

Space News Update – August 2018

By Pat Williams

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

NASA'S INSIGHT PASSES HALFWAY TO MARS, INSTRUMENTS CHECK IN



This artist's concept shows the InSight spacecraft, encapsulated in its aeroshell, as it cruises to Mars. Image Credit: NASA/JPL-Caltech

NASA's InSight spacecraft, en route to a Nov. 26 landing on Mars, passed the halfway mark on Aug. 6. All of its instruments have been tested and are working well. As of Aug. 20, the spacecraft had covered 172 million miles (277 million kilometers) since its launch 107 days ago. In another 98 days, it will travel another 129 million miles (208 million kilometers) and touch down in Mars' Elysium Planitia region, where it will be the first mission to study the Red Planet's deep interior. InSight stands for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport. InSight's seismometer, which will be used to detect quakes on Mars, received a clean bill of health on July 19. The SEIS instrument (Seismic Experiment for Interior Structure) is a six-sensor seismometer combining two types of sensors to measure ground motions over a wide range of frequencies. The team also checked an instrument that will measure the amount of heat escaping from Mars. InSight's Heat Flow and Physical Properties Package (HP3) instrument will use a self-hammering mechanical mole burrowing to a depth of 10 to 16 feet (3 to 5 meters). The third of InSight's three main investigations, Rotation and Interior Structure Experiment (RISE), uses the spacecraft's radio connection with Earth to assess perturbations of Mars' rotation axis. (JPL) [NASA's InSight passes halfway to Mars, instruments check in](#) (20 August 2018)

NASA, ULA LAUNCH PARKER SOLAR PROBE ON JOURNEY TO TOUCH SUN



Launch of the Parker Solar Probe Image Credit & Copyright: [John Kraus](#)

NASA's Parker Solar Probe (PSP) launched from Florida to begin its journey to the Sun, where it will undertake a landmark mission. The spacecraft will transmit its first science observations in December. Parker Solar Probe carries four instrument suites designed to study magnetic fields, plasma and energetic particles, and capture images of the solar wind. Throughout its seven-year mission, Parker Solar Probe will make seven Venus flybys and 24 total passes by the Sun, journeying steadily closer to the Sun until it makes its closest approach at 3.8 million miles. Parker Solar Probe's launch window to its planned orbit occurred, in part, at night, but also because most PSP instruments will operate in the shadow of its shield, in effect creating its own perpetual night near the Sun. Before then, years will pass as the PSP sheds enough orbital energy to approach the Sun, swinging past Venus seven times. Eventually, the PSP is scheduled to pass dangerously close to the Sun, within 9 solar radii, the closest ever. This close, the temperature will be 1,400 degrees Celsius on the day side of the PSP's Sun shield, hot enough to melt many forms of glass. On the night side, though, it will be near room temperature. A major goal of the PSP's mission to the Sun is to increase humanity's understanding of the Sun's explosions that impact Earth's satellites and power grids. Pictured is the night launch of the PSP aboard the United Launch Alliance' Delta IV Heavy rocket early Sunday morning. (APOD)

Parker Solar Probe will set its sights on the corona to solve long-standing, foundational mysteries of our Sun. What is the secret of the scorching corona, which is more than 300 times hotter than the Sun's surface, thousands of miles below? What drives the supersonic solar wind – the constant stream of solar material that blows through the entire solar system? And finally, what accelerates solar energetic particles, which can reach speeds up to more than half the speed of light as they rocket away from the Sun?

[NASA, ULA launch Parker Solar Probe on journey to touch Sun](#) (12 August 2018)

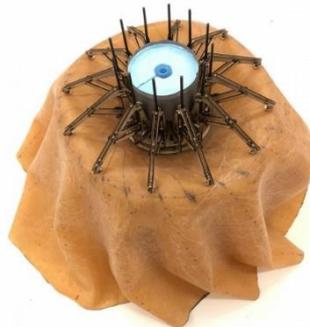
NASA INVESTMENT IN CHOLERA FORECASTS HELPS SAVE LIVES IN YEMEN



*The United Nations Children's Fund (UNICEF), with support from U.K. Aid, distributes clean water and information about cholera to prevent outbreaks of the disease in Yemen. Humanitarian teams in Yemen are targeting areas identified by a NASA-supported project that precisely forecasts high-risk regions based on environmental conditions observed from space.
Credits: UNICEF*

The NASA forecast tool divides the entire country of Yemen into regions about the size of a typical U.S. county, and predicts the risk of cholera outbreaks in each region. To calculate the likelihood of an outbreak, the science team runs a computer model that combines satellite observations of environmental conditions that affect the cholera bacteria with information on sanitation and clean water infrastructure. The forecast tool analyzes a variety of NASA satellite observations, including precipitation data from the Global Precipitation Measurement mission, air and ocean temperatures from the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments on NASA's Terra and Aqua satellites, as well as measurements of phytoplankton concentrations in nearby coastal ocean areas. (NASA) [NASA investment in cholera forecasts helps save lives in Yemen](#) (27 August 2018)

SPINNING HEAT SHIELD FOR FUTURE SPACECRAFT

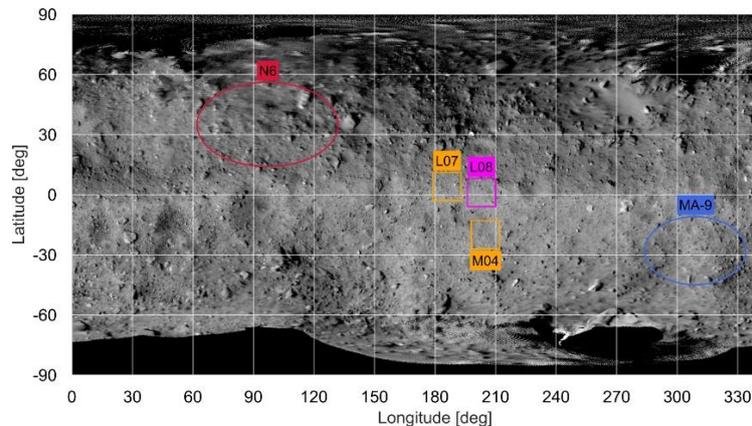


A flexible heat shield that is shaped like a skirt and spins like a sycamore seed. Credit: University of Manchester

A University of Manchester PhD student has developed a prototype flexible heat shield for spacecraft that could reduce the cost of space travel and even aid future space missions to Mars. Heat shields are essentially used as the brakes to stop spacecraft burning up and crashing on entry and re-entry into a planet's atmosphere. This design is the first in the world to utilise centrifugal forces that stiffen lightweight materials to prevent burnup. Current spacecraft heat shield methods include huge inflatables and mechanically deployed structures that are often heavy and complicated to use.

[Spinning heat shield for future spacecraft](#) (9 August 2018)

NEXT FOR MASCOT: A SOUTHERN LOCATION, PLEASANT TEMPERATURES AND A BEAUTIFUL VIEW



Not too hot and not too cold. Not too many boulders, nor too few. Easily accessible and scientifically exciting. Meeting the requirements that the [Mobile Asteroid Surface Scout \(MASCOT\)](#) team had for the landing site on the asteroid Ryugu was no easy task. "However, we have now decided on an almost perfect landing site. In consultation with more than 100 international and national partners, the MASCOT landing site was selected from 10 potential candidates. MASCOT's landing is scheduled for 3 October 2018. The locations at which the Hayabusa2 probe is expected to take soil samples have also been designated, as have the sites where the three MINVERVA-II rovers will be placed on the asteroid's surface. Located at approximately 315 degrees east and 30 degrees south, the place at which MASCOT is supposed to land on the primordial celestial body and carry out measurements on the asteroid's surface using four instruments is, at the moment, still simply called 'MA-9'. The landing site area has several advantages. Firstly, it is far enough from the regions in which Hayabusa2 will descend to the surface and take soil samples, in this way, MASCOT and Hayabusa2 will not get in each other's way as they perform their activities. Secondly, the landing site lies in Ryugu's southern hemisphere, so with the data collected by Hayabusa2 at the equator and MINERVA in the northern hemisphere, scientists will be able to gain good coverage of and investigate the 950-metre-diameter asteroid. (DLR)

[Next stop for MASCOT: A southern location, pleasant temperatures and a beautiful view](#)
(23 August 2018)

MAPPING THE UNIVERSE IN 3-D: FERMILAB CONTRIBUTES TO THE DARK ENERGY SPECTROSCOPIC INSTRUMENT



The Dark Energy Spectroscopic Instrument will attach to the Mayall Telescope at Kitt Peak National Observatory, shown here. Credit: Marilyn Chung/Lawrence Berkeley National Laboratory

In 1998, scientists discovered that the universe's expansion is accelerating. Physicists don't know how or why the universe is accelerating outward, but they gave the mysterious force

behind this phenomenon a name: dark energy. Scientists know a great deal about the effects of dark energy, but they don't know what it is. Cosmologists approximate that 68 percent of the universe's total energy must be made of the stuff. One way to get a better handle on dark energy and its effects is to create detailed maps of the universe, plotting its expansion. Scientists, engineers and technicians are currently building the Dark Energy Spectroscopic Instrument, or DESI, to do just that. DESI will help create the largest 3-D map of galaxies to date, one that will span a third of the entire sky, stretch back 11 billion light-years, and record approximately 35 million galaxies and quasars. It will measure the spectra of light emanating from galaxies to determine their distances from Earth. Other surveys have created maps that locate galaxies' lateral positions in the sky, but scientists using DESI will be able to take more precise measurements of their distance from us, creating high-resolution, 3-D maps. DESI is currently being installed at the Mayall 4-Meter Telescope at Kitt Peak National Observatory in Tucson, Arizona. Once installation is complete, it will run for five years. (Fermilab)

[Mapping the universe in 3-D: Fermilab contributes to the Dark Energy Spectroscopic Instrument](#) (13 August 2018)

LINKS TO OTHER SPACE NEWS PUBLISHED IN AUGUST 2018

ASTEROIDS

[SSL expands scope of work for NASA asteroid exploration mission Psyche](#) (9 August 2018)
[SSL](#), a Maxar Technologies company and a leading provider of innovative satellites and spacecraft systems, announced that it was selected by [Zin Technologies](#) to build and test the Psyche Compute Element. This critical flight system component was designed by [NASA's Jet Propulsion Laboratory](#) for Psyche, a NASA Discovery Mission, which will investigate a metal asteroid that is expected to offer insight into how our planet formed. (SSL)

[Three landing sites selected for Hayabusa2 mission to explore asteroid Ryugu](#)
(23 August 2018)

The JAXA project team selected and approved the three final sites for sample collection by Hayabusa2 and landing by MASCOT and MINERVA II. Again, CNES's expertise proved crucial here as Ryugu is a particularly inhospitable place strewn with rocks that will make touching its surface a highly risky proposition for Hayabusa2. Two back-up sites have therefore been identified. The target landing site for MASCOT is in the asteroid's southern hemisphere and has been provisionally named MA-9. This site fulfils the technical criteria required for MASCOT to be able to operate as planned, notably with regard to the thermal environment, illumination conditions and the radiofrequency link with the probe, and it in no way impinges on the sites selected by JAXA for Hayabusa-2 and MINERVA II operations. The science teams for the MicrOmega, MASMAG, MASCAM and MARA instruments are also convinced of the science value of the zone selected, despite the different requirements of each instrument. MASCOT is scheduled to separate from its 'mothership' and land on Ryugu in the early hours of 3 October (CET). Wherever MASCOT comes to a stop after bouncing on the surface, it is sure to make fascinating discoveries. (CNES)

[OSIRIS-REx begins asteroid operations campaign](#) (24 August 2018)

After an almost two-year journey, NASA's asteroid sampling spacecraft, the Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx),

caught its first glimpse of asteroid Bennu last week and began the final approach toward its target. Kicking off the mission's asteroid operations campaign on Aug. 17. During the mission's approach phase, OSIRIS-REx will: regularly observe the area around the asteroid to search for dust plumes and natural satellites, and study Bennu's light and spectral properties; execute a series of four asteroid approach maneuvers, beginning on Oct. 1, slowing the spacecraft to match Bennu's orbit around the Sun; jettison the protective cover of the spacecraft's sampling arm in mid-October and subsequently extend and image the arm for the first time in flight; and use OCAMS to reveal the asteroid's overall shape in late-October and begin detecting Bennu's surface features in mid-November. (NASA Goddard)

ASTROPHYSICS

[Students digging into data archive spot mysterious X-ray source](#) (10 August 2018)

Six students analysed about 200 X-ray sources, looking at their light curve and checking the scientific literature to verify whether they had been studied already. They identified a handful of sources exhibiting interesting properties, a powerful flare, for example, that had not been previously reported by other studies. Featuring the shortest flare of all analysed objects, this source appears to be located in the globular cluster NGC 6540. The source identified by the students displays brightness changes like no other known objects. An otherwise low luminosity source of X-rays, XMM-Newton saw it brighten by up to 50 times its normal level in 2005, and quickly fall again after about five minutes. (ESA)

[Measurements of the Earth's magnetosphere promise better space weather forecasts](#)

(10 August 2018)

A Japan-based research team led by Kanazawa University equipped the Arase satellite with sensors to study the convoluted interactions between high-energy particles in the inner magnetosphere and the Earth's electric and magnetic field. They have collected their first set of data from the satellite and from ground-based sensors, which they will soon analyze. Their approach promises to provide better predictions of harmful bursts of high-energy particles from the magnetosphere. (Kanazawa University)

[Light from ancient quasars helps confirm quantum entanglement](#) (19 August 2018)

Last year, physicists provided strong support for quantum entanglement, the seemingly far-out idea that two particles, no matter how distant from each other in space and time, can be inextricably linked, in a way that defies the rules of classical physics. Take, for instance, two particles sitting on opposite edges of the universe. If they are truly entangled, then according to the theory of quantum mechanics their physical properties should be related in such a way that any measurement made on one particle should instantly convey information about any future measurement outcome of the other particle, correlations that Einstein sceptically saw as "spooky action at a distance." In the 1960s, the physicist John Bell calculated a theoretical limit beyond which such correlations must have a quantum, rather than a classical, explanation. Now, the same team has vastly extended the case for quantum entanglement and further restricted the options for the freedom-of-choice loophole. The researchers used distant quasars, one of which emitted its light 7.8 billion years ago and the other 12.2 billion years ago, to determine the measurements to be made on pairs of entangled photons. They found correlations among more than 30,000 pairs of photons, to a degree that far exceeded the limit that Bell originally calculated for a classically based mechanism. (MIT)

EARTH

[SSTL and NOC launch first global GNSS-Reflectometry ocean wind data service](#)

(1 August 2018)

The first global GNSS-Reflectometry ocean wind data service has been launched by Surrey Satellite Technology Ltd (SSTL) together with partner the National Oceanography Centre (NOC), and with support from the European Space Agency. The data service is free and is hosted on the website www.merrbys.co.uk where users can access measurements of wind taken by a specially designed Global Navigation Satellite Systems (GNSS) receiver hosted on SSTL's TechDemoSat-1 satellite, which collects GNSS signals, such as GPS, reflected off the surface of the ocean. TechDemoSat-1 is also collecting GNSS reflections off land and polar regions, opening the door for new applications of this technology, such as soil moisture and ice measurements. (SSTL)

[Success in major testing milestone for Sentinel space mission](#) (2 August 2018)

A model of future European space mission, Sentinel-5 has successfully completed thermal testing in our world-class space test facility in Oxfordshire. This essential step will allow the Earth Observation project to progress to the next stages of testing in preparation for the instrument to eventually go into orbit in space. The model is built to test the mechanical and thermal design under the same conditions the instrument will encounter in orbit. Sentinel-5 is dedicated to monitoring air pollution to study our planet's climate and atmosphere in greater detail than before. Once in orbit it will work alongside other instruments on board to collect data that will ultimately help improve weather forecasts and to better understand our changing climate. (STFC)

[New kind of aurora is not an aurora at all](#) (20 August 2018)

The study's results suggest STEVE is an entirely new phenomenon distinct from typical auroras. The POES-17 satellite detected no charged particles raining down to the ionosphere during the STEVE event, which means it is likely produced by an entirely different mechanism, according to the authors. The researchers said STEVE is a new kind of optical phenomenon they call "skyglow." Their next step is to see whether the streams of fast ions and hot electrons in the ionosphere are creating STEVE's light, or if the light is produced higher up in the atmosphere. (American Geophysical Union)

[NASA launching advanced laser to measure Earth's changing ice](#) (22 August 2018)

Next month, NASA will launch into space the most advanced laser instrument of its kind, beginning a mission to measure changes in the heights of Earth's polar ice. NASA's Ice, Cloud and land Elevation Satellite-2 (ICESat-2) will measure the average annual elevation change of land ice covering Greenland and Antarctica to within the width of a pencil, capturing 60,000 measurements every second. The new observational technologies of ICESat-2 will advance our knowledge of how the ice sheets of Greenland and Antarctica contribute to sea level rise. ICESat-2 will extend and improve upon NASA's 15-year record of monitoring the change in polar ice heights, which started in 2003 with the first ICESat mission and continued in 2009 with NASA's Operation IceBridge, an airborne research campaign that kept track of the accelerating rate of change. (NASA)

[Another successful launch by Arianespace and Vega for ESA and sustainable development](#)

(22 August 2018)

Arianespace has launched the European Space Agency's (ESA) Aeolus satellite, the first space mission designed to acquire profiles of Earth's winds on a global scale. (Arianespace)

[Teledyne e2v ultraviolet laser detector technology deployed on ESA's Aeolus Satellite to profile the world's winds](#) (23 August 2018)

Teledyne e2v provided a key component for the highly customized ultraviolet laser detector for the Atmospheric Laser Doppler Instrument (ALADIN) on the European Space Agency's Aeolus Satellite that launched yesterday. Teledyne e2v developed a unique Charge Coupled Device (CCD) type detector specifically for the mission. The CCD69 ultraviolet detector blasted off into space, as part of a unique satellite named Aeolus, marking the conclusion of a sixteen-year project for ESA. Its mission is to gather wind data profiles of the Earth. The data will improve the accuracy of global weather forecasts. (Teledyne e2v)

[RemoveDEBRIS mission completes in-orbit commissioning](#) (23 August 2018)

The RemoveDEBRIS mission will perform four innovative Active Debris Removal (ADR) experiments, beginning in October with the deployment of a net developed by Airbus in Bremen which has been designed to capture a target cubesat. The mission is then scheduled to test a vision-based navigation system from Airbus in Toulouse and CSEM in Switzerland that uses 2D and 3D LiDaR (light detection and ranging) technology to track a cubesat released from the main spacecraft. Early in 2019 a harpoon developed by Airbus in Stevenage will be fired at 20 metres/second to penetrate a target made of composite material. Finally, the RemoveDEBRIS craft will deploy a large dragsail to speed de-orbit into the Earth's atmosphere. (SSTL)

[Installation of DLR's hyperspectral camera in space](#) (27 August 2018)

Its view of Earth will be something special: The DESIS hyperspectral instrument has 235 spectral channels to look at our planet and observe the changes in land and water surfaces. The instrument equipped with a robotic arm was taken out of the airlock of the International Space Station (ISS) and installed on the MUSES platform located on the space station's exterior. The hyperspectral data obtained from space is expected to deliver information for environmental monitoring, among other uses. With this data, for example, we can recognise whether the plants in a field on Earth are in a state of stress at a given point in time from a distance of 400 kilometres. This will allow us to look at the world from a new perspective and thereby benefit our society through this view from space. (DLR)

[Space sector to benefit from multi-million pound work on UK alternative to Galileo](#)

(29 August 2018)

UK industry will benefit from a £92 million injection to design a national alternative to the EU's Galileo satellite system, ensuring UK security post Brexit. (HM Government)

EXOPLANETS

[Northrop Grumman-built and operated planet-seeking spacecraft begins multi-year mission](#)

(2 August 2018)

Northrop Grumman Corporation announced that NASA's Transiting Exoplanet Survey Satellite (TESS) has successfully reached its desired stable orbit and begun science operations. The spacecraft was built and operated by Northrop Grumman. The TESS spacecraft instrument is the set of four wide-field cameras designed and built by MIT and MIT Lincoln Lab. The principal goal of the TESS mission is to use its cameras to detect planets around bright host stars in the solar neighbourhood so that detailed characterizations of the planets and their atmospheres can be performed through follow-up observations from telescopes on Earth and in space. As the first-ever satellite to perform an exoplanet survey of

nearly the entire sky, TESS will identify planets ranging from Earth-sized to Jupiter-sized, orbiting a wide range of stellar types at various orbital distances. (Northrop Grumman)

[VLA detects possible extrasolar planetary-mass magnetic powerhouse](#) (2 August 2018)

The strange object, called SIMP J01365663+0933473 is right at the boundary between a planet and a brown dwarf; a semi-stellar object, made up mostly of hydrogen, that straddles the line between a massive Jupiter-like planet and a low-mass red dwarf star. A brown dwarf, however, has insufficient mass to sustain nuclear fusion or 'failed star. Brown dwarfs are objects too massive to be considered planets, yet not massive enough to sustain nuclear fusion of hydrogen in their cores, the process that powers stars. The difference between a gas giant planet and a brown dwarf remains hotly debated among astronomers, but one rule of thumb that astronomers use is the mass below which deuterium fusion ceases, known as the "deuterium-burning limit", around 13 Jupiter masses. Last year, an independent team of scientists discovered that SIMP J01365663+0933473 was part of a very young group of stars. Its young age meant that it was in fact so much less massive that it could be a free-floating planet, only 12.7 times more massive than Jupiter, with a radius 1.22 times that of Jupiter. At 200 million years old and 20 light-years from Earth, the object has a surface temperature of about 825 degrees Celsius. By comparison, the Sun's surface temperature is about 5,500 degrees Celsius. (NRAO)

[Water is destroyed, then reborn in ultrahot Jupiters](#) (9 August 2018)

Imagine a place where the weather forecast is always the same: scorching temperatures, relentlessly sunny, and with absolutely zero chance of rain. This hellish scenario exists on the permanent daysides of a type of planet found outside our solar system dubbed an "ultrahot Jupiter." These worlds orbit extremely close to their stars, with one side of the planet permanently facing the star. What has puzzled scientists is why water vapor appears to be missing from the toasty worlds' atmospheres, when it is abundant in similar but slightly cooler planets. Observations of ultrahot Jupiters by NASA's Spitzer and Hubble space telescopes, combined with computer simulations, have served as a springboard for a new theoretical study that may have solved this mystery. According to the new study, ultrahot Jupiters do in fact possess the ingredients for water (hydrogen and oxygen atoms). But due to strong irradiation on the planet's daysides, temperatures there get so intense that water molecules are completely torn apart. (JPL)

[Iron and titanium in the atmosphere of an exoplanet](#) (15 August 2018)

KELT-9 is a star located 650 light years from Earth in the constellation Cygnus (the Swan). With a temperature of over 10,000 degrees, it is almost twice as hot as the Sun. This star is orbited by a giant gas planet, KELT-9b, which is 30 times closer than the Earth's distance from the Sun. Because of this proximity, the planet circles its star in 36 hours and is heated to a temperature of over 4,000 degrees. It's not as hot as the Sun, but hotter than many stars. Using the HARPS-North spectrograph, astronomers discovered a strong signal corresponding to iron vapour in the planet's spectrum. The team also detected the signature of another metal in vapour form: titanium. (University of Geneva)

[Infant exoplanet weighed by Hipparcos and Gaia](#) (20 August 2018)

The mass of a very young exoplanet has been revealed for the first time using data from ESA's star mapping spacecraft Gaia and its predecessor, the quarter-century retired Hipparcos satellite. Astronomers deduced the mass of the planet Beta Pictoris b from the motion of its host star over a long period of time as captured by both Gaia and Hipparcos.

The planet is a gas giant similar to Jupiter but, according to the new estimate, is 9 to 13 times more massive. (ESA)

[NASA researchers find evidence of planet-building clumps](#) (21 August 2018)

A new paper from planetary scientists provides evidence for an astrophysical theory called “pebble accretion” where golf ball-sized clumps of space dust came together to form tiny planets, called planetesimals, during the early stages of planetary formation. This research provides the first direct evidence supporting this theory. There have been a lot of theories about planetesimal formation, but many have been stymied by a factor called the ‘bouncing barrier’. (NASA)

FUTURE PLANNED MISSIONS

[Lockheed Martin begins final assembly on NASA's Orion spaceship that will take astronauts further than ever before](#) (28 August 2018)

Technicians have completed construction on the spacecraft capsule structure that will return astronauts to the Moon and have successfully shipped the capsule to Florida for final assembly into a full spacecraft. The capsule structure, or pressure vessel, for NASA's [Orion](#) Exploration Mission-2 ([EM-2](#)) spacecraft was [welded together](#) over the last seven months by Lockheed Martin (NYSE: LMT) technicians and engineers. Orion is the world's only exploration-class spaceship, and the EM-2 mission will be its first flight with astronauts on board, taking them farther into the solar system than ever before. (Lockheed Martin)

GALAXIES

[In a massive region of space, astronomers find far fewer galaxies than they expected](#) (14 August 2018)

Astronomers have known that more than 12 billion years ago, about 1 billion years after the Big Bang, the gas in deep space was, on average, much more opaque than it is now in some regions. They weren't sure about what caused those variations. To learn why the differences occurred, the astronomers used one of the world's largest telescopes, the Subaru telescope on Mauna Kea in Hawaii, to search for galaxies of young stars in an exceptionally large region of space, 500 million light-years across, where they knew the intergalactic gas was extremely opaque. If the region had an unusually small number of galaxies, the scientists would be able to conclude that starlight could not penetrate as far as expected through the intergalactic gas; if it had an unusually large number of galaxies, the implication would be that the region had cooled significantly over the previous several hundred million years. (Having few galaxies in a region would mean not only that there was less light created by those galaxies, but also that even more opaque gas was being formed, so the light could not travel as far as astronomers had expected.) The researchers found that region contains far fewer galaxies than expected, clear evidence that starlight could not get through. The paucity of galaxies could be the reason this region is so opaque. It is not that the opacity is a *cause* of the lack of galaxies, it's the other way around. Because the gas in deep space is kept transparent by ultraviolet light from galaxies, fewer nearby galaxies might make it murkier. (UCLA)

[Sprawling galaxy cluster found hiding in plain sight](#) (16 August 2018)

MIT scientists have uncovered a sprawling new galaxy cluster hiding in plain sight. The cluster, which sits a mere 2.4 billion light years from Earth, is made up of hundreds of

individual galaxies and surrounds an extremely active supermassive black hole, or quasar. The central quasar goes by the name PKS1353-341 and is intensely bright, so bright that for decades astronomers observing it in the night sky have assumed that the quasar was quite alone in its corner of the universe, shining out as a solitary light source from the centre of a single galaxy. But as the MIT team reports today the quasar's light is so bright that it has obscured hundreds of galaxies clustered around it. (MIT)

[Astronomers identify some of the earliest galaxies in the universe](#) (16 August 2018)

Astronomers have found evidence that the faintest satellite galaxies orbiting our own Milky Way galaxy are among the very first galaxies that formed in our Universe. The research group's results suggest that galaxies including Segue-1, Bootes I, Tucana II and Ursa Major I are, in fact, some of the first galaxies ever formed, thought to be over 13 billion years old. (Harvard-Smithsonian Center for Astrophysics)

[Stars memorize rebirth of our home galaxy](#) (20 August 2018)

The Milky Way galaxy has died once before and we are now in what is considered its second life. Calculations have revealed previously unknown details about the Milky Way. Stars formed in two different epochs through different mechanisms. There was a long dormant period in between, when star formation ceased. Our home galaxy has turned out to have a more dramatic history than was originally thought. (Tohoku University)

[Gemini confirms the most distant radio galaxy](#) (27 August 2018)

Using the Gemini North telescope in Hawai'i, an international team of astronomers has discovered the most distant radio galaxy to date, at 12.5 billion light years, when the Universe was just 7% of its current age. (Gemini Observatory)

[Unstoppable monster in the early universe - ALMA obtains most detailed view of distant starburst galaxy](#) (30 August 2018)

Astronomers obtained the most detailed anatomy chart of a monster galaxy located 12.4 billion light-years away. Using the Atacama Large Millimeter/submillimeter Array (ALMA), the team revealed that the molecular clouds in the galaxy are highly unstable, which leads to runaway star formation. Monster galaxies are thought to be the ancestors of the huge elliptical galaxies in today's Universe, therefore these findings pave the way to understand the formation and evolution of such galaxies. (ALMA)

JUPITER AND MOONS

[Million fold increase in the power of waves near Jupiter's moon Ganymede](#) (7 August 2018)

Listening to electro-magnetic waves around the Earth, converted to sound, is almost like listening to singing and chirping birds at dawn with a crackling camp fire nearby. This is why such waves are called chorus waves. They cause polar lights but also high-energy 'killer' electrons that can damage spacecraft. Scientists report that the power of chorus waves is a million times more intense near the Jovian moon Ganymede, and 100 times more intense near the moon Europa than the average around these planets. These are the new results from a systematic study on Jupiter's wave environment taken from the Galileo Probe spacecraft. It's a really surprising and puzzling observation showing that a moon with a magnetic field can create such a tremendous intensification in the power of waves. Chorus waves are a special type of radio wave occurring at very low frequencies. Unlike the Earth, Ganymede and Europa orbit inside the giant magnetic field of Jupiter and the authors believe this is one of the key factors powering the waves. Jupiter's magnetic field is the largest in the solar system,

and some 20,000 times stronger than the Earth's. Chorus waves have been detected in space around the Earth, but they are nowhere near as strong as the waves at Jupiter. Even if small portion of these waves escapes the immediate vicinity of Ganymede, they will be capable of accelerating particles to very high energies and ultimately producing very fast electrons inside Jupiter's magnetic field. (Helmholtz Centre Potsdam)

[Jupiter had growth disorders](#) (27 August 2018)

Data collected from meteorites had indicated that the growth of the giant planet had been delayed for two million years. Now the researchers have found an explanation: Collisions with kilometre-sized blocks generated high energy, which meant that in this phase hardly any accretion of gas could take place and the planet could only grow slowly. (University of Zurich)

LAUNCH SERVICES

[Spaceflight prepares for launch of more than 70 spacecraft aboard SpaceX Falcon 9](#)

(6 August 2018)

Spaceflight, the leading rideshare and mission management provider, announced details behind its SSO-A mission, the largest single rideshare mission from a US-based launch vehicle to date. Spaceflight has contracted with more than 70 spacecraft from approximately 35 different organizations, to launch from a SpaceX Falcon 9 later this year. The mission, named *SSO-A: SmallSat Express*, represents the company's purchase of an entire Falcon 9 to accommodate the growing number of domestic, international, government and commercial customers seeking affordable rideshare options to launch their spacecraft into orbit. (Spaceflight)

MARS

[Umbilical cord designed in Warsaw will fly to Mars](#) (7 August 2018)

It's critical to the success of the ExoMars space mission, which in 2020 will set off on a journey to Mars. The device will provide power to the rover after landing on the surface of the Red Planet. SENER designed and produced one of the key mechanisms - the "umbilical cord", or Umbilical Release Mechanism connecting the rover and the landing platform. The rover will enter the atmosphere of Mars inside the landing platform. After reaching the surface of the planet, the landing platform will unfold the solar panels and start charging the rover. When the robot is started, the power will be transmitted by the "umbilical cord" created by SENER. After charging, the rover will lift itself on the wheels, and then the "umbilical cord" will detach itself to allow the vehicle to go to the surface of Mars and start researching the Red Planet. (Sener)

[Aerojet Rocketdyne delivers power generator for Mars 2020 Rover](#) (7 August 2018)

Aerojet Rocketdyne recently delivered the electrical power generator for NASA's Mars 2020 rover to the U.S. Department of Energy's (DOE), where it will be fuelled, tested and readied for flight. In addition to providing the primary power source for the rover, they also playing a critical role in spacecraft propulsion for the journey to Mars. The Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) will supply electrical power to the rover as it traverses the red planet, collecting samples for a potential return to Earth by a future mission. A similar device supplied by Aerojet Rocketdyne continues to power the Mars Curiosity rover, which has been exploring the Martian surface since 2012. (Aerojet Rocketdyne)

[Martian skies clearing over Opportunity rover](#) (30 August 2018)

A planet-encircling dust storm on Mars, which was first detected May 30 and halted operations for the Opportunity rover, continues to abate. With clearing skies over Opportunity's resting spot in Mars' Perseverance Valley, engineers at NASA's Jet Propulsion Laboratory in Pasadena, California, believe the nearly 15-year-old, solar-powered rover will soon receive enough sunlight to automatically initiate recovery procedures, if the rover is able to do so. To prepare, the Opportunity mission team has developed a two-step plan to provide the highest probability of successfully communicating with the rover and bringing it back online. The Sun is breaking through the haze over Perseverance Valley, and soon there will be enough sunlight present that Opportunity should be able to recharge its batteries. When the tau level [a measure of the amount of particulate matter in the Martian sky] dips below 1.5, we will begin a period of actively attempting to communicate with the rover by sending it commands via the antennas of NASA's Deep Space Network. Assuming that we hear back from Opportunity, we will begin the process of discerning its status and bringing it back online. (JPL)

METEORS AND METEORITES

[Organic makeup of ancient meteorites sheds light on early Solar System](#) (6 August 2018)

The origin of organic matter found in meteorites that formed during the birth of the Solar System 4.5 billion years ago may provide key clues to understanding the birth of life here on Earth. It could also help astronomers investigate the potential habitability of other solar systems. The new research confirms that organic materials accreted in chondritic asteroids probably formed via basic chemical reactions during the infant stage of our Solar System. Carbonaceous chondrites are meteorites that originated from chondritic asteroids that are as old as our Solar System. Researchers have been analyzing the isotopic makeup of oxygen in the organic materials found in these specific meteorites. Isotopic analysis provides scientists with the isotopic signature of a compound, which acts as a fingerprint of processes involved in its formation. By doing this, the team has helped pinpoint the origins of the organic materials contained within the meteorites, which are made up of key elements necessary for life, such as carbon, hydrogen, oxygen, nitrogen, and sulphur. (University of Manchester)

[Crystalline silica in primitive meteorite brings scientists a step closer to understanding solar evolution](#) (21 August 2018)

A team of researchers discovered silica (SiO₂) mineral quartz in a primitive meteorite, becoming the first in the world to present direct evidence of silica condensation within the solar protoplanetary disk and coming a step closer to understanding solar formation and evolution. (Waseda University)

MOON

[Sierra Nevada Corporation completes key step for NASA's NextSTEP-2 long-duration space travel study](#) (9 August 2018)

Sierra Nevada Corporation (SNC) completed a NASA study for the Power and Propulsion Element (PPE), which is the first module planned to be launched for NASA's Gateway in lunar orbit. The PPE is the first element of the lunar Gateway and represents the beginning of human lunar and deep space presence in the 21st century. (Sierra Nevada Corporation)

[Bricks from Moon dust](#) (20 August 2018)

Lunar masonry starts on Earth. European researchers are working with Moon dust simulants that could one day allow astronauts to build habitats on our natural satellite and pave the way for human space exploration. The surface of the Moon is covered in grey, fine, rough dust. This powdery soil is everywhere, an indigenous source that could become the ideal material for brickwork. You can crush it, burn it and compress it. (ESA)

[Ice confirmed at the Moon's poles](#) (20 August 2018)

In the darkest and coldest parts of its polar regions, scientists have directly observed definitive evidence of water ice on the Moon's surface. These ice deposits are patchily distributed and could possibly be ancient. At the southern pole, most of the ice is concentrated at lunar craters, while the northern pole's ice is more widely, but sparsely spread. They used data from NASA's Moon Mineralogy Mapper (M3) instrument to identify three specific signatures that definitively prove there is water ice at the surface of the Moon. (NASA Ames)

NEBULA

[International team discovers an inside-out nebula surrounds a 'born-again' star](#)

(15 August 2018)

The Instituto de Astrofísica de Andalucía (IAA-CSIC) in Spain, the Laboratory for Space Research (LSR) of the University of Hong Kong (HKU), and an International team comprising scientists from Argentina, Mexico and Germany have discovered the unusual evolution of the central star of a planetary nebula in our Milky Way. This extraordinary discovery sheds light on the future evolution, and more importantly, the ultimate fate of the Sun. The discovery of a structurally 'inside-out' planetary nebula, the ionized material that surrounds a white dwarf, was just reported online in *Nature Astronomy*. The research team believes this inverted ionization structure of the nebula is resulted from the central star undergoing a 'born-again' event, ejecting material from its surface and creating a shock that excites the nebular material. (University of Hong Kong)

SATELLITES

[UK National Satellite Test Facility awards its first contracts for major space test equipment](#)

(14 August 2018)

STFC RAL Space has been awarded £99 million from the UK Government's Industrial Strategy Challenge Fund to develop the National Satellite Test Facility (NSTF). The NSTF will address the need in the UK for a set of world-class, co-located facilities run by the experts, for environmental testing of space payloads and satellites up to 7000 kg. The NSTF will enable UK industry to bid competitively for more national and international contracts and ensure the UK remains a world-leader in space technologies for decades to come. (STFC)

SPACE ECONOMY GLOBAL

[NASA invests in concepts for a vibrant future commercial space economy](#) (8 August 2018)

In an ongoing effort to foster commercial activity in space, NASA has selected 13 companies to study the future of commercial human spaceflight in low-Earth orbit, including long-range opportunities for the [International Space Station](#). The studies will assess the potential growth of a low-Earth orbit economy and how to best stimulate private demand for commercial human spaceflight. The portfolio of selected studies will include specific industry concepts

detailing business plans and viability for habitable platforms, whether using the space station or separate free-flying structures. The studies also will provide NASA with recommendations on the role of government and evolution of the space station in the process of transitioning U.S. human spaceflight activities in low-Earth orbit to non-governmental enterprises. (NASA)

STARS AND STAR CLUSTERS

[Astronomers blown away by historic stellar blast](#) (2 August 2018)

Imagine traveling to the Moon in just 20 seconds! That's how fast material from a 170 year-old stellar eruption sped away from the unstable, eruptive, and extremely massive star Eta Carinae. Astronomers conclude that this is the fastest jettisoned gas ever measured from a stellar outburst that didn't result in the complete annihilation of the star. The blast, from the most luminous star known in our galaxy, released almost as much energy as a typical supernova explosion that would have left behind a stellar corpse. However, in this case a double-star system remained and played a critical role in the circumstances that led to the colossal blast. Over the past seven years a team of astronomers determined the extent of this extreme stellar blast by observing light echoes from Eta Carinae and its surroundings. Light echoes occur when the light from bright, short-lived events are reflected off of clouds of dust, which act like distant mirrors redirecting light in our direction. Like an audio echo, the arriving signal of the reflected light has a time delay after the original event due to the finite speed of light. In the case of Eta Carinae, the bright event was a major eruption of the star that expelled a huge amount of mass back in the mid-1800s during what is known as the "Great Eruption." The delayed signal of these light echoes allowed astronomers to decode the light from the eruption with modern astronomical telescopes and instruments, even though the original eruption was seen from Earth back in the mid-19th century. That was a time before modern tools like the astronomical spectrograph were invented. This was a behemoth stellar explosion from a very rare monster star, the likes of which has not happened since in our Milky Way Galaxy. (STFC)

SUN

[How scientists predicted corona's appearance during Aug. 21, 2017, total solar eclipse](#)(27 August 2018)

After the eclipse, the group found their prediction bore a striking resemblance to the Aug. 21, 2017, corona, although the model lacks many finer structures. Both the prediction and photos from the ground taken on the day of the eclipse show three helmet streamers, immense, petal-shaped structures that form over a network of magnetic loops. The strength of the comparison supports advances in the new model. (NASA Goddard)

TECHNOLOGY

[KULR Technology's thermal architecture included in two upcoming NASA-JPL space missions](#) (2 August 2018)

KULR's proprietary, light-weight, high-performance carbon fiber heat sinks will safeguard crucial lasers and scanning components on the 2020 Mars Rover's search for signs of life on Mars as well as a 2018 mission to measure ice deposits near the lunar south pole. (KULR Technology)

[Xenesis, Atlas and Laser Light form first space to ground all optical global data distribution joint venture – the Empower Space Alliance](#) (3 August 2018)

Xenesis, ATLAS Space Operations, and Laser Light Communications announced today they have joined forces in a Service-Level Solution – Empower Space Alliance™. Empower Space™ will provide a turnkey direct optical data distribution service from spacecraft to customer locations, worldwide. Empower Space™ intends to serve LEO, MEO, GEO, Cislunar, and Deep Space capability with standardized interoperability, robust data capacity and unprecedented access to customer locations worldwide. Space data platforms will now have a choice between relying on legacy radio frequency transmission and distribution, or high capacity & low cost all optical “direct delivery” of their data to its ultimate distribution...on a single network. (ATLAS Space Operations)

[Astrobotic announces selection of two new NASA research contracts](#) (7 August 2018)

A key challenge of high performance computing in space is radiation, which can introduce errors into electronics and software. The conventional solution is to design computers that are “hardened,” to this radiation, but such custom and low volume production computing is expensive and introduces significant development delays. Astrobotic’s technology seeks to address this issue by moving the “hardening” into software with efficient distributed consensus algorithms to enable flexible error detection and correction on off-the-shelf processors with minimal overhead.

The STTR contract is for “Mission Coordination and Co-Localization for Planetary Rover Teams.” The objective of the 13-month contract is to develop strategies to enable accurate localization of multiple planetary exploration rovers without requiring high fidelity sensing or onboard high-performance computing. (Astrobotic)

[NASA studies space applications for GaN crystals](#) (7 August 2018)

Two NASA teams are examining the use of gallium nitride, a crystal-type semiconductor compound first discovered in the 1980s, and currently used in consumer electronics such as laser diodes in DVD readers. Among its many attributes, gallium nitride, GaN, for short, demonstrates less electrical resistance and thus loses only a small proportion of power as heat. The material can handle 10 times the electrical current of silicon, enabling smaller, faster, and more efficient devices. In addition, it’s tolerant to a wide range of temperatures, resistant to radiation, and as it turns out, adept at detecting energetic particles. It’s no wonder then that scientists and engineers at NASA are interested in seeing how they could tap into this versatile material to enhance space exploration. (NASA Goddard)

[NASA announces new partnerships to develop space exploration technologies](#)

(8 August 2018)

NASA is partnering with six U.S. companies to develop 10 “tipping point” technologies that have the potential to significantly benefit the commercial space economy and future NASA missions, including lunar lander and deep space rocket engine technologies. Selections are based on the agency’s third competitive [Tipping Point solicitation](#), and have a combined total award value of approximately \$44 million. A technology is considered at a “tipping point” if investment in a ground or flight demonstration will result in significantly maturing the technology and improving the company’s ability to bring it to market. These key technologies will support NASA’s science and human exploration missions in the future. These awards are yet another example of NASA’s commitment to the USA’s growing commercial space industry. This solicitation targeted three Space Technology Mission Directorate ([STMD](#)) strategic technology focus areas: Expand Utilization of Space, Enable Efficient and Safe Transportation Into and Through Space, and Increase Access to Planetary Surfaces. (NASA)

[Astrobotic selected for NASA award to develop sensor for precise planetary landings](#)

(8 August 2018)

NASA's Space Technology and Mission Directorate (STMD) announced today the selection of Astrobotic for a "Tipping Point" award to develop a novel terrain relative navigation (TRN) sensor for precise lunar landings. This sensor will enable spacecraft to land with unprecedented precision at the most challenging and promising scientific and economically compelling destinations on the lunar surface, such as lunar skylights and the ice-rich poles of the Moon. (Astrobotic)

[Goonhilly and Spacebit partner to accelerate commercial space exploration through blockchain technology](#) (13 August 2018)

Ian Jones, CEO of Goonhilly Earth Station said, "Exploring the new commercial opportunities in space requires new ways of thinking. Many of the underlying techniques used in blockchain technology have strong parallels in existing secure communication technology. We look forward to working with Spacebit to discover innovative use cases and business models for blockchain-enabled space communications and showing how these might be applied." (Goonhilly Earth Station)

[NASA awards UbiQD contract to develop greenhouse films for space missions](#)

(13 August 2018)

[UbiQD, Inc.](#), a New Mexico-based nanotechnology development company, announced today that it has been awarded a Small Business Technology Transfer Program (STTR) Phase I contract by the National Aeronautics and Space Administration (NASA). The contract will provide funding for UbiQD's collaborative research and development with the University of Arizona to explore using quantum dots (QDs) to tailor the spectrum of sunlight for optimized crop growth for in-space and planetary exploration missions. (UbiQD)

[NASA team demonstrates "science on a shoestring" with greenhouse gas-measuring instrument](#) (14 August 2018)

Although NASA is currently measuring carbon dioxide from space, the agency has never flown a laser heterodyne radiometer to do the job. Laser heterodyne radiometers were adapted from radio receiver technology. In this variation, the concentrations of greenhouse gases are found by measuring their absorption of infrared sunlight. Each absorption signal is mixed with laser light in a fast photoreceiver within the instrument and the resulting signal is detected at an easier-to-process radio frequency. While this is similar to other absorption techniques, such as those used in the Orbiting Carbon Observatory-2, laser heterodyne radiometry offers higher spectral resolution as well as improved signal-to-noise levels due to the internal mixing of sunlight with laser light. Other advantages are that the mini-LHR is more compact and includes no moving parts. Furthermore, the instrument can measure three greenhouse gases: in addition to carbon dioxide, the instrument can simultaneously measure water vapor and methane in Earth's atmospheric limb. Comparatively speaking, the instrument cost a small fraction to build compared with more traditional, non-CubeSat instruments. This is the epitome of science on a shoestring. (NASA Goddard)

[Space is hard: tough testing for 3D-printed metal parts](#) (21 August 2018)

3D-printed metal parts produced through a Europe-wide collaboration of high-performance industrial sectors have undergone extensive testing for space use, tested to destruction in many cases, by ESA's specialist advanced manufacturing lab in the UK. The goal is to develop common procurement, qualification and acceptance standards for 3D printing. The

starting point for a 3D printed part is feedstock material, such as metal powder. Companies need common standards on judging feedstock quality, how best to 3D print with it, finish parts to an acceptable standard and then test them. (ESA)

[NASA selects 15 new potential space technologies for flight tests, looks to expand opportunities](#) (29 August 2018)

NASA's [Flight Opportunities program](#) has selected 15 promising space technologies to be tested on commercial low-gravity simulating aircraft, high-altitude balloons and suborbital rockets. These flights will help advance technologies for future spaceflight, taking them from the laboratory to a relevant flight environment. (NASA Armstrong)

[NASA launching Mars lander parachute test from Wallops Sep. 7](#) (31 August 2018)

NASA will conduct the third in a series of parachute tests for possible future missions to Mars during the flight of a Terrier-Black Brant IX suborbital sounding rocket in the morning on Sep. 7, 2018, from the agency's Wallops Flight Facility in Virginia. The launch window for the 58-foot tall rocket is from 9:30 a.m. – 12:30 p.m. EDT. The backup launch days are Sep. 8 – 15. The rocket will carry the Advanced Supersonic Parachute Inflation Research Experiment (ASPIRE) from NASA's Jet Propulsion Laboratory. The payload carrying the parachute test article is expected to reach an altitude of 32 miles approximately 2 minutes into the flight. The payload will splash-down in the Atlantic Ocean 40 miles from Wallops Island and will be recovered and returned to Wallops for data retrieval and inspection. The payload is a bullet-nosed, cylindrical structure holding a supersonic parachute, the parachute's deployment mechanism, and the test's high-definition instrumentation, including cameras, to record data. (NASA Wallops)

TELESCOPES

[Indian-led Telescope Manager consortium concludes design work on SKA](#) (6 August 2018)

After four and a half years, the international Telescope Manager (TM) consortium has formally concluded its work on the architectural design of a fundamental part of the software for the Square Kilometre Array: the nervous system of the Observatory, which is called the Telescope Manager. Formed in November 2013, the consortium was tasked with designing the crucial software that will control, monitor and operate the SKA telescopes. TM brought expertise in the field of Monitoring and Control for large-scale, complex systems and design of user interface experience. Led by India's National Centre for Radio Astrophysics (NCRA), the international consortium comprised nine institutions in seven countries. (SKA)

[Excavation begins on Giant Magellan Telescope site in Chile](#) (14 August 2018)

GMTO Corporation (GMTO) today announced the start of hard rock excavation for the Giant Magellan Telescope's massive concrete pier and the foundations for the telescope's enclosure on its site at Las Campanas Observatory in Chile. The work will be performed by Minería y Montajes Conpax (known as Conpax), a construction services company that has previously performed site work for other observatories in Chile. Using a combination of hydraulic drilling and hammering, the excavation work is expected to take about five months to complete. Excavation is a key step towards the construction of the GMT, which is expected to see first light as early as 2024. Las Campanas Observatory, located in the southern Atacama Desert of Chile and owned by the Carnegie Institution for Science, is one of the world's premier astronomical sites, known for its clear, dark skies and stable airflow, producing exceptionally sharp images. With its unique design, the GMT will produce images that are 10 times sharper than those from the Hubble Space Telescope in the infrared region

of the spectrum and will be used by astronomers to study planets around other stars and to look back to the time when the first galaxies formed. (GMTO)

[Student-built satellite telescope prepares for space](#) (16 August 2018)

In 2008, a series of workshops at the Keck Institute of Space Studies (KISS) at Caltech inspired a low-cost mission to demonstrate the feasibility of sending a telescope to space in pieces and having it assemble itself once in orbit. That telescope, which came to be known as [AAReST](#) (Autonomous Assembly of a Reconfigurable Space Telescope), was designed and built in large part by students in Caltech's Ae 105 Aerospace Engineering class, working in collaboration with the Surrey Space Centre in England and the Indian Institute of Space Science and Technology. Over the years, these students planned the mission and designed the telescope. With the spacecraft nearly complete, 2018 marks the conclusion of the AAReST project for the Ae 105 students. The AAReST satellite is scheduled to be launched on an Indian Space Research Organization (ISRO) rocket in 2019. (Caltech)

[First science with ALMA's highest-frequency capabilities](#) (17 August 2018)

One of ALMA's first Band 10 results was also one of the most challenging, the direct observation of jets of water vapor streaming away from one of the massive **protostar** **Protostar** A hot, dense ball of mostly hydrogen gas that is poised to ignite self-sustaining fusion at its core, giving rise to a newborn star. s in the region. ALMA was able to detect the submillimeter-wavelength light naturally emitted by heavy water (water molecules made up of oxygen, hydrogen and deuterium atoms, which are hydrogen atoms with a proton and a neutron in their nucleus). In addition to making striking images of objects in space, ALMA is also a supremely sensitive cosmic chemical sensor. As molecules tumble and vibrate in space, they naturally emit light at specific wavelengths, which appear as spikes and dips on a spectrum. All of ALMA's receiver bands can detect these unique spectral fingerprints, but those lines at the highest frequencies offer unique insight into lighter, important chemicals, like heavy water. They also provide the ability to see signals from complex, warm molecules, which have weaker spectral lines at lower frequencies. Using Band 10, the researchers were able to observe a region of the spectrum that is extraordinarily rich in molecular fingerprints, including glycolaldehyde, the simplest sugar-related molecule. When compared to previous best-in-the-world observations of the same source with the European Space Agency's Herschel Space Observatory, the ALMA observations detected more than ten times as many spectral lines. (National Radio Astronomy Observatory)

Pat Williams August 2018