

# Space News Update – July 2020

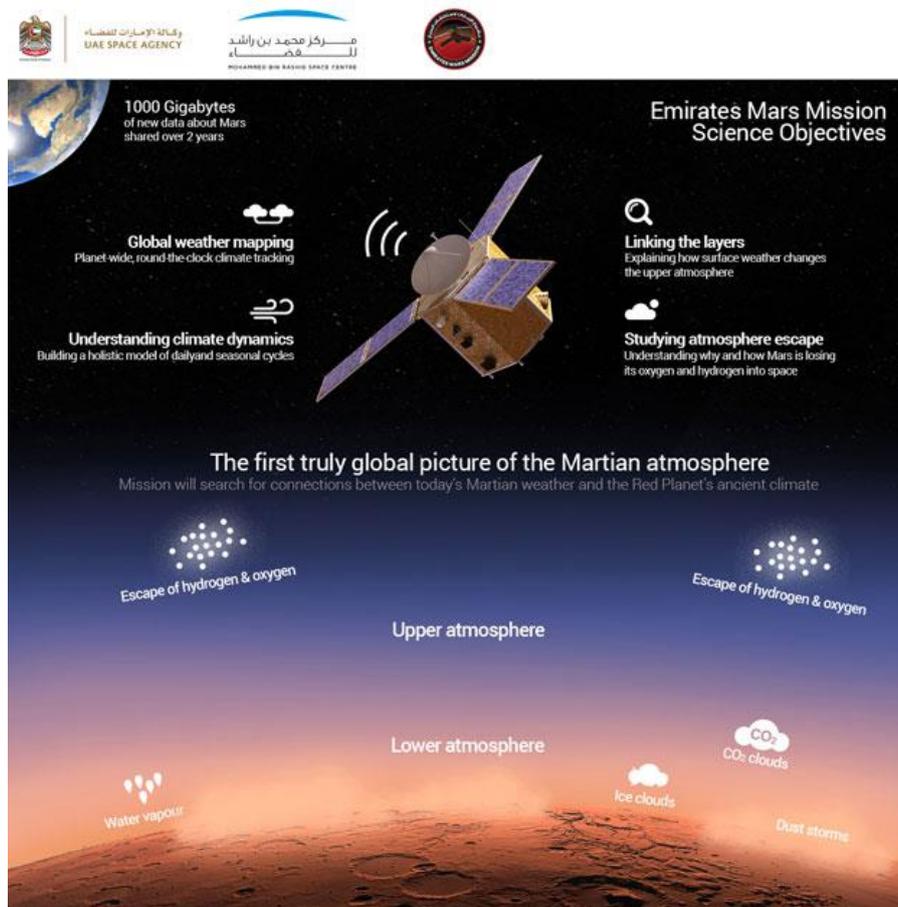
*By Pat Williams*

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

## MHI LAUNCHES THE EMIRATES MARS MISSION, HOPE SPACECRAFT



*Credit: UAE Space Agency*

The launch of the H-IIA Launch Vehicle No.42 (H-IIA F42) which carries the Emirates Mars Mission's (EMM) HOPE spacecraft developed by the Mohammed Bin Rashid Space Centre (MBRSC) in the United Arab Emirates launched on Monday, July 20, 2020. The launch vehicle trajectory was executed as planned and separation of the HOPE spacecraft was confirmed. The H-IIA launch vehicle is one of the most reliable launch vehicles in the world, and with this 45th consecutive successful H-IIA/H-IIB launch, the vehicle now has an accumulative success rate of 98.0%. HOPE will be the first probe to provide a complete picture of the Martian atmosphere and its layers when it reaches Mars in 2021 to coincide with the 50th anniversary of the founding of the UAE. The successful launch of the Emirates Mars Mission HOPE Probe, the first interplanetary mission undertaken by any Arab nation, is a key milestone in UAE's history. With this achievement, the UAE has become the youngest nation to successfully launch a mission to Mars within six years of project commencement. The success of HOPE Probe is a huge leap forward for the UAE's ambitious space programme. The Emirates Mars Mission targets to reach Mars in 2021 to commemorate the 50th anniversary of the founding of the UAE. (Mitsubishi Heavy Industries)  
[MHI Launches the Emirates Mars Mission, HOPE spacecraft](#) (20 July 2020)

### **CHINA LAUNCHES ROCKET WITH PROBE TO MARS**



China launched a Long March 5 Y-4 rocket from the Wenchang Space Launch Centre in the southern island province of Hainan on Thursday. In February, the probe is expected to reach Mars where it will deploy a rover to explore the planet for 90 days. The Chinese rover is named Tianwen-1, which means "quest for heavenly truth," in Mandarin. It weighs 240 kilograms (530 pounds) and is equipped with six wheels and four solar panels, Chinese state media reported. The spacecraft is set to complete its 55-million-kilometer (34-million-mile) journey to Mars in about seven months. It will then orbit the red planet for two to three months before attempting a landing. If all goes well, it will search for underground water, analyse the planet's soil and atmosphere, take photos, chart maps as well as search for evidence of possible ancient life. (Deutsche Welle DW)  
[China launches rocket with probe to Mars](#) (23 July 2020)

## NASA, ULA LAUNCH MARS 2020 PERSEVERANCE ROVER MISSION TO RED PLANET



*A United Launch Alliance Atlas V rocket with NASA's Mars 2020 Perseverance rover onboard launches from Space Launch Complex 41, Thursday, July 30, 2020, at Cape Canaveral Air Force Station in Florida. The Perseverance rover is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the Red Planet. Credits: NASA/Joel Kowsky*

NASA's Mars 2020 Perseverance rover mission is on its way to the Red Planet to search for signs of ancient life and collect samples to send back to Earth. Humanity's most sophisticated rover launched with the Ingenuity Mars Helicopter. The ULA Atlas V's Centaur upper stage initially placed the Mars 2020 spacecraft into a parking orbit around Earth. The engine fired for a second time and the spacecraft separated from the Centaur as expected. Navigation data indicate the spacecraft is perfectly on course to Mars. Mars 2020 sent its first signal to ground controllers via NASA's Deep Space Network. However, telemetry (more detailed spacecraft data) had not yet been acquired at that point. Around 11:30 a.m. a signal with telemetry was received from Mars 2020 by NASA ground stations. Data indicate the spacecraft had entered a state known as safe mode, likely because a part of the spacecraft was a little colder than expected while Mars 2020 was in Earth's shadow. All temperatures are now nominal and the spacecraft is out of Earth's shadow. When a spacecraft enters safe mode, all but essential systems are turned off until it receives new commands from mission control. An interplanetary launch is fast-paced and dynamic, so a spacecraft is designed to put itself in safe mode if its onboard computer perceives conditions are not within its pre-set parameters. The Perseverance rover's astrobiology mission is to seek out signs of past microscopic life on Mars, explore the diverse geology of its landing site, Jezero Crater, and demonstrate key technologies that will help us prepare for future robotic and human exploration. The Martian rock and dust Perseverance's Sample Caching System collects could answer fundamental questions about the potential for life to exist beyond Earth. Two future missions currently under consideration by NASA, in collaboration with ESA (European Space Agency), will work together to get the samples to an orbiter for return to Earth. When they arrive on Earth, the Mars samples will undergo in-depth analysis by scientists around the world using equipment far too large to send to the Red Planet. While most of Perseverance's seven instruments are geared toward learning more about the planet's geology and astrobiology, the MOXIE (Mars Oxygen In-Situ Resource Utilization Experiment) instrument's job is focused on missions yet to come. Designed to demonstrate that converting Martian carbon dioxide into oxygen is possible, it could lead to future versions of MOXIE technology that become

staples on Mars missions, providing oxygen for rocket fuel and breathable air. Also future-leaning is the Ingenuity Mars Helicopter, which will remain attached to the belly of Perseverance for the flight to Mars and the first 60 or so days on the surface. A technology demonstrator, Ingenuity's goal is a pure flight test – it carries no science instruments. Over 30 sols (31 Earth days), the helicopter will attempt up to five powered, controlled flights. The data acquired during these flight tests will help the next generation of Mars helicopters provide an aerial dimension to Mars explorations, potentially scouting for rovers and human crews, transporting small payloads, or investigating difficult-to-reach destinations. The rover's technologies for entry, descent, and landing also will provide information to advance future human missions to Mars. About seven cold, dark, unforgiving months of interplanetary space travel lay ahead for the mission reaching the crater in Feb. 18, 2021. The Mars 2020 Perseverance mission is part of America's larger Moon to Mars exploration approach that includes missions to the Moon as a way to prepare for human exploration of the Red Planet. Charged with sending the first woman and next man to the Moon by 2024, NASA will establish a sustained human presence on and around the Moon by 2028 through NASA's Artemis program. (NASA)

[NASA, ULA launch Mars 2020 Perseverance Rover mission to Red Planet](#) (30 July 2020)

### **CURIOSITY MARS ROVER'S SUMMER ROAD TRIP HAS BEGUN**

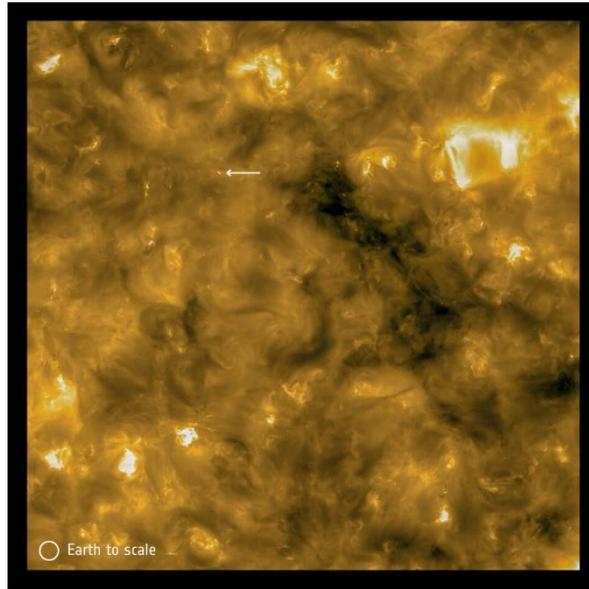


*Stitched together from 28 images, NASA's Curiosity Mars rover captured this view from "Greenheugh Pediment" on April 9, 2020, the 2,729th Martian day, or sol, of the mission. In the foreground is the pediment's sandstone cap. At centre is the "clay-bearing unit"; the floor of Gale Crater is in the distance. Credits: NASA/JPL-Caltech/MSSS*

NASA's Curiosity Mars rover has started a road trip that will continue through the summer across roughly a mile (1.6 kilometres) of terrain. By trip's end, the rover will be able to ascend to the next section of the 3-mile-tall Martian (5-kilometer-tall) mountain it's been exploring since 2014, searching for conditions that may have supported ancient microbial life. Located on the floor of Gale Crater, Mount Sharp is composed of sedimentary layers that built up over time. Each layer helps tell the story about how Mars changed from being more Earth-like, with lakes, streams and a thicker atmosphere, to the nearly-airless, freezing desert it is today. The rover's next stop is a part of the mountain called the "sulphate-bearing unit." Sulphates, like gypsum and Epsom salts, usually form around water as it evaporates, and they are yet another clue to how the climate and prospects for life changed nearly 3 billion years ago. (JPL)

[Curiosity Mars rover's summer road trip has begun](#) (6 July 2020)

## **SOLAR ORBITER'S FIRST IMAGES REVEAL 'CAMPFIRES' ON THE SUN**

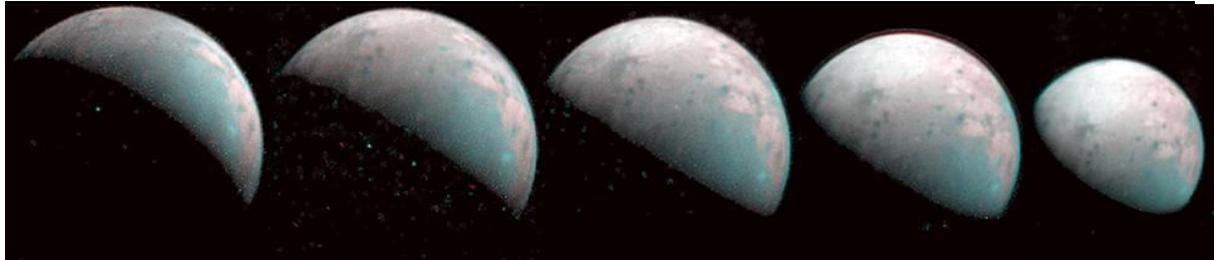


*A high-resolution image from the Extreme Ultraviolet Imager (EUI) on ESA's Solar Orbiter spacecraft, taken with the HRIEUV telescope on 30 May 2020. The circle in the lower left corner indicates the size of Earth for scale. The arrow points to one of the ubiquitous features of the solar surface, called 'campfires' and revealed for the first time by these images.*

According to the scientists behind the mission, seeing phenomena that were not observable in detail before hints at the enormous potential of Solar Orbiter, which has only just finished its early phase of technical verification known as commissioning. Solar Orbiter, launched on 10 February 2020, carries six remote-sensing instruments, or telescopes, that image the Sun and its surroundings, and four in situ instruments that monitor the environment around the spacecraft. By comparing the data from both sets of instruments, scientists will get insights into the generation of the solar wind, the stream of charged particles from the Sun that influences the entire Solar System. The unique aspect of the Solar Orbiter mission is that no other spacecraft has been able to take images of the Sun's surface from a closer distance. (ESA)

[Solar Orbiter's first images reveal 'campfires' on the Sun](#) (16 July 2020)

## **JUNO TAKES FIRST IMAGES OF JOVIAN MOON GANYMEDE'S NORTH POLE**



*These images the JIRAM instrument aboard NASA's Juno spacecraft took on Dec. 26, 2019, provide the first infrared mapping of Ganymede's northern frontier. Frozen water molecules detected at both poles have no appreciable order to their arrangement and a different infrared signature than ice at the equator.*

*Credits: NASA/JPL-Caltech/SwRI/ASI/INAF/JIRAM*

On its flyby of Jupiter, NASA's Juno spacecraft flew in the proximity of the north pole of the ninth-largest object in the solar system, the moon Ganymede. The infrared imagery collected by the spacecraft's Jovian Infrared Auroral Mapper (JIRAM) instrument provides the first infrared mapping of the massive moon's northern frontier. Larger than the planet Mercury,

Ganymede consists primarily of water ice. Its composition contains fundamental clues for understanding the evolution of the 79 Jovian moons from the time of their formation to today. Ganymede is also the only moon in the solar system with its own magnetic field. On Earth, the magnetic field provides a pathway for plasma (charged particles from the Sun) to enter our atmosphere and create aurora. As Ganymede has no atmosphere to impede their progress, the surface at its poles is constantly being bombarded by plasma from Jupiter's gigantic magnetosphere. The bombardment has a dramatic effect on Ganymede's ice. The JIRAM data show the ice at and surrounding Ganymede's north pole has been modified by the precipitation of plasma. It is a phenomenon that we have been able to learn about for the first time with Juno because we are able to see the north pole in its entirety. The ice near both poles of the moon is amorphous. This is because charged particles follow the moon's magnetic field lines to the poles, where they impact, wreaking havoc on the ice there, preventing it from having an ordered (or crystalline) structure. In fact, frozen water molecules detected at both poles have no appreciable order to their arrangement, and the amorphous ice has a different infrared signature than the crystalline ice found at Ganymede's equator. JIRAM was designed to capture the infrared light emerging from deep inside Jupiter, probing the weather layer down to 30 to 45 miles (50 to 70 kilometres) below Jupiter's cloud tops. (JPL)

[Juno takes first images of Jovian moon Ganymede's north pole](#) (22 July 2020)

## **LINKS TO OTHER SPACE NEWS PUBLISHED IN JULY 2020**

### **ASTEROIDS**

[New data about asteroid surfaces will help explorers touchdown safely](#) (17 July 2020)

The researchers used sand to represent an asteroid's surface in the lab. They then used marbles to measure how objects impact the sandy surfaces at different angles and filmed the marbles with high-speed video in order to track the marbles' trajectories and spin during impact with the sand. The researchers constructed a mathematical model that includes the Froude number, a dimensionless ratio that depends on gravity, speed, and size. By scaling the model with the Froude number, the researchers were able to apply the knowledge gained from their experiments with the marbles to low-gravity environments, such as those found on asteroid surfaces. They found that at velocities near the escape velocity, the velocity at which an object will escape gravitational attraction, many if not most rocks and boulders are likely to ricochet on asteroids. The results provide an explanation for why asteroids have strewn boulders and rocks that are perched on their surfaces, and they also influence the angle at which robotic missions will need to successfully touch down on the surface of an asteroid. Robotic missions that touch down on the surface of an asteroid will need to control the moment of touch down so that they don't bounce. The robots can accomplish this by making their angle of impact nearly vertical, by reducing the velocity of impact to a very small value, or by making the velocity of impact large enough to form a deep crater that the robotic explorer won't bounce out of. (University of Rochester)

### **EARTH**

[Contracts awarded for development of six new Copernicus missions](#) (3 July 2020)

The new industrial contracts now kick off the key design phases (Phase B) for these six missions.

1. The Copernicus Anthropogenic Carbon Dioxide Monitoring, CO2M, mission will carry a near-infrared and shortwave-infrared spectrometer to measure atmospheric carbon dioxide produced by human activity. OHB-System Germany will lead the development with a contract value of €445 million.
2. The Copernicus Hyperspectral Imaging Mission, CHIME, will carry a hyperspectral imager to return detailed information for sustainable agricultural and biodiversity management. Thales Alenia Space France will lead the development with a contract value of €455 million.
3. The Copernicus Imaging Microwave Radiometer, CIMR, mission will carry a microwave radiometer to provide observations of sea-surface temperature, sea-ice concentration and sea-surface salinity. Thales Alenia Space Italy will lead the development with a contract value of €495 million.
4. The Copernicus Polar Ice and Snow Topography Altimeter, CRISTAL, mission will carry a multi-frequency radar altimeter and microwave radiometer to measure and monitor sea-ice thickness and overlying snow depth. Airbus Defence and Space Germany will lead the development with a contract value of €300 million.
5. The Copernicus Land Surface Temperature Monitoring, LSTM, mission will carry a high spatial-temporal resolution thermal infrared sensor to provide observations of land-surface temperature for sustainable agriculture and to predict drought. Airbus Defence and Space Spain will lead the development with a contract value of €375M.
6. The L-band Synthetic Aperture Radar, ROSE-L, mission will carry an L-band synthetic radar altimeter that penetrates through materials such as vegetation, to support forest management and to monitor subsidence and soil moisture. Thales Alenia Space will lead the development with a contract value of €482 million. (ESA)

#### [Proba-V passes the torch](#) (9 July 2020)

ESA's cubic-metre-sized Proba-V minisatellite, seen left, has ended its seven-year global mission to monitor the daily growth of all Earth's vegetation, a task being taken up by Copernicus Sentinel-3 instead, seen right. (ESA)

#### [Syncing NASA laser, ESA radar for a new look at sea ice](#) (16 July 2020)

With a small nudge to a satellite's orbit, scientists will soon have simultaneous laser and radar measurements of ice, providing new insights into Earth's frozen regions. On July 16, the European Space Agency (ESA) begins a series of precise manoeuvres that will push the orbit of its radar-carrying CryoSat-2 satellite about half a mile higher – putting it in sync with NASA's laser-carrying Ice, Cloud and land Elevation Satellite 2, or ICESat-2. When the manoeuvres are complete later this summer, the two satellites will pass over a swath of the Arctic within a few hours of each other. That synchronous stretch, of more than 2,000 miles (3,200 kilometres) every day or so, will be key for studying sea ice, which floats on the Arctic Ocean and is moved around with currents and winds. If the satellites take measurements at different times, the two could be measuring different floes of fast-moving ice. Syncing up the satellites provides scientists with two datasets for the same ice. (NASA Goddard)

#### [Sea-level charting satellite passes with flying colours](#) (21 July 2020)

Renamed in honour of Michael H. Freilich, who led NASA's work in Earth science, Copernicus Sentinel-6 Michael Freilich will take over the critical role of monitoring sea-level change by extending the long-term measurement record of global sea level from space. With millions of people living in coastal communities around the world, rising seas are at the top of the list of major concerns linked to climate change. Monitoring sea-surface height is

critical to understanding the changes taking place so that decision-makers have the evidence to implement appropriate policies to help curb climate change and for authorities to take action to protect vulnerable communities. (ESA)

#### [Contract signed to build Europe's carbon dioxide monitoring mission](#) (31 July 2020)

With the amount of carbon dioxide in Earth's atmosphere approaching levels that humans may have never before experienced, the need to monitor sources of emissions is more urgent than ever, hence the Copernicus Carbon Dioxide Monitoring mission being one of Europe's new high-priority satellite missions. Taking the mission a significant step forward, ESA and OHB System AG have, today, signed a contract to build the first two satellites that make up the mission. (ESA)

### **GAMMA RAY BURSTS**

#### [Gemini Observatory's quick reflexes capture fleeting flash](#) (14 July 2020)

Rapid follow-up of the optical afterglow from one of the most distant confirmed short gamma-ray bursts (SGRB), thought to be the merger of two neutron stars, is casting new light on these enigmatic objects. The observations, made by the international Gemini Observatory, confirmed the object's distance and placed it squarely in the epoch of cosmic high noon, when the Universe was in its "teenage years" and rapidly forming stars. The appearance of an SGRB so early in the history of the Universe could alter theories about their origin, in particular how long it takes two neutron stars to merge to produce these powerful events. Precisely-localized SGRBs are rare, typically only 7–8 are detected per year, and this is the most distant high-confidence SGRB with an optical afterglow detection. Despite their spectacular nature, the formation pathway to a SGRB is unknown. Astronomers believe they are likely formed from a pair of massive stars that were born together and "die" together as neutron stars before merging. (Gemini Observatory)

### **GRAVITATIONAL WAVES**

#### [Gravitational wave researchers go beyond the quantum limit](#) (14 July 2020)

Scientists at the LIGO site have now succeeded in looking below the so-called standard quantum limit, the limit when only natural quantum states are utilised in the measurement. The experiment the LIGO team carried out used non-classical 'squeezed light' which reduces quantum fluctuations of the laser field. Just a few years ago, this type of quantum behaviour would have been too weak to be observed. But new measurement techniques are now enabling us to go beyond these limits. Not only that, but the approach taken by LIGO scientists in these experiments means that future improvements and upgrades to the instruments can be made with increased confidence that they will yield the improved sensitivity that we are looking for. The ability to make these measurements, opens up the possibility of reducing the effects of quantum mechanics and improving overall the sensitivity of the instruments. The research marks an important step towards making further improvements in the sensitivity of gravitational wave technologies, enabling instruments in the future to reach even further through space and time to detect the echoes of these massive collisions. (University of Birmingham)

### **INTERNATIONAL SPACE STATION**

#### [Boeing to support International Space Station operations through 2024](#) (15 July 2020)

Boeing, NASA's lead industry partner for the International Space Station (ISS) since 1993,

will continue supporting the celebrated orbiting laboratory through September of 2024 under a \$916 million contract extension awarded today Boeing will provide engineering support services, resources, and personnel for activities aboard the ISS and manage many of the station's systems. The contract is valued at about \$225 million annually. Congress, NASA and its international partners have agreed to extend ISS operations to at least 2024. Recent structural analysis shows that the spacecraft continues to be safe and mission-capable. NASA selected Boeing as the ISS prime contractor in 1993. Throughout development, assembly, habitation and daily operations aboard ISS, Boeing has partnered closely with NASA to help the agency and its international partners safely host astronauts and cosmonauts for months at a time. The astronauts conduct microgravity experiments that help treat disease, increase food production, and manufacture technology impossible to produce on Earth's surface. (Boeing)

#### [NASA's 'Robot Hotel' gets its occupants](#) (21 July 2020)

Storage is just as important aboard the International Space Station as it is on Earth. While the space station is about the size of a football field, the living space inside is much smaller than that. Just as you wouldn't store garden tools in a house when you could store them in a shed outside, astronauts now have a "housing unit" in which they can store tools for use on the exterior of the space station. On Dec. 5, 2019, a protective storage unit for robotic tools called Robotic Tool Stowage (RiTS) was among the items launched to station as part of SpaceX's 19th commercial resupply services mission for NASA. As part of a spacewalk on July 21, NASA astronauts Robert Behnken and Chris Cassidy installed the "robot hotel" where the tools are stored to the station's Mobile Base System (MBS), where it will remain a permanent fixture. The MBS is a moveable platform that provides power to the external robots. This special location allows RiTS to traverse around the station alongside a robot that will use the tools it stores. The first step in the RiTS installation process involved preparing the unit inside the space station. The astronauts unpacked RiTS' occupants from storage, two units of a tool called the Robotic External Leak Locator (RELL) and affixed them inside RiTS' aluminium housing. (NASA Goddard)

#### [Progress MS-15 cargo spacecraft launched from the Baikonur Cosmodrome](#) (23 July 2020)

Cargo spacecraft Progress MS-15 developed and manufactured by RSC Energia was launched from the Baikonur Cosmodrome under the program of the 76th resupply mission to the International Space Station (ISS). Medium capacity launch vehicle Soyuz-2.1a carrying Progress MS-15 cargo spacecraft lifted off from Site No. 31. In 8 minutes 49 seconds after the lift-off, the spacecraft separated from the upper stage block and entered a planned orbit. The solar arrays were deployed according to the timeline. In the very first earth orbit, Progress MS-15 proceeded with a "super-fast" two-orbit autonomous rendezvous profile to approach the ISS under control of specialists from the Lead Operational Control Team of the Russian Segment of the International Space Station working at the Mission Control Center. The spacecraft docking with the Pirs module of the ISS is expected to take place at 17:47:52 UTC. Progress MS-15 delivered to the ISS 620 kg of propellant, 46 kg of compressed gases, as well as 1.43 tons of cargo including 420 litres of water of Rodnik system, consumables for the ISS onboard systems and devices for space experiments, clothing and sanitary and hygienic materials, and food for the current Expedition crewmembers. (Roscosmos)

## LAUNCH SERVICES

#### [Rocket Lab mission fails to reach orbit](#) (4 July 2020)

Following a successful lift-off, first stage burn, and stage separation, Rocket Lab experienced an anomaly during its 13th Electron mission 'Pics Or It Didn't Happen.' The issue occurred

approximately four minutes into the flight on July 4, 2020 and resulted in the safe loss of the vehicle. As a result, the payloads onboard Electron were not deployed to orbit. Electron remained within the predicted launch corridors and caused no harm to personnel or the launch site. Rocket Lab is working closely with the FAA to investigate the anomaly and identify its root cause to correct the issue to move forward. The anomaly occurred after 11 consecutive successful orbital launches of the Electron launch vehicle. Rocket Lab currently has more than eight Electron vehicles in production, ready for a rapid return to flight as soon as investigations are complete, and any required corrective actions are in place. (Rocket Lab)

## **MARS**

[Northrop Grumman to provide extended life capability for Perseverance Mars rover mission](#) (10 July 2020)

The design life of the Perseverance Rover mission is about 1,071 Earth days (1.5 Mars year); however, NASA JPL required Northrop Grumman's technology to be rigorously tested to double that time. The LN-200S, part of the LN-200 product line of fiber-optic gyroscope (FOG) IMUs, will provide attitude and acceleration information throughout the Perseverance Mars Rover surface mission. It will be mounted deep inside the Rover as the vehicle traverses the planet's surface and drills to collect core samples. The low cost, small size, weight and power (SWAP) LN-200S features three FOG gyroscopes and three silicon Micro Electro-Mechanical Systems (MEMS) accelerometers in a hermetically sealed package ideal for space applications, including asteroid and planetary probes. (Northrop Grumman)

[Emirates launches first Mars probe with help from UC Berkeley](#) (19 July 2020)

the United Arab Emirates (UAE) successfully launched an interplanetary probe, the first by any country in the Arab world, thanks, in part, to science collaboration, training and instrument components provided by the University of California, Berkeley's Space Sciences Laboratory (SSL). The Emirates Mars Mission's Hope Probe is scheduled to arrive at Mars in February 2021 and spend two years orbiting the "red planet," providing an unprecedented global view of the Martian atmosphere. It will also give scientists greater insight into how our Earth may have evolved and enable greatly improved weather forecasting to help support future human missions to Mars. The mission is led by Emirati engineers and scientists, with significant sharing of expertise and technical knowledge by colleagues at UC Berkeley and three other U.S. institutions, the University of Colorado at Boulder, Arizona State University and Northern Arizona University, jump-starting an interplanetary space program in a nation that, until now, had produced only Earth observation satellites. The Hope Probe was launched from a site on Tanegashima, an island in Japan, aboard a Japanese H-IIA rocket. An hour and a half after launch, the solar panels deployed and the probe was officially on its way to Mars. (UC Berkeley)

[United Launch Alliance Atlas V set to launch Mars 2020 mission for NASA](#) (27 July 2020)

A United Launch Alliance (ULA) Atlas V rocket is in final preparations to launch NASA's Mars 2020 mission with the Perseverance rover. The launch is on track for July 30 at Space Launch Complex-41 from Cape Canaveral Air Force Station. (United Launch Alliance)

## MISCELLANEOUS

### [Latvia becomes ESA Associate Member state](#) (29 July 2020)

ESA has now established formal relations with all the 13 States that acceded to the European Union since 2004 and are thereby associated to the definition of an overall European Space Policy and participating with full rights and obligations in the EU Copernicus and Galileo programmes. While Latvia was the first country to approach ESA, it followed Hungary, the Czech Republic, Romania, Poland, Estonia and Slovenia in joining the European Cooperating State (ECS) status, a frame for cooperation dating back to 2001. The five first countries have become Member States between 2008 and 2015, and Slovenia became an Associate Member in 2016. Latvia was followed as ECS by Lithuania, Slovakia, Bulgaria and Cyprus, while Malta and Croatia have concluded Cooperation Agreement in 2012 and 2018 respectively. (ESA)

## MOON

### [NASA increases investment in US small businesses to mature lunar capabilities for Artemis](#) (8 July 2020)

The selected companies and technologies are:

- Fibertek of Herndon, Virginia, will advance optical communications technologies for small spacecraft around the Moon and beyond. The system could establish high bandwidth communications in the vicinity of the Moon to relay vast amounts of data from lunar landers to Earth.
  - Qualtech Systems of Rocky Hill, Connecticut, will mature autonomous systems capable of continuously monitoring and providing fault and health management for spacecraft such as Gateway, a future outpost around the Moon, whether there are astronauts aboard or not. Other potential exploration applications include space vehicles, surface systems, habitats, and rovers.
  - Pioneer Astronautics of Lakewood, Colorado, will build and demonstrate hardware to produce oxygen and steel from lunar regolith, or soil. The technology would support sustainable lunar operations such as manufacturing using resources already on the Moon, also known as in-situ resource utilization.
  - Protoinnovations of Pittsburgh will advance traction control and improve the driving ability of robotic and crewed rovers in unknown and highly variable terrain on the Moon.
- (NASA)

### [Voyager Space Holdings acquires Pioneer Astronautics](#) (13 July 2020)

It's beginning to be a sign of the times: smaller or younger space companies getting acquired by larger entities. Today, the company being acquired is Pioneer Astronautics, which has been bought by Voyager Space Holdings in a combined cash and stock deal. Voyager, which bills itself as the "first space-focused holding company," now has a portfolio that includes both Pioneer and Altius Space Machines, which it acquired last year. Pioneer Astronautics was founded in 1996 and focuses on R&D of new technologies related to space exploration. The company's focus of late has been on sustainable human space exploration, including leveraging materials found on deep-space destinations, including the moon, and turning them into resources that are required for sustained human presence in those places. Pioneer was actually selected by NASA recently to research materials systems for use under the Artemis program, for instance, and it plans to demonstrate how it's possible to create oxygen for breathable air, and steel for construction, from lunar regolith, essentially the soil analogue found on the moon's surface. (Voyager Space Holdings)

[Solar power investigation to launch on lunar lander](#) (16 July 2020)

When Artemis astronauts go back to the Moon, they will need access to electric power to live and work on the surface. Solar power will be one of the options to sustain human life and science for those long duration missions. Next summer, a solar power experiment designed by a team of investigators at NASA's Glenn Research Center will launch to the Moon on Astrobotic's Peregrine Lander. Using state-of-the-art solar cells like the ones on today's orbiting satellites and next generation space solar cell technologies, PILS (Photovoltaic Investigation on the Lunar Surface) will demonstrate light-to-electricity power conversion devices for future missions. The experiment will also collect data on the electrical charging environment of the lunar surface using a small array of solar cells. PILS includes multi-junction solar cells made from improved gallium arsenide, a highly efficient semiconductor material, and silicon solar cells based on technology used on Earth. The cells will be connected to instrumentation measuring current and voltage outputs for the eight to 10 days of the experiment. (NASA Glenn)

[Aerojet Rocketdyne completes its propulsion for NASA's Artemis II mission](#) (20 July 2020)

Aerojet Rocketdyne recently completed all of its propulsion hardware for the first crewed flight of NASA's Space Launch System (SLS) rocket and Orion spacecraft. The engines and motors, which Aerojet Rocketdyne produces at its major space operations sites across the country, will support NASA's Artemis II mission. The Artemis II mission is the second flight of SLS and Orion and the first to send an astronaut crew to fly around the Moon. (Aerojet Rocketdyne)

[Thales Alenia Space technology to enable NASA's VIPER lunar rover to communicate directly to Earth](#) (28 July 2020)

NASA's lunar rover will explore the South Pole of the Moon in search for water ice and other potential resources by means of its three instruments and a 1-meter (3.28-foot) drill. The data collected by the rover will show where the Moon's water ice is most likely to be found and easiest to access. The first water maps of the Moon will mark a critical step forward in NASA's Artemis program to establish a sustainable human presence on the surface of the Moon later this decade. Furthermore, the exploration of lunar resources to produce oxygen and propellants could enable new mission architectures to human space exploration. The VIPER (Volatiles Investigating Polar Exploration Rover) rover will be delivered to the Moon as part of NASA's Commercial Lunar Payload Services (CLPS). With a launch foreseen in late 2023, the mission will have a duration of 100 Earth days, covering 3 cycles of lunar day and night. Thales Alenia Space in Spain will design, manufacture, test and deliver the X-Band Transceiver and X-Band Diplexer, which are responsible for the rover communications with direct links between the lunar rover and Earth over NASA's Deep Space Network. (Thales Alenia Space)

## **SATELLITES**

[Smallspark Space Systems and Leaf Space enter agreement to offer cutting edge ground station services to the UK](#) (14 July 2020)

Cardiff-based aerospace company Smallspark Space Systems has entered into an exciting agreement with Leaf Space, an Italian provider of ground segment services to satellite operators and launchers, to bring cutting edge ground station services to UK Government and private sector clients. Smallspark and Leaf Space plan for a partnership to deliver joint bids for projects with the UK Government and other commercial operators in the UK, with the

aim of becoming the primary contractor for services related to supporting the UK governments ambitions with OneWeb, the proposed 650-satellite constellation which will provide worldwide satellite internet and broadband services to people across the globe. (Leaf Space)

## STARS AND STAR CLUSTERS

### [Herschel and Planck views of star formation](#) (5 July 2020)

A collection of intriguing images based on data from ESA's Herschel and Planck space telescopes show the influence of magnetic fields on the clouds of gas and dust where stars are forming. Both Herschel and Planck were instrumental in exploring the cool Universe and shed light on the many complexities of the interstellar medium, the mix of gas and dust that fills the space between the stars in a galaxy. Both telescopes ended their operational lifetime in 2013, but new discoveries continue to be made from their treasure trove of data. Herschel revealed in unprecedented detail the filaments of dense material in molecular clouds across our Milky Way galaxy, and their key role in the process of star formation. Filaments can fragment into clumps which eventually collapse into stars. The results from Herschel show a close link between filament structure and the presence of dense clumps. Herschel observed the sky in far-infrared and sub-millimetre wavelengths, and the data is seen in these images as a mixture of different colours, with light emitted by interstellar dust grains mixed within the gas. The texture of faint grey bands stretching across the images like a drapery pattern, is based on Planck's measurements of the direction of the polarised light emitted by the dust and show the orientation of the magnetic field. The study explored several nearby molecular clouds all within 1500 light years from the Sun including Taurus, Ophiuchus, Lupus, Corona Australis, Chamaeleon-Musca, Aquila Rift, Perseus, and Orion. (ESA)

### [Massive stellar embryos undergo episodic growth](#) (13 July 2020)

The supply of massive stellar embryos with food from their surrounding disk of gas and dust has long been a mystery. An international research team, in which the Max Planck Institute for Astronomy is participating, has now discovered a spiral structure in such a disk, in the centre of which a growing star of about 12 solar masses has experienced a dramatic increase in brightness. This spiral confirms the hypothesis that such disks become temporarily unstable and therefore partially disintegrate into compact packets. These feed the young star in bites, resulting in episodes of sharply increasing luminosity. (Max Planck Institute for Astronomy)

### [Thermonuclear blast sends supernova survivor star hurtling across the Milky Way](#) (15 July 2020)

Bizarre white dwarf star shows evidence of a 'partial supernova' in observations using the Hubble Space Telescope, led by University of Warwick astronomers. Unusual mix of elements cooked up in the nuclear burning of the supernova differs from any other white dwarf previously observed. The star is travelling at 900,000 kilometres per hour through the Milky Way. Provides evidence for previously undiscovered types of supernovae and stars that survived them. (University of Warwick)

### [Dead star emits never-before seen mix of radiation](#) (28 July 2020)

A global collaboration of telescopes including ESA's Integral high-energy space observatory has detected a unique mix of radiation bursting from a dead star in our galaxy, something that has never been seen before in this type of star and may solve a long-standing cosmic mystery. The finding involves two kinds of interesting cosmic phenomena: magnetars and Fast Radio

Bursts. Magnetars are stellar remnants with some of the most intense magnetic fields in the Universe. When they become ‘active’, they can produce short bursts of high-energy radiation that typically last for not even a second but are billions of times more luminous than the Sun. Fast Radio Bursts are one of astronomy’s major unsolved mysteries. First discovered in 2007, these events pulse brightly in radio waves for just a few milliseconds before fading away and are only rarely seen again. Their true nature remains unknown, and no such burst has ever been observed either within the Milky Way, with a known origin, or emitting any other kind of radiation beyond the radio wave domain until now. In late April, SGR 1935+2154, a magnetar discovered six years ago in the constellation of Vulpecula, following a substantial burst of X-rays, became active again. Soon after, astronomers spied something astonishing: this magnetar was not only radiating its usual X-rays, but radio waves, too. (ESA)

## SUN

[SwRI awarded contract to develop Solar Wind Plasma Sensor](#) (22 July 2020)

A joint NASA and National Oceanic and Atmospheric Administration (NOAA) team has awarded Southwest Research Institute a contract to develop the Solar Wind Plasma Sensor (SWiPS) for a satellite mission dedicated to tracking space weather. SWiPS will measure the properties of solar wind ions originating from the Sun, including the very fast ions associated with coronal mass ejections that interact with the Earth’s magnetic environment. The satellite will collect solar wind data and coronal imagery to support NOAA’s mission to monitor and forecast space weather events. Space weather refers to the variable conditions on the Sun and in space that can influence the performance of technology we use on Earth, such as electrical power grids, and disrupt satellite-based communication and navigation systems. The Space Weather Follow On-Lagrange 1 (SWFO-L1) satellite will orbit the Sun at approximately 1.5 million kilometres from Earth, a point known as L1. The satellite will make in-situ measurements of the solar wind, high-energy particles and the interplanetary magnetic field. SwRI will develop the solar wind instrument and maintain its ground system and support operations. (SwRI)

## SUPERNOVA

[Spectacular ultraviolet flash may finally explain how white dwarfs explode](#) (23 July 2020)

For just the second time ever, astrophysicists have spotted a spectacular flash of ultraviolet (UV) light accompanying a white dwarf explosion. An extremely rare type of supernova, the event is poised to offer insights into several long-standing mysteries, including what causes white dwarfs to explode, how dark energy accelerates the cosmos and how the universe creates heavy metals, such as iron. The UV flash is telling us something very specific about how this white dwarf exploded. As time passes, the exploded material moves farther away from the source. As that material thins, we can see deeper and deeper. After a year, the material will be so thin that we will see all the way into the centre of the explosion. (Northwestern University)

## TECHNOLOGY

[Resilient timing just got smaller](#) (30 June 2020)

Septentrio, a leader in high-precision GNSS positioning solutions, announces today an

addition to its GNSS timing portfolio: mosaic-TTM is a high-end GPS/GNSS\* receiver module built specifically for resilient and precise time and frequency synchronization under challenging conditions. Its multi-frequency multi-constellation GNSS technology together with AIM+ Advanced Interference Mitigation algorithms allows mosaic-TTM to achieve maximal availability even in the presence of GNSS jamming or spoofing. This compact surface-mount module is designed for automated assembly and high-volume production. Septentrio mosaic-TTM delivers timing with nanosecond-level accuracy and has additional inputs for an external high-accuracy clock. Its small form factor offers an easy-to-integrate robust solution for any mission-critical timing application. (Septentrio)

#### [BAE Systems delivers first radiation-hardened RAD5545 radios](#) (1 July 2020)

BAE Systems has delivered its first shipment of next-generation radiation-hardened software defined radios (SDR) enabled by its RAD5545 computer to Lockheed Martin Space. The radios provide spacecraft with the performance, availability, reliability and on-board signals processing capacity needed to support future space missions, from planetary exploration to communications, national security, surveillance, and weather missions. (BAE Systems)

#### [ESA to boost business from new UK hub](#) (7 July 2020)

ESA's world-leading initiative to use space to spark business innovation will be extended to a new regional hub at the state-of-the-art Space Park Leicester in the East Midlands. As the needs of society evolve, space provides businesses with the opportunity to develop innovative solutions and keep pace with a fast-moving global market. The ESA Business Incubation Centre UK (ESA BIC UK) enables start-ups to transform ideas for applying space assets into viable commercial products and supports the development of technologies for use in space. Managed by ESA and the Science and Technology Facilities Council, it has been nurturing businesses since operations started in 2011 by creating thriving communities focused on space-connected products and services. ESA BIC UK is already located at three regional hubs in Harwell in Oxfordshire, Daresbury in the Liverpool City Region, and Edinburgh, each of which has their own specialism in business, science and technology, allowing companies to benefit from the expertise on offer and collaborate with each other. The initiative has a proven track record, with 90 start-ups developing products or services in the fields of healthcare, renewable energy, transport and much more. (ESA)

#### [NASA's deep space station in Australia is getting an upgrade](#) (9 July 2020)

One of three networks in NASA's Space Communications and Navigation program (SCaN), the Deep Space Network is spread over three locations around the world – California, Spain, and Australia. This allows mission controllers to communicate with spacecraft on the Moon and beyond at all times during Earth's rotation. The Deep Space Network is NASA's interplanetary switchboard that enables constant communications with our robotic spacecraft. In March, one of the network's largest antennas, Deep Space Station 43 (DSS-43) in Canberra, Australia began undergoing much-needed upgrades. Forty-eight years old and 70 meters (230 feet) wide, the dish recently received a new X-band frequency cone. Inside the cone is a powerful state-of-the-art transmitter system and highly sensitive receivers, which will be used to send commands to spacecraft and receive telemetry and science data back from robotic missions exploring the solar system. However, as the sole 70-meter antenna in the Southern Hemisphere, only DSS-43 can send commands to Voyager 2, which is traveling in a southward direction relative to Earth's orbital plane. (Other antennas at the Canberra complex can receive signals from Voyager 2, but DSS-43 is the only dish that can send commands to the spacecraft.) Launched in 1977, Voyager 2 is more than 11 billion miles (18 billion kilometres) from Earth and therefore requires a powerful radio antenna to transmit

commands. Deep Space Station 43's special S-band transmitter has this capability and operates on a frequency that can communicate with Voyager's technology. While the repairs will benefit Voyager 2 directly, they'll also enhance communications with the soon-to-launch Perseverance Mars rover and future Moon to Mars exploration efforts. The network will play a critical role in ensuring communication and navigation support for both the precursor Moon and Mars missions and the crewed Artemis missions. (JPL)

#### [Gilmour Space achieves successful 110-second mission duty cycle test fire](#) (13 July 2020)

Australian rocket company Gilmour Space Technologies has achieved one of the longest hybrid rocket engine test firings in the world: a 110-second mission duration burn of its upper stage engine. The test is a significant milestone for Gilmour Space, which is pioneering new single-port hybrid propulsion rocket engines that will be significantly cheaper, greener and safer to operate than traditional liquid and solid propulsion rockets. What you see here is a mission duty cycle and throttle test of their smallest upper-stage engine with 110 seconds being the time expected for this final stage to deliver customer payloads into their specific orbit. They also conducted a controlled throttle-down during the test to demonstrate the engine's on-orbit manoeuvring capability to a customer. This capability could be very useful for surface landings on the Moon or Mars. (Gilmour Space)

#### [Skyrora opens rocket engine test complex in Scotland](#) (14 July 2020)

Skyrora has established an engine test complex in Scotland, where it already has successfully tested its 3.5kN engine and three-tonne engine for its sub-orbital and orbital rockets. Skyrora expects the newly established Engine Test Complex to help the company create over 170 new jobs in the area by 2030. (Skyrora)

## TELESCOPES

#### [Euclid space telescope is coming together](#) (9 July 2020)

Video: <https://youtu.be/IUBA6utlfk0>

Euclid consists of a 1.2-metre mirror telescope that is designed to work at both visible and near-infrared wavelengths, the latter being just longer than the red light humans can see. The telescope will collect light from distant cosmic objects and feed it into two instruments. The Visible instrument (VIS) and the Near Infrared Spectrometer and Photometer (NISF) will run in parallel, recording data simultaneously from whatever portion of the sky the telescope is pointed at. Euclid's mission is to measure the shapes of more than a billion galaxies, and the accurate redshifts of tens of millions of galaxies across more than one third of the sky. The redshift is an effect caused by the expansion of the Universe. It stretches the wavelength of light emitted by distant galaxies. The further away the galaxy, the more extreme its redshift. Euclid is an ESA medium class astronomy and astrophysics space mission. By making use of both weak gravitational lensing, which measures the distortion of distant galaxies caused by intervening matter, and baryonic acoustic oscillations, based on measurements of the clustering of galaxies, the mission will capture a 3D picture of the evolving distribution of both dark and ordinary (or baryonic) matter in the cosmos. This will enable scientists to reconstruct the past few billion years of the Universe's expansion history, estimating the acceleration caused by the mysterious dark energy to percent-level accuracy, and possible variations in the acceleration to 10 percent accuracy. (ESA)

#### [Ground system for NASA's Roman space telescope completes major review](#) (24 July 2020)

When it launches in the mid-2020s, NASA's Nancy Grace Roman Space Telescope will

create enormous space panoramas of unprecedented detail. The mission's wide field of view will enable scientists to conduct sweeping cosmic surveys, yielding a wealth of information about celestial realms from our solar system to the edge of the observable universe. Roman has just successfully completed a preliminary design review of the mission's ground systems, including the Science Operations Center that will be hosted by the Space Telescope Science Institute (STScI) in Baltimore, Maryland. This means the plan for science operations has met all of the design, schedule, and budget requirements. The mission will now proceed to the next phase: building the newly designed systems that will enable planning and scheduling of Roman observations and managing the resulting data. Roman will survey the sky in infrared light, which is invisible to human eyes. It will have the same resolution in near-infrared wavelengths as NASA's Hubble Space Telescope but will capture a field of view about 100 times larger. As a result, scientists expect the telescope to collect more data than any of NASA's other astrophysics missions. Since scientists everywhere will have rapid access to the data, they will be able to quickly discover short-lived phenomena, such as supernovae explosions. Prompt notification will allow other telescopes to perform follow-up observations. (STScI)

## UNIVERSE

[Astrophysicists fill in 11 billion years of our universe's expansion history](#) (19 July 2020)

Scientists from the Sloan Digital Sky Survey (SDSS) have released a comprehensive analysis of the largest three-dimensional map of the universe ever created. The new results come from the Extended Baryon Oscillation Spectroscopic Survey (eBOSS), an SDSS collaboration of more than 100 astrophysicists worldwide. They provide detailed measurements of more than two million galaxies and quasars, filling in 11 billion years in our picture of the universe. (Sloan Digital Sky Survey)

## VENUS

[Volcanoes on Venus are still active](#) (20 July 2020)

In the new study, the researchers used numerical models of thermo-mechanic activity beneath the surface of Venus to create high-resolution, 3-D simulations of coronae formation. Their simulations provide a more detailed view of the process than ever before. The results helped the scientists identify features that are present only in recently active coronae. The team was then able to match those features to those observed on the surface of Venus, revealing that some of the variation in coronae across the planet represents different stages of geological development. The study provides the first evidence that coronae on Venus are still evolving, indicating that the interior of the planet is still churning. (University of Maryland)(Phys.org)

*Pat Williams July 2020*