that we know from

the Milky Way in a distant galaxy 11 billion light years from Earth. This type of dust has been found to be rare in other galaxies and the new discovery plays an important role in understanding what it takes for this particular type of interstellar dust to be formed. The dust in galaxies consists of small grains of carbon, silicon, iron, aluminum and other heavier elements. The Milky Way has a very high content of carbonaceous dust, which has been shown to be very rare in other galaxies. But now a similar type of dust has been found in a few, very distant galaxies that researchers have been able to investigate using light from gamma-ray bursts. Gamma-ray bursts come from massive stars that explode when the fuel in its core is exhausted. The explosion causes the dying stars to emit powerful bursts of light that astronomers can use to analyze what the galaxies are comprised of. Specifically, they can measure the elemental content and analyze their way forward to the properties of the dust properties by examining the light that escapes from the galaxies. (University of Copenhagen)

[Einstein gets it right again](#) (4 July 2018)

Harnessing the exquisite sensitivity of the [National Science Foundation's](#) Green Bank Telescope (GBT), astronomers have given one of Einstein's predictions on gravity its most stringent test yet. By precisely tracking the meanderings of three stars in a single system, two white dwarf stars and one ultra-dense neutron star, the researchers determined that even phenomenally compact neutron stars "fall" in the same manner as their less-dense counterparts, an aspect of nature called the "Strong Equivalence Principle." Einstein's understanding of gravity, as outlined in his general theory of relativity, predicts that all objects fall at the same rate, regardless of their mass or composition. This theory has passed test after test here on Earth, but does it still hold true for some of the most massive and dense objects in the known universe, an aspect of nature known as the Strong Equivalence Principle? An international team of astronomers has given this lingering question its most stringent test ever. Their findings show that Einstein's insights into gravity still hold sway, even in one of the most extreme scenarios the Universe can offer. Take away all air, and a hammer and a feather will fall at the same rate, a concept explored by Galileo in the late 1500s and famously illustrated on the Moon by Apollo 15 astronaut David Scott. (Green Bank Observatory)

[Space station experiment reaches ultracold milestone](#) (27 July 2018)

NASA's Cold Atom Laboratory (CAL) was installed in the station's U.S. science lab in late May and is now producing clouds of ultracold atoms known as Bose-Einstein condensates. These "BECs" reach temperatures just above absolute zero, the point at which atoms should theoretically stop moving entirely. This is the first time BECs have ever been produced in orbit. CAL is a multiuser facility dedicated to the study of fundamental laws of nature using ultracold quantum gases in microgravity. Cold atoms are long-lived, precisely controlled quantum particles that provide an ideal platform for the study of quantum phenomena and potential applications of quantum technologies. This NASA facility is the first of its kind in space. It is designed to advance scientists' ability to make precision measurements of gravity, probing long-standing problems in quantum physics (the study of the universe at the very smallest scales), and exploring the wavelike nature of matter. CAL scientists confirmed last week that the facility has produced BECs from atoms of rubidium, with temperatures as low as 100 nanoKelvin, or one ten-millionth of one Kelvin above absolute zero. At these ultracold temperatures, the atoms in a BEC begin to behave unlike anything else on Earth. In fact,

BECs are characterized as a fifth state of matter, distinct from gases, liquids, solids and plasma. In a BEC, atoms act more like waves than particles. The wave nature of atoms is typically only observable at microscopic scales, but BECs make this phenomenon macroscopic, and thus much easier to study. The ultracold atoms all assume their lowest energy state, and take on the same wave identity, becoming indistinguishable from one another. Together, the atom clouds are like a single "super atom," instead of individual atoms. (JPL)

BLACK HOLES

[Elusive intermediate mass black hole revealed by cosmic belch](#) (9 July 2018)

The frustrating search for intermediate mass black holes is advancing thanks to Gemini observations of a "belch" which escaped when a black hole devoured a star. The black hole powering the blast weighed in at a few tens of thousands solar masses and is quite possibly a missing link between supermassive and stellar mass black holes. (Gemini Observatory)

[Galaxy outskirts likely hunting grounds for dying massive stars and black holes](#)

(25 July 2018)

Findings from a Rochester Institute of Technology study provide further evidence that the outskirts of spiral galaxies host massive black holes. These overlooked regions are new places to observe gravitational waves created when the massive bodies collide. Low levels of elements heavier than hydrogen and helium found in dwarf/satellite galaxies create favorable conditions for massive black holes to form and create binary pairs. A similar galactic environment in the outer disks of spiral galaxies also creates likely hunting grounds for massive black holes. (Rochester Institute of Technology)

[Testing the predictions of general relativity near the Milky Way's central black hole](#)

(26 July 2018)

For detecting the effects of general relativity, the timing had to be just right. The orbit of the best-observed star orbiting the black hole, called S2, is somewhat eccentric – not a circle, but an elongated ellipse. At the star's closest approach to the black hole, called the orbit's pericentre or peribothron (the latter from the Greek *bothros* for hole or pit), the speed of S2 is highest, reaching values of about 7650 kilometers per second, which corresponds to 2.6% of the speed of light. The results were unambiguous: Classical Newtonian gravity cannot explain the observed orbit of S2 near the pericentre. Instead, the observations clearly show the combined effects of both the fast motion of S2 and the black hole's gravitational field on the orbital dynamics (specifically, time dilation for moving objects as predicted by special relativity and the gravitational redshift predicted by general relativity's equivalence principle). (Max Planck Institute for Astronomy)

COMETS

[Molecular oxygen in comet's atmosphere not created on its surface](#) (3 July 2018)

The Rosetta science team [originally reported](#) that the oxygen was most likely from the comet's main body, or nucleus. This meant it was 'primordial', that it was already present

when the comet itself formed at the beginning of the Solar System 4.6 billion years ago. One group of outside researchers however suggested there might be a [different source](#) for molecular oxygen at comets. They had discovered a new way to produce molecular oxygen in space triggered by energetic ions, electrically charged molecules. They proposed that reactions with energetic ions on the surface of comet 67P could instead be the source of the detected molecular oxygen. The new analysis is consistent with team's original conclusion, that molecular oxygen is most likely primordial. Other theories have been proposed, and can't yet be ruled out, but the primordial theory currently fits the data best. (Imperial College London)

COSMIC RAYS

[NuSTAR mission proves superstar Eta Carinae shoots cosmic rays](#) (3 July 2018)

A new study using data from NASA's [NuSTAR space telescope](#) suggests that Eta Carinae, the most luminous and massive stellar system within 10,000 light-years, is accelerating particles to high energies, some of which may reach Earth as [cosmic rays](#). We know the blast waves of exploded stars can accelerate cosmic ray particles to speeds comparable to that of light, an incredible energy boost. Similar processes must occur in other extreme environments. Our analysis indicates Eta Carinae is one of them. Astronomers know that cosmic rays with energies greater than 1 billion electron volts (eV) come to us from beyond our solar system. But because these particles, electrons, protons and atomic nuclei, all carry an electrical charge, they veer off course whenever they encounter magnetic fields. This scrambles their paths and masks their origins. (NASA Goddard)

[CALET succeeds in direct measurements of cosmic-ray electron spectrum up to 4.8 TeV](#) (16 July 2018)

CALET, a detector optimized to observe high-energy electrons, was installed on the Japanese Experimental Module Kibo on the International Space Station (ISS) on August 2015 as the first, Japanese-led, space-based mission dedicated to cosmic ray observations. Intended for a long-term operation, CALET has been accumulating data since October 2015. An international team of researchers succeeded in extending their result from a previous study and directly measured the cosmic-ray all-electron (electron + positron) spectrum in an energy range from 11 GeV to 4.8 TeV with the Calorimetric Electron Telescope (CALET). (Waseda University)

[High-flying telescope focuses on cosmic radiation](#) (30 July 2018)

The new UNH telescope is dubbed ASCOT, which stands for Advanced Scintillator Compton Telescope. A scintillator detects charged particles produced by gamma ray interactions, and this version is faster, more compact, rugged and less expensive than previous versions built at UNH. Perhaps the most unique aspect of ASCOT is that it utilizes light-sensing technology developed not for astronomy, but instead for medical imaging. Positron emission tomography (PET) scans are used to detect certain diseases in the human body by measuring photons from ingested radioactive material, and as it turns out, detectors built for this measurement come in handy when dealing with particles like gamma rays. (University of New Hampshire)

EARTH

[Copernicus Sentinel-5P releases first data](#) (11 July 2018)

Following months of tests and careful evaluation, the first data on air pollutants from the Copernicus Sentinel-5P satellite have been released. These first maps show a range of trace gases that affect air quality such as carbon monoxide, nitrogen dioxide and ozone. (ESA)

[Flann working with NASA on space mission to map Earth's water](#) (16 July 2018)

World leading microwave engineering company Flann Microwave is supplying vital components to the US space agency NASA for a major spaceflight mission making the first-ever global survey of Earth's surface water. The multinational Surface Water and Ocean Topology (SWOT) satellite is planned to launch in 2021. It is UK-based Flann's first project for NASA. They are developing custom-made waveguide equipment. This will be linked to the satellite's high-resolution radar as it tracks how Earth's water bodies change over time, with the aim of improving ocean circulation models, weather and climate predictions, and aiding in freshwater management around the world. (Flann Microwave)

[ATLAS Space Operations brings on BlackSky's Earth observation constellation as customer](#) (17 July 2018)

BlackSky is a leading geospatial monitoring and alerting service that helps organizations observe and understand global events by integrating a diverse set of sensors and data, including satellite images. The company is launching its first four satellites (of a planned constellation of 60) in the next year. The constellation will provide 1-meter resolution color imagery with frequent revisit rates of 95 percent of the Earth's population. (Atlas Space Operations)

[Seeking 72-hour space environment forecasts with updates on the hour](#) (17 July 2018)

When it comes to predicting environmental conditions in specific locations within the vast volume of space, no such forecasting exists. As space launch companies make access to space more affordable and constellations of low-Earth orbit small satellites continue to grow, military and commercial space operators need new tools to track space environmental conditions and their potential impact. DARPA's new Space Environment Exploitation (SEE) program aims to accurately predict near-Earth space environment disturbances and perturbations (scales as small as 100 kilometers in size) in one-hour increments extending out 72 hours. If SEE is successful, it may become routine for space planners and operators to get timely updates like this: "Satellite Weather Alert! Severe geomagnetic storm expected in one hour for the next 12 hours over the polar region producing ionospheric disturbances affecting LEO satellites between 100 – 175km above the earth." (DARPA - Defense Advanced Research Projects Agency)

[Scientists use satellites to measure vital underground water resources](#) (19 July 2018)

Scientists are developing new methods of monitoring groundwater levels using satellite-based measurements of Earth's surface, providing a more comprehensive picture of the health of groundwater resources. The team measured land subsidence (when land above and around an aquifer shifts downward) using space-borne Interferometric Synthetic Aperture Radar (InSAR) and added that to data on groundwater levels sampled at thousands of wells across the Central Valley. The researchers then used data from NASA's twin satellite mission, the

Gravity Recovery and Climate Experiment (GRACE), to estimate groundwater loss. (National Science Foundation)

[NASA's 'space botanist' gathers first data](#) (23 July 2018)

Just days after its successful installation on the International Space Station, NASA's newest Earth-observing mission, the ECOSystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS), has collected its first science data on Earth's surface temperature. ECOSTRESS will measure the temperature of plants from space, enabling researchers to determine how much water plants use and to study how droughts affect plant health. (JPL)

[Flood detection a surprising capability of microsattelites mission](#) (24 July 2018)

In 2016 NASA launched a set of eight satellites called the Cyclone Global Navigation Satellite System, or CYGNSS, mission to gather more data on the winds in tropical cyclones as part of an effort to increase data coverage of hurricanes and aid forecasts. As the first year of data is being evaluated, a new and unexpected capability has emerged. CYGNSS's advantage over other space-based sensors for flood detection is its ability to see through clouds, rain and vegetation that may otherwise obscure floodwaters. Currently, flood detection is generally done by optical sensors on the U.S. Geological Survey-NASA Landsat satellites, which can't see through clouds, and the microwave sensors on the European Space Agency's Sentinel 1 and 2, which can't see through vegetation. Capturing data from eight satellites instead of one is another advantage because it decreases the time between observations for locations, meaning more coverage, more rapidly, of flooding in the tropics. Together this means CYGNSS could bridge gaps in current coverage. (NASA Goddard)

EXOPLANETS

[First confirmed image of newborn planet caught with ESO's VLT](#) (2 July 2018)

SPHERE, a planet-hunting instrument on ESO's Very Large Telescope, has captured the first confirmed image of a planet caught in the act of forming in the dusty disc surrounding a young star. The young planet is carving a path through the primordial disc of gas and dust around the very young star PDS 70. The data suggest that the planet's atmosphere is cloudy. (ESO)

[Detecting the boiling atmosphere of the hottest known exoplanet](#) (2 July 2018)

Astronomers have found that the atmosphere of the hottest known exoplanet, the hot Jupiter-like planet KELT-9b, is "boiling off," with the escaping gas being captured by the host star. Using the CARMENES instrument at Calar Alto Observatory, the Max Planck Institute for Astronomy in Heidelberg was able to detect the escaping hydrogen atmosphere of the planet. The observations indicate a spread-out hydrogen envelope that is being pulled towards the host star. (Max Planck Institute for Astronomy)

[New IR instrument searches for habitable planets](#) (2 July 2018)

A new instrument to search for potentially habitable/inhabited planets has started operation at the Subaru Telescope. This instrument, IRD (InfraRed Doppler), will look for habitable planets around red dwarf stars. Astronomers are hoping that investigating these small but

numerous stars will uncover a plethora of new planets. Red dwarfs are smaller than the Sun and emit most of their energy as infrared (IR) rather than visible light. But because they are smaller, it is easier to find planets around them. Also, in the neighborhood around the Sun there are many late-M-type stars (a type of red dwarf) ripe for investigation. The sheer number of candidates raises the odds of finding potentially habitable or otherwise interesting planets. (NAOJ)

[Rocky planet neighbour looks familiar, but is not Earth's twin](#) (10 July 2018)

Last autumn, the world was excited by the discovery of an exoplanet called Ross 128 b, which is just 11 light years away from Earth. [New work](#) has for the first time determined detailed chemical abundances of the planet's host star, Ross 128. Understanding which elements are present in a star in what abundances can help researchers estimate the makeup of the exoplanets that orbit them, which can help predict how similar the planets are to the Earth. The team determined that Ross 128 has iron levels similar to our Sun. Although they were not able to measure its abundance of silicon, the ratio of iron to magnesium in the star indicates that the core of its planet, Ross 128 b, should be larger than Earth's. Because they knew Ross 128 b's minimum mass, and stellar abundances, the team was also able to estimate a range for the planet's radius, which is not possible to measure directly due to the way the planet's orbit is oriented around the star. Knowing a planet's mass and radius is important to understanding what it's made of, because these two measurements can be used to calculate its bulk density. What's more, when quantifying planets in this way, astronomers have realized that planets with radii greater than about 1.7 times Earth's are likely surrounded by a gassy envelope, like Neptune, and those with smaller radii are likely to be more-rocky, as is our own home planet. The estimated radius of Ross 128 b indicates that it should be rocky. Lastly, by measuring the temperature of Ross 128 and estimating the radius of the planet the team was able to determine how much of the host star's light should be reflecting off the surface of Ross 128 b, revealing that our second-closest rocky neighbour likely has a temperate climate. Although Ross 128 b is not Earth's twin, and there is still much we don't know about its potential geologic activity, we were able to strengthen the argument that it's a temperate planet that could potentially have liquid water on its surface. (Carnegie Institution for Science)

[TESS spacecraft continues testing prior to first observations](#) (11 July 2018)

After a successful launch on April 18, 2018, NASA's newest planet hunter, the Transiting Exoplanet Survey Satellite, is currently undergoing a series of commissioning tests before it begins searching for planets. The TESS team has reported that the spacecraft and cameras are in good health, and the spacecraft has successfully reached its final science orbit. The team continues to conduct tests to optimize spacecraft performance with a goal of beginning science at the end of July. (NASA Goddard)

[Astronomers find a famous exoplanet's doppelgänger](#) (16 July 2018)

When it comes to extrasolar planets, appearances can be deceiving. Astronomers have imaged a new planet, and it appears nearly identical to one of the best studied gas-giant planets. But this doppelgänger differs in one very important way: its origin. They have found a gas-giant planet that is a virtual twin of a previously known planet, but it looks like the two objects formed in different ways. (Canada-France-Hawaii Telescope)

[Finding a planet with a 10 years orbit in a few months](#) (17 July 2018)

Recent data from the Gaia mission was used to determine the diameter of the star referenced as EPIC248847494 and its distance, 1500 light-years away from the planet Earth. With that knowledge and the fact that the transit lasted 53 hours, it was found that the planet is located at 4.5 times the distance from the Sun to the Earth, and that consequently it takes about 10 years to orbit once. The key question left to answer was whether it was a planet and not a star. The Euler telescope of the UNIGE in Chile would provide the answer. By measuring the radial velocity of the star, which makes it possible to deduce the mass of the planet, it was shown that the mass of the object is less than 13 times that of Jupiter, well below the minimum mass of a star (at least 80 times the mass of Jupiter). (University of Geneva)

[TESS spacecraft starts science operations](#) (27 July 2018)

NASA's Transiting Exoplanet Survey Satellite has started its search for planets around nearby stars, officially beginning science operations on July 25, 2018. TESS is expected to transmit its first series of science data back to Earth in August, and thereafter periodically every 13.5 days, once per orbit, as the spacecraft makes its closest approach to Earth. The TESS Science Team will begin searching the data for new planets immediately after the first series arrives. (NASA Goddard)

FUTURE PLANNED MISSIONS

[British Spaceports Confirmed](#)(15 July 2018)

In 2014, eight sites were identified by the UK Space Agency as being possible locations for a British spaceport, all of which presented excellent cases to win the bid. Now it appears that the difficult decision will not have to be made, with an announcement that a vertical launch spaceport will be established in Sutherland, at the Northern edge of Scotland, with a development fund to support additional horizontal launch sites in Newquay, Glasgow, and Snowdonia. Following this release, Cornwall and Virgin Orbit announced a new partnership that could create up to 480 jobs and see launches within three years. <https://www.cornwalllive.com/news/cornwall-news/groundbreaking-spaceport-agreement-means-space-1788015> (Gov.UK)

[Orbex secures funding for UK space launch vehicles](#) (16 July 2018)

Orbex has announced that it has secured £30 million in public and private funding for the development of orbital space launch systems. Orbex will launch orbital vehicles from the newly-announced UK Vertical Launch spaceport in Sutherland in the Scottish Highlands as part of the main consortium. Orbex is constructing a completely re-thought and re-designed orbital launch vehicle, called Prime, to deliver small satellites into Earth's orbit. The Prime launcher has a novel architecture that eliminates the fundamental mass challenge of small launchers. Prime launchers are up to 30% lighter and 20% more efficient than any other vehicle in the small launcher category, packing more power per cubic litre than many heavy launchers. The Prime vehicle will launch satellites to altitudes up to 1,250km, inserting them into sun-synchronous or polar orbits. Minimising the environmental impact of launches was a key consideration in the rocket's design. Prime is a low-mass and low-carbon launcher, using a single renewable fuel, bio-propane, that cuts carbon emissions by 90% compared to old-

fashioned hydrocarbon fuels. The rocket uses a novel zero-shock staging system called Magic, which leaves zero orbital debris. It also features a novel reusability concept, with an innovative new low mass recovery and re-flight system. (Orbex)

[Harris Corporation to provide astronaut audio system for NASA's first human deep-space exploration mission](#) (17 July 2018)

Harris Corporation will provide the crucial audio communication system for NASA's first human deep-space exploration mission, scheduled to launch in 2022 onboard the Orion spacecraft. Orion is NASA's first spacecraft designed for long-duration, deep-space exploration by humans. Harris will deliver the audio system for Exploration Mission-2, the first crewed flight for the Orion spacecraft. The system, which will enable astronauts to communicate with each other and NASA, will feature audio control units (ACU), audio interface units (AIU) and a speaker unit (SPU). The ACU provides central audio control and signal processing; the AIU is the push to talk interface clipped to the spacesuit or shirt sleeve; and the SPU transmits voice communications, as well as caution and warning alarm tones, in the cabin. The audio system will be a crucial communications tool for astronauts on board this and future Orion missions, such as flights to Mars and beyond. (Harris)

[Orbital Micro Systems teams with Lockheed Martin on UK Space Agency pathfinder mission](#) (17 July 2018)

Orbital Micro Systems, in partnership with both Lockheed Martin and other UK-based firms, will create and fly a UK-built pathfinder spacecraft for an initial launch planned for the early 2020s. The mission payload will include OMS's miniaturized microwave radiometer instrument that provides highly accurate temperature, humidity, and precipitation data that will add to the vast array of weather observations taken every day. (Orbital Micro Systems)

GALAXIES

[The Gaia Sausage: the major collision that changed the Milky Way Galaxy](#) (4 July 2018)

An international team of astronomers has discovered an ancient and dramatic head-on collision between the Milky Way and a smaller object, dubbed the "Sausage" galaxy. The cosmic crash was a defining event in the early history of the Milky Way and reshaped the structure of our galaxy, fashioning both its inner bulge and its outer halo, the astronomers report in a series of new papers. The astronomers propose that around 8 billion to 10 billion years ago, an unknown dwarf galaxy smashed into our own Milky Way. The dwarf did not survive the impact: It quickly fell apart, and the wreckage is now all around us. (Simons Foundation)

[Young galaxy's halo offers clues to its growth and evolution](#) (25 July 2018)

The team used the Keck Cosmic Web Imager (KCWI) to take spectra of the Lyman alpha emission of BX418's halo. This allowed them to trace the gas, plot its velocity and spatial extent, then create a 3-D map showing the structure of the gas and its behaviour. The team's data suggests that the galaxy is surrounded by a roughly spherical outflow of gas and that there are significant variations in the density and velocity range of this gas. This analysis is the first of its kind. Because it has only been tested on one galaxy, other galaxies need to be studied to see if these results are typical. (WM Keck Observatory)

GAMMA RAY BURSTS

[LOFAR rapidly responds to mysterious astronomical events](#) (11 July 2018)

On 6 July 2018 ASTRON's Low Frequency Array (LOFAR) automatically responded to a transient astronomical event for the first time. A bright burst of gamma-rays was detected by a NASA satellite and an urgent message was sent to observatories on the ground. Within a few minutes, LOFAR stopped what it was doing and started a new observation of the exploding astrophysical object. This LOFAR rapid response mode is important to help identify the sources of mysterious short-duration astronomical events. Transient astronomical events are phenomena in the sky that last only a short amount of time, from milliseconds to hours. Examples of these events are gamma-ray bursts, or fast radio bursts.

(Netherlands Institute for Radio Astronomy)

[Enduring 'radio rebound' powered by jets from gamma-ray burst](#) (26 July 2018)

A star exploded into a supernova fueling a gamma-ray burst. Astronomers caught the enduring "afterglow" of one of these cataclysmic explosions with both ALMA and the VLA for the first time. The rebound, or reverse shock, triggered by the GRB's powerful jets slamming into surrounding debris, lasted thousands of times longer than expected, giving astronomers an unprecedented glimpse into the structure and dynamics of the jets.

(National Radio Astronomy Observatory)

INTERNATIONAL SPACE STATION

[Access your space experiment anywhere with ICE Cubes](#) (13 July 2018)

Europe's new commercial research facility on the International Space Station, called [ICE Cubes](#) or International Commercial Experiments Service, is inaugurating its new service with a special event in Belgium. With the first experiments installed, the service is ready to perform operations in orbit. The ICE Cubes facility in ESA's space laboratory Columbus offers plug-and-play installation for cube-sized experiments that relay experiment data back to Earth through the International Space Station's infrastructure. (ESA)

[NanoRacks completes 14th CubeSat deployment mission from International Space Station](#) (13 July 2018)

NanoRacks successfully completed the 14th CubeSat Deployment mission from the Company's commercially developed platform on the International Space Station. Having released nine CubeSats into low-Earth orbit, this mission marks NanoRacks' 185th CubeSat released from the Space Station, and 217th small satellite deployed by NanoRacks overall. (NanoRacks)

[Cygnus spacecraft successfully concludes ninth cargo supply mission to the International Space Station](#) (30 July 2018)

Northrop Grumman Corporation (NYSE: NOC) announced that its "S.S. J.R. Thompson" Cygnus™ spacecraft successfully completed its ninth cargo supply mission to the International Space Station under NASA's Commercial Resupply Services (CRS-1) contract. The spacecraft removed more than 6,600 pounds (over 3,000 kilograms) of disposable cargo, a new record for Cygnus. The "S.S. J.R. Thompson" also successfully executed secondary missions that included the demonstration of Cygnus' ability to re-boost the space station and

the deployment of six CubeSats into orbit from a NanoRacks CubeSat deployer.
(Northrop Grumman)

JUPITER AND MOONS

[Juno data indicate another possible volcano on Jupiter moon Io](#) (13 July 2018)

Data collected by NASA's Juno spacecraft using its Jovian InfraRed Auroral Mapper (JIRAM) instrument point to a new heat source close to the south pole of Io that could indicate a previously undiscovered volcano on the small moon of Jupiter. (JPL)

[A dozen new moons of Jupiter discovered, including one “oddball”](#) (16 July 2018)

Twelve new moons orbiting Jupiter have been found; 11 “normal” outer moons, and one that they’re calling an “oddball.” This brings Jupiter’s total number of known moons to a whopping 79; the most of any planet in our Solar System. This new “oddball” moon is more distant and more inclined than the prograde group of moons and takes about one and a half years to orbit Jupiter. So, unlike the closer-in prograde group of moons, this new oddball prograde moon has an orbit that crosses the outer retrograde moons.
(Carnegie Institution for Science)

[Radiation maps of Jupiter's moon Europa: key to future missions](#) (23 July 2018)

By studying material from the interior, scientists developing future missions hope to learn more about the possible habitability of Europa's ocean. However, Europa's surface is bombarded by a constant and intense blast of radiation from Jupiter. This radiation can destroy or alter material transported up to the surface, making it more difficult for scientists to know if it actually represents conditions in Europa's ocean. (JPL)

KUIPER BELT

[New Horizons team prepares for stellar occultation ahead of Ultima Thule flyby](#)

(31 July 2018)

Successfully observing an object from more than four billion miles away is difficult, yet NASA’s New Horizons mission team is banking that they can do that again. Preparations are on track for a final set of stellar occultation observations to gather as much information about the size, shape, environment, and other conditions around New Horizons’ next flyby target, the ancient Kuiper Belt object 2014 MU69, nicknamed Ultima Thule. The occultation team used data from the Hubble Space Telescope and European Space Agency’s Gaia satellite to pinpoint two roughly 18.5 miles (30 kilometre) strips on Earth where Ultima Thule will cast its shadow on August 4th. Telescopes will be placed at multiple points in those strips to attempt to observe the occultation when Ultima Thule passes in front of a star and momentarily blocks its light (Johns Hopkins University Applied Physics Laboratory)

LAUNCH SERVICES

[Largest-ever solid rocket motor poised for first hot firing](#) (9 July 2018)

The largest solid rocket motor ever built in one piece will be test fired at Europe’s Spaceport

in French Guiana for the first time. This important milestone validates the booster for use on Vega-C next year and on Ariane 6 from 2020. Fully loaded with solid fuel, the P120C rocket motor common to Europe's future launchers Vega-C and Ariane 6, will be held vertically in the test stand and ignited. Sensors will gather about 600 measures during the test. The P120C is 13.5 m long and 3.4 m in diameter, contains 142 tonnes of solid propellant and provides a maximum thrust of 4615 kN (in vacuum) over a burn time of about 135 s. (ESA)

[Hot firing proves solid rocket motor for Ariane 6 and Vega-C](#) (16 July 2018)

Hot firing of the P120C solid-propellant motor at Europe's Spaceport in French Guiana proves its flight-worthiness for use on Vega-C next year and on Ariane 6 from 2020. (ESA)

[NASA Armstrong contributing to AA-2](#) (20 July 2018)

(NASA Armstrong)

When the Orion spacecraft is on the launch pad preparing for liftoff atop the Space Launch System (SLS) rocket, the crew module will have a launch abort system (LAS) mounted on top. If there is a problem on the launch pad or during the first few minutes of the ascent to orbit, astronauts could use the system to separate from the rocket and escape to safety. NASA's Armstrong Flight Research Center has played a key role in developing systems and subsystems for an upcoming test of the LAS in 2019, called Ascent Abort-2 (AA-2).

MARS

[AeroVironment collaborating with NASA's Jet Propulsion Laboratory to build first drone - the Mars Helicopter - to fly on Mars](#) (3 July 2018)

Flying at nearly 100,000 feet on Earth is much like flying on the surface of Mars, same air density, so AeroVironment used airfoil design principles and simulation tools the technology company learned from record high-altitude flights and incorporated them into the Mars helicopter design. The Mars Helicopter effort also benefits from the ultra-lightweight and ultra-high-precision methods integral to the nano projects that have been developed in the laboratory. AeroVironment first developed subscale Mars helicopter prototypes to test and demonstrate the feasibility of lift in the thin Martian atmosphere. Then in May 2016, AeroVironment delivered to NASA/JPL a Mars Helicopter rotor and landing gear prototype that was integrated with a JPL-developed controller and demonstrated free flight in a simulated Mars atmosphere, proving that it is possible to fly on the Red Planet. Next, AeroVironment delivered major helicopter subsystems in the fall of 2017 for integration into Mars-representative engineering development models. (AeroVironment)

[InSight mission to Mars, CNES's SEIS seismometer is in good shape](#) (18 July 2018)

The spring and the pendulum mass are perfectly balanced. When the ground moves, the pendulum begins to move. This movement is registered by the DCS sensor. The balance mechanism can adjust the pendulum balance in real use conditions (poorly known gravity, levelling flaw, influence of the temperature on the pendulum balance). The pivot should enable the rotation of the mobile part around its axis without any friction. InSight is now about 18½ million kilometres from Earth. Mars is currently in opposition and on 30 July it will be only 57.6 million kilometres from Earth, almost as close as the record closest distance

during the historic opposition of 2003. The lander is 132 days away from setting down on Elysium Planitia on 26 November. (CNES)

[Martian atmosphere behaves as one](#) (18 July 2018)

A new study based on 10 years of data from the radar instrument on Mars Express now offers clear evidence of a sought-after link between the upper and lower atmospheres of the planet. While best known for probing the interior of Mars via radar sounding, the instrument has also gathered observations of the Martian ionosphere since it began operating in 2005. The lower and middle levels of Mars' atmosphere appear to be coupled to the upper levels: there's a clear link between them throughout the Martian year. (ESA)

[MAVEN spacecraft finds that "stolen" electrons enable unusual aurora on Mars](#)

(23 July 2018)

Mars has auroras and NASA's MAVEN spacecraft just found a new type of Martian aurora that occurs over much of the day side of the Red Planet, where auroras are very hard to see. Auroras flare up when energetic particles plunge into a planet's atmosphere, bombarding gases and making them glow. While electrons generally cause this natural phenomenon, sometime protons can elicit the same response, although it's rarer. Now, the MAVEN team has learned that protons were doing at Mars the same thing as electrons usually do at Earth, create aurora. This is especially true when the Sun ejects a particularly strong pulse of protons, which are hydrogen atoms stripped of their lone electrons by intense heat. The Sun ejects protons at speeds up to two million miles per hour (more than 3 million kilometers per hour) in an erratic flow called the solar wind. (NASA Goddard)

[Where Martian dust comes from](#) (24 July 2018)

The dust that coats much of the surface of Mars originates largely from a single thousand-kilometre-long geological formation near the Red Planet's equator. A study published in the journal Nature Communications found a chemical match between dust in the Martian atmosphere and the surface feature, called the Medusae Fossae Formation. Mars wouldn't be nearly this dusty if it wasn't for this one enormous deposit that is gradually eroding over time and polluting the planet. The science team looked at the dust's chemical composition. Landers and rovers far apart on the planet have all reported surprisingly similar data about the dust. Dust everywhere on the planet is enriched in sulfur and chlorine and it has this very distinct sulfur-to-chlorine ratio. They also studied data captured by the spacecraft Mars Odyssey, which has orbited the planet since 2001. The MFF region has an abundance of sulfur and chlorine, as well as a match to the ratio of sulfur to chlorine in Mars dust. Earlier findings suggest that the MFF had a volcanic origin. (Johns Hopkins University)

[Mars Express detects liquid water hidden under planet's south pole](#) (25 July 2018)

Ground-penetrating radar uses the method of sending radar pulses towards the surface and timing how long it takes for them to be reflected back to the spacecraft, and with what strength. The properties of the material that lies between influences the returned signal, which can be used to map the subsurface topography. The radar investigation shows that south polar region of Mars is made of many layers of ice and dust down to a depth of about 1.5 km in the 200 km-wide area analysed in this study. A particularly bright radar reflection underneath the layered deposits is identified within a 20 km-wide zone. Analysing the properties of the reflected radar signals and considering the composition of the layered deposits and expected

temperature profile below the surface, the scientists interpret the bright feature as an interface between the ice and a stable body of liquid water, which could be laden with salty, saturated sediments. For MARSIS to be able to detect such a patch of water, it would need to be at least several tens of centimetres thick. (ESA)

METEORITES AND METEORS

[Fragment of impacting asteroid recovered in Botswana](#) (6 July 2018)

The meteorite is one of the fragments of asteroid 2018 LA which collided with Earth on June 2, 2018 and turned into a meteor fireball that detonated over Botswana a few seconds after entering the atmosphere. The incident was witnessed by several spectators in Botswana and neighbouring countries and was captured on numerous security cameras. Asteroid 2018 LA was detected in space eight hours before hitting Earth. It was detected by the Catalina Sky Survey, operated by the University of Arizona and sponsored by NASA as part of its Planetary Defence mission. This is the third time in history that an asteroid inbound to hit Earth was detected early and only the second time that fragments were recovered. (University of Helsinki)

[Planetary defence has new tool in weather satellite lightning detector](#) (31 July 2018)

NASA's efforts to better understand asteroid impacts has found unexpected support from a new satellite sensor designed to detect lightning. New research published in the journal Meteoritics and Planetary Science finds that the new Geostationary Lightning Mapper, or GLM, on two weather satellites is able to pick up signals of meteors in Earth's atmosphere. (NASA Ames)

MOON

[The toxic side of the Moon](#) (4 July 2018)

When the Apollo astronauts returned from the Moon, the dust that clung to their spacesuits made their throats sore and their eyes water. Lunar dust is made of sharp, abrasive and nasty particles, but how toxic is it for humans? The “lunar hay fever”, as NASA astronaut Harrison Schmitt described it during the Apollo 17 mission created symptoms in all 12 people who have stepped on the Moon. From sneezing to nasal congestion, in some cases it took days for the reactions to fade. Inside the spacecraft, the dust smelt like burnt gunpowder. The Moon missions left an unanswered question of lunar exploration, one that could affect humanity's next steps in the Solar System: can lunar dust jeopardise human health? An ambitious ESA research programme with experts from around the planet is now addressing the issues related to lunar dust. Lunar dust has silicate in it, a material commonly found on planetary bodies with volcanic activity. Miners on Earth suffer from inflamed and scarred lungs from inhaling silicate. On the Moon, the dust is so abrasive that it ate away layers of spacesuit boots and destroyed the vacuum seals of Apollo sample containers. Fine like powder, but sharp like glass. The low gravity of the Moon, one sixth of what we have on Earth, allows tiny particles to stay suspended for longer and penetrate more deeply into the lung. Particles 50 times smaller than a human hair can hang around for months inside your lungs. The longer the particle stays, the greater the chance for toxic effects. The potential damage from inhaling

this dust is unknown but [research](#) shows that lunar soil simulants can destroy lung and brain cells after long-term exposure. (ESA)

[Astrobotic selects Dynetics as propulsion provider for the Peregrine lunar lander](#)

(17 July 2018)

During the 49th anniversary week of the historic Apollo 11 Moon landing Astrobotics has selected Dynetics of Huntsville, Alabama as the propulsion provider for its Peregrine Lunar Lander. Peregrine will return America to the Moon for the first time since Apollo and begin delivering customer payloads once a year starting in 2020. Dynetics will integrate Peregrine's main engines and attitude control thrusters, controller electronics, tanks, and feed system into a single system that performs all propulsive maneuvers from cruise to soft landing on the Moon. The Dynetics-led system will feature a propellant with a next-generation oxidizer called MON-25, which has a higher nitric oxide content to provide better thermal capability to operate more efficiently in deep space environments than previous oxidizers. (Astrobotic)

PLUTO

[First global maps of Pluto and Charon from New Horizons mission published](#) (13 July 2018)

The complexity of the Pluto system, from its geology to its satellite system to its atmosphere, has been beyond our wildest imagination. Everywhere we turn are new mysteries. These new maps from the landmark exploration of Pluto by NASA's New Horizons mission in 2015 will help unravel these mysteries and are for everyone to enjoy.

(Johns Hopkins University Applied Physics Laboratory)

SATELLITES

[Blue Canyon Technologies helps ASTERIA satellite point the way to discovering new planets](#) (9 July 2018)

The ASTERIA spacecraft, or the Arcsecond Space Telescope Enabling Research in Astrophysics satellite, has claimed the title of being the most accurately pointed small satellite on orbit. The 6U CubeSat, which was deployed into low-earth orbit (LEO) in November 2017, has already demonstrated the ability of miniaturized technology to operate properly on orbit and has become the first CubeSat to achieve sub-arcsecond pointing accuracy. ASTERIA is also one of the first 6U spacecraft to be deployed from the International Space Station. (Blue Canyon Technologies)

[Atos launches new VSAT monitoring and geolocation system to mitigate interference as space becomes more crowded](#) (12 July 2018)

Atos, a global leader in digital transformation, launches its new satellite monitoring and geolocation system which can detect, localize and mitigate interference from the ever-increasing number of small satellite carriers and devices (Very Small Aperture Terminal - VSAT). Named Atos SkyMon ILS (Interference Localization System) is the latest innovation resulting in reinforced capabilities in the space market. As, over the next couple of years thousands of powerful small satellites will be launched into Low Earth Orbit (LEO), detecting and localizing interference is therefore becoming more and more crucial. (Atos)

[NanoRacks completes fifth external Cygnus deployment, six more CubeSats in orbit](#)

(16 July 2018)

NanoRacks successfully deployed six CubeSats from the Company's CubeSat deployer mounted on the outside of the Cygnus spacecraft. This brings the overall count to 223 small satellites deployed into low-Earth orbit. Prior to launch, the [NanoRacks External Cygnus Deployer](#) is installed on the exterior of the Cygnus service module with the capability to deploy satellites after the spacecraft completes its primary space station commercial resupply mission. The Cygnus spacecraft was raised to over 480 kilometers after departing the International Space Station before the CubeSats were released. (NanoRacks)

[MDA to provide mission-critical sensors for the Space Drone on-orbit servicing spacecraft built by Effective Space](#)

(18 July 2018)

MDA announced that a contract was signed between its recently acquired Neptec UK Ltd. (Neptec) company and Effective Space, the UK company pioneering last-mile logistics in space, for the supply of a space flight LIDAR and infrared camera for its on-orbit servicing SPACE DRONE™ spacecraft. Capable of extending the life of ageing satellites by as many as 15 years, the SPACE DRONE™ spacecraft uses MDA's LIDAR and infrared camera to confidently and safely approach and dock with orbiting geostationary satellites. Two SPACE DRONE™ spacecraft will be launched into orbit in 2020 (MDA)

SOLAR SYSTEM

[Exoplanet detectives create catalog of 'light-fingerprints' of our own Solar System](#)

(31 July 2018)

Cornell researchers have created a reference catalog using calibrated spectra and geometric albedos (the light reflected by a surface) of 19 of the most diverse bodies in our solar system: all eight planets, from rocky to gaseous; nine moons, from frozen to lava spewing; and two dwarf planets, one in the asteroid belt (Ceres) and one in the Kuiper belt (Pluto). By comparing observed spectra and albedos of exoplanets to this catalog of our own home planetary system, scientists will be able to characterize them in reference to the wide range of icy, rocky and gaseous worlds in our home system. (Carl Sagan Institute)

SPACE

[Astroscale establishes S/X-band ground station optimized for low-earth orbit satellites to develop space debris removal services](#)

(4 July 2018)

ASTROSCALE Pte. Ltd. ("Astroscale"), an international company developing space debris removal services to secure long-term spaceflight safety and sustainability, has established a ground station in Totsuka, Yokohama for sending and receiving satellite data. This is the first ground station for the rapidly growing company and represents an important step towards its mission of monitoring and removing space debris. (Astroscale)

[Pair of colliding stars spill radioactive molecules into space](#)

(30 July 2018)

Astronomers have made the first definitive detection of a radioactive molecule in interstellar space: a form, or isotopologue of aluminium monofluoride (26AlF). The new data, made with

ALMA and the NOEMA radio telescopes, reveal that this radioactive isotopologue was ejected into space by the collision of two stars, a tremendously rare cosmic event that was witnessed on Earth as a “new star,” or nova, in the year 1670.
(National Radio Astronomy Observatory)

STARS AND STAR CLUSTERS

[X-ray data may be first evidence of a star devouring a planet](#) (18 July 2018)

Physicists have observed the star, named RW Aur A, using NASA’s Chandra X-Ray Observatory. They’ve found evidence for what may have caused its most recent dimming event: a collision of two infant planetary bodies, which produced in its aftermath a dense cloud of gas and dust. As this planetary debris fell into the star, it generated a thick veil, temporarily obscuring the star’s light. (MIT)

SUB ORBITAL SPACE

[NASA selects US firms to provide commercial suborbital flight services](#) (31 July 2018)

NASA’s Flight Opportunities Program has selected four companies to integrate and fly technology payloads on commercial suborbital reusable platforms that carry payloads near the boundary of space. The selection is part of NASA's continuing effort to foster a viable market for American commercial reusable suborbital platforms that allow testing of new space technologies within Earth's atmosphere. The five-year contracts have a combined potential contract value of \$45 million. The flights will carry a variety of payloads to help meet the agency's research and technology needs. The selected companies are: Aerostar International (Raven Aerostar), Sioux Falls, South Dakota; Blue Origin Texas, LLC, Van Horn, Texas; Up Aerospace Inc., Littleton, Colorado; World View Enterprises, Inc., Tucson, Arizona. (NASA)

SUN

[Cutting-edge heat shield installed on NASA’s Parker Solar Probe](#) (5 July 2018)

The launch of Parker Solar Probe, the mission that will get closer to the Sun than any human-made object has ever gone, is quickly approaching, and on June 27, 2018, Parker Solar Probe’s heat shield, called the Thermal Protection System, or TPS, was installed on the spacecraft. A mission 60 years in the making, Parker Solar Probe will make a historic journey to the Sun’s corona, a region of the solar atmosphere. With the help of its revolutionary heat shield, now permanently attached to the spacecraft in preparation for its August 2018 launch, the spacecraft’s orbit will carry it to within 4 million miles of the Sun's fiercely hot surface, where it will collect unprecedented data about the inner workings of the corona.
(NASA Goddard)

[Blue crystals in meteorites show that our Sun went through the “terrible twos”](#) (30 July 2018)

Our Sun’s beginnings are a mystery. It burst into being 4.6 billion years ago, about 50 million years before the Earth formed. Since the Sun is older than the Earth, it’s hard to find physical objects that were around in the Sun’s earliest days, materials that bear chemical records of the

early Sun. But in a new study in *Nature Astronomy*, ancient blue crystals trapped in meteorites reveal what the early Sun was like. And apparently, it had a pretty rowdy start. The Sun was very active in its early life, it had more eruptions and gave off a more intense stream of charged particles. Almost nothing in the Solar System is old enough to really confirm the early Sun's activity, but these minerals from meteorites in the Field Museum's collections are old enough. They're probably the first minerals that formed in the Solar System. The minerals looked at are microscopic ice-blue crystals called hibonite, and their composition bears earmarks of chemical reactions that only would have occurred if the early Sun was spitting lots of energetic particles. These crystals formed over 4.5 billion years ago and preserve a record of some of the first events that took place in our Solar System. And even though they are so small, many are less than 100 microns across, they were still able to retain these highly volatile noble gases that were produced through irradiation from the young Sun such a long time ago (Field Museum)

TECHNOLOGY

[Combined orbital Galileo-GPS position fix achieved aboard ISS](#) (2 July 2018)

Europe's satellite navigation system Galileo is already in use worldwide, usable by itself or in combination with the US Global Positioning System (GPS). Now a combined Galileo-GPS positioning fix has been achieved in space, aboard the International Space Station, through an ESA-NASA collaboration. Work has started to determine whether we can use Galileo, in combination with GPS and other systems, for navigation to the Moon (ESA)

[Giant satellite fuel tank sets new record for 3-D printed space parts](#) (11 July 2018)

Lockheed Martin has embraced a 3-D printed titanium dome for satellite fuel tanks so big you can't even put your arms around it. The 46-inch- (1.16-meter-) diameter vessel completed final rounds of quality testing this month, ending a multi-year development program to create giant, high-pressure tanks that carry fuel on board satellites. The titanium tank consists of three parts welded together: two 3-D printed domes that serve as caps, plus a variable-length, traditionally-manufactured titanium cylinder that forms the body. (Lockheed Martin)

[Blue Origin Mission 9: safe escape in any phase of flight](#) (18 July 2018)

Blue Origin, owned by Amazon founder Jeff Bezos, plans to someday carry people into space. The *New Shepard* system is a fully reusable vertical takeoff, vertical landing (VTVL) space vehicle. New Shepard flew for the ninth time on July 18, 2018. During this mission, known as Mission 9 (M9), the escape motor was fired shortly after booster separation. The Crew Capsule was pushed hard by the escape test and we stressed the rocket to test that astronauts can get away from an anomaly at any time during flight. The mission was a success for both the booster and capsule. Most importantly, astronauts would have had an exhilarating ride and safe landing. (Blue Origin)

[Next-generation photodetector camera to deploy during robotic servicing demonstration mission](#)

(31 July 2018) An advanced, highly compact thermal camera that traces its heritage to one now flying on NASA's [Landsat 8](#) has been mounted in a corner of the RRM3 payload and from that position will image and videotape Earth's surface below once the SpaceX Dragon resupply vehicle delivers the payload to the orbiting outpost in November. While

RRM3 demonstrates its specially developed satellite-servicing tools developed by NASA's Satellite Servicing Projects Division, its hitchhiker companion, the Compact Thermal Imager, or CTI, will image and measure fires, ice sheets, glaciers, and snow surface temperatures. CTI will also measure the transfer of water from soil and plants into the atmosphere, important measurements for understanding plant growth. Many of the conditions that Earth scientists study, including these, are easily detected in the infrared or thermal wavelength bands. (NASA Goddard)

TELESCOPES

[Japan's VERA telescope granted SKA pathfinder status](#) (3 July 2018)

In operation since 2003, VERA uses Very Long Baseline Interferometry (VLBI) to explore the three-dimensional structure of the Milky Way based on high-precision astrometry of Galactic maser sources. It comprises four Cassegrain antennas each measuring 20 metres in diameter. VERA joins more than a dozen pathfinder facilities around the globe which are contributing to SKA-related technology and science. Pathfinder telescopes provide valuable information to teams working on the design of the SKA, but unlike precursors they are not located at SKA sites. VERA mainly performs K (22 GHz) and Q (43 GHz) band VLBI observations. Therefore, science cases at such high frequencies will be intensively developed with VERA. In future, VERA could enhance SKA VLBI capabilities, providing SKA-mid instrument with the intercontinental, longest baseline. Such a potential will also improve the value of the SKA. (SKA)

[First laser light for GRACE Follow-On](#) (2 July 2018)

The laser ranging interferometer (LRI) instrument has been successfully switched on aboard the recently launched twin U.S./German Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) satellites. The LRI, which is being flown as a technology demonstration, has made its first measurements in parallel with GRACE-FO's main microwave ranging instrument. Initial comparisons of the data from the two types of instruments show that they agree as expected. The LRI is a breakthrough for precision distance measurements in space. It's the first inter-spacecraft laser interferometer. The GRACE-FO mission, launched on May 22, continues the work of the original GRACE mission of monitoring phenomena such as the melting of ice sheets and changes in groundwater levels by tracking the changing pull of gravity on the GRACE-FO satellites. The microwave ranging interferometer records these changes in gravity by measuring how they change the distance between the twin spacecraft. By accurately measuring these minute changes as the two space-craft orbit the planet, scientists are able to calculate month-to-month variations in Earth's gravity field. (JPL)

[MeerKAT radio telescope inaugurated in South Africa](#) (13 July 2018)

After a decade in design and construction, this project of South Africa's Department of Science and Technology has now begun science operations. At the launch event, a panorama obtained with the new telescope was unveiled that reveals extraordinary detail in the region surrounding the supermassive black hole at the centre of our Milky Way Galaxy. This is one of several very exciting new views of the Universe already observed by the telescope. (South African Radio Astronomy Observatory)

UNIVERSE

[Distant quasar providing clues to early-universe conditions](#) (9 July 2018)

Astronomers using the National Science Foundation's Very Long Baseline Array (VLBA) have made an image revealing tantalizing details of a quasar nearly 13 billion light-years from Earth, an object that may provide important clues about the physical processes at work in the Universe's first galaxies. The scientists studied a quasar called PSO J352.4034-15.3373 (P352-15), an unusually bright emitter of radio waves for an object so distant. The extremely sharp radio "vision" of the VLBA showed the object split into three major components, two of which show further subdivision. The components are spread over 5,000 light-years.

Quasars are galaxies with supermassive black holes at their cores, black holes millions or billions of times more massive than the Sun. The powerful gravitational pull of such a black hole draws in nearby material, which forms a rotating disk around the massive object. The rapidly-spinning disk spews jets of particles moving outward at speeds approaching that of light. These energetic "engines" are bright emitters of light and radio waves. This is the most detailed image yet of such a bright galaxy at this great distance. We are seeing P352-15 as it was when the Universe was less than a billion years old, or only about 7 percent of its current age. This is near the end of a period when the first stars and galaxies were re-ionizing the neutral hydrogen atoms that pervaded intergalactic space. Further observations may allow us to use this quasar as a background 'lamp' to measure the amount of neutral hydrogen remaining at that time. (NRAO)

Pat Williams July 2018