Space News Update – June 2016

By Pat Williams

IN THIS EDITION:

- **Three space station crew members return to Earth, land safely in Kazakhstan.**
- **LISA Pathfinder exceeds expectations.**
- **NASA's Juno Spacecraft enters Jupiter's magnetic field.**
- **Tracking down the Arizona fireball.**
- **Pluto's heart: like a cosmic 'lava lamp'.**
- **New space law to provide framework for space resource utilization.**
- **Links to other space and astronomy news published in June 2016.**

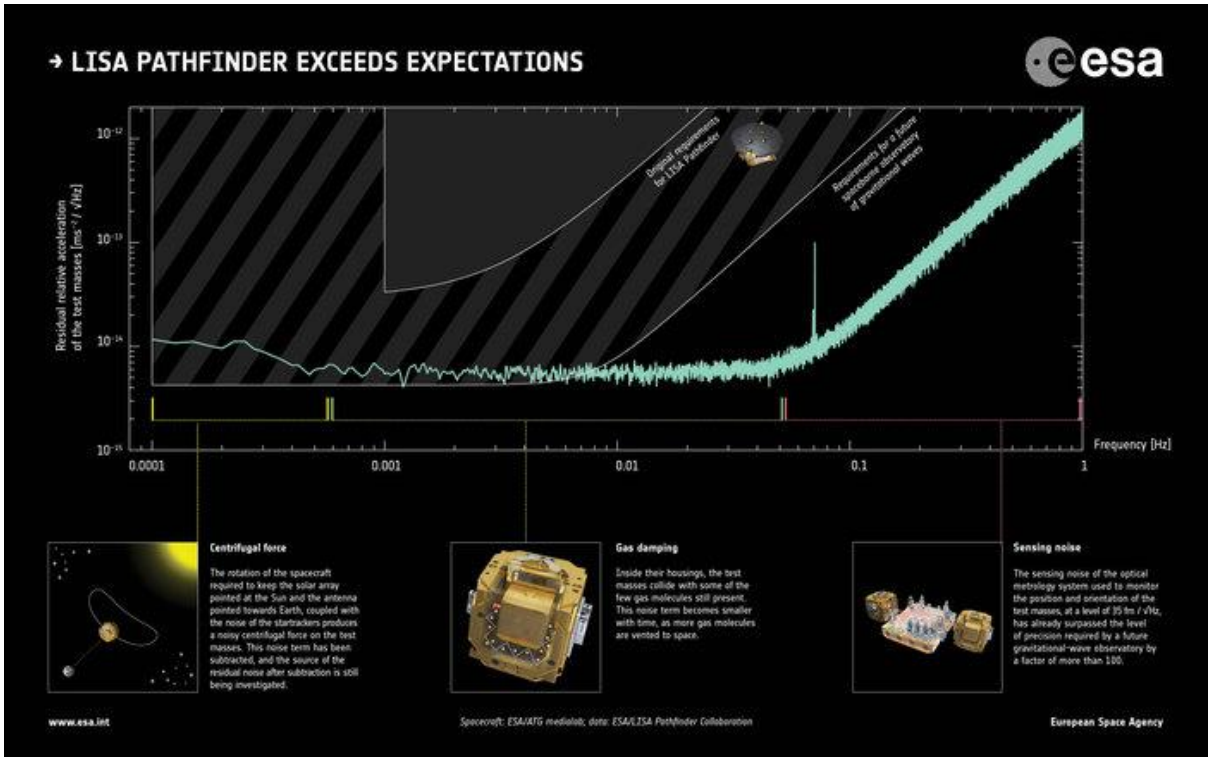
Disclaimer - I claim no authorship for the printed material; except where noted (PW).

3 SPACE STATION CREW MEMBERS RETURN TO EARTH, LAND SAFELY IN KAZAKHSTAN

Tim Peake of the European Space Agency, left, Yuri Malenchenko of Roscosmos center, and Tim Kopra of NASA sit in chairs outside the Soyuz TMA-19M spacecraft just minutes after they landed in a remote area near the town of Zhezkazgan, Kazakhstan on Saturday, June 18, 2016. Kopra, Peake, and Malenchenko are returning after six months in space where they served as members of the Expedition 46 and 47 crews onboard the International Space Station. Photo Credit: (NASA/Bill Ingalls)

Three crew members from the International Space Station returned to Earth at 5:15 a.m. EDT (3:15 p.m. Kazakhstan time) Saturday after wrapping up 186 days in space and several NASA research studies in human health.
Three space station crew members return to Earth, land safely in Kazakhstan (18 June 2016)

LISA PATHFINDER EXCEEDS EXPECTATIONS



ESA's LISA Pathfinder mission has demonstrated the technology needed to build a space-based gravitational wave observatory.

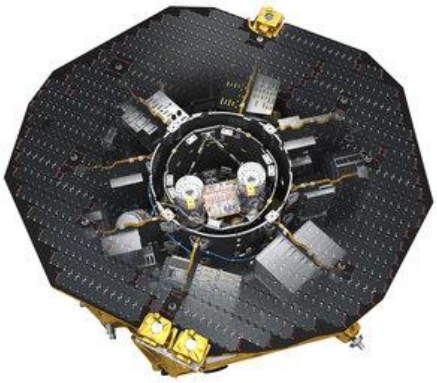
Results from only two months of science operations show that the two cubes at the heart of the spacecraft are falling freely through space under the influence of gravity alone, unperturbed by other external forces, to a precision more than five times better than originally required. The LISA Pathfinder team shows that the test masses are almost motionless with respect to each other, with a relative acceleration lower than ten millionths of a billionth of Earth's gravity. The demonstration of the mission's key technologies opens the door to the development of a large space observatory capable of detecting gravitational waves emanating from a wide range of exotic objects in the Universe.

Hypothesised by Albert Einstein a century ago, gravitational waves are oscillations in the fabric of spacetime, moving at the speed of light and caused by the acceleration of massive objects. They can be generated, for example, by supernovas, neutron star binaries spiralling around each other, and pairs of merging black holes. Even from these powerful objects, however, the fluctuations in spacetime are tiny by the time they arrive at Earth – smaller than 1 part in 100 billion billion. Sophisticated technologies are needed to register such minuscule changes, and gravitational waves were directly detected for the first time only in September 2015 by the ground-based Laser Interferometer Gravitational-Wave Observatory (LIGO).

This experiment saw the characteristic signal of two black holes, each with some 30 times the mass of the Sun, spiralling towards one another in the final 0.3 seconds before they coalesced to form a single, more massive object. The signals seen by LIGO have a frequency of around 100 Hz, but gravitational waves span a much broader spectrum. In particular, lower-frequency oscillations are produced by even more exotic events such as the mergers of supermassive black holes.

With masses of millions to billions of times that of the Sun, these giant black holes sit at the centres of massive galaxies. When two galaxies collide, these black holes eventually coalesce, releasing vast amounts of energy in the form of gravitational waves throughout the merger process, and peaking in the last few minutes. To detect these events and fully exploit the new field of gravitational astronomy, it is crucial to open access to gravitational waves at low frequencies between 0.1 mHz and 1 Hz.

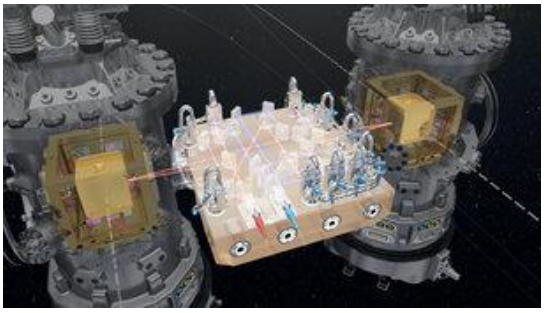
This requires measuring tiny fluctuations in distance between objects placed millions of kilometres apart, something that can only be achieved in space, where an observatory would also be free of the seismic, thermal and terrestrial gravity noises that limit ground-based detectors. LISA Pathfinder was designed to demonstrate key technologies needed to build such an observatory. A crucial aspect is placing two test masses in freefall, monitoring their relative positions as they move under the effect of gravity alone. Even in space this is very difficult, as several forces, including the solar wind and pressure from sunlight, continually disturb the cubes and the spacecraft. Thus, in LISA Pathfinder, a pair of identical, 2 kg, 46 mm gold–platinum cubes, 38 cm apart, fly, surrounded, but untouched, by a spacecraft whose job is to shield them from external influences, adjusting its position constantly to avoid hitting them.



Test masses inside LISA Pathfinder payload.

LISA Pathfinder was launched on 3 December 2015, reaching its operational orbit roughly 1.5 million km from Earth towards the Sun in late January 2016. The mission started operations on 1 March, with scientists performing a series of experiments on the test masses to measure and control all of the different aspects at play, and determine how still the masses really are. These extraordinary results show that the control achieved over the test masses is essentially at the level required to implement a gravitational wave observatory in space.

“Not only do we see the test masses as almost motionless, but we have identified, with unprecedented precision, most of the remaining tiny forces disturbing them,” explains Stefano Vitale of University of Trento and INFN, Italy, Principal Investigator of the LISA Technology Package, the mission’s core payload.

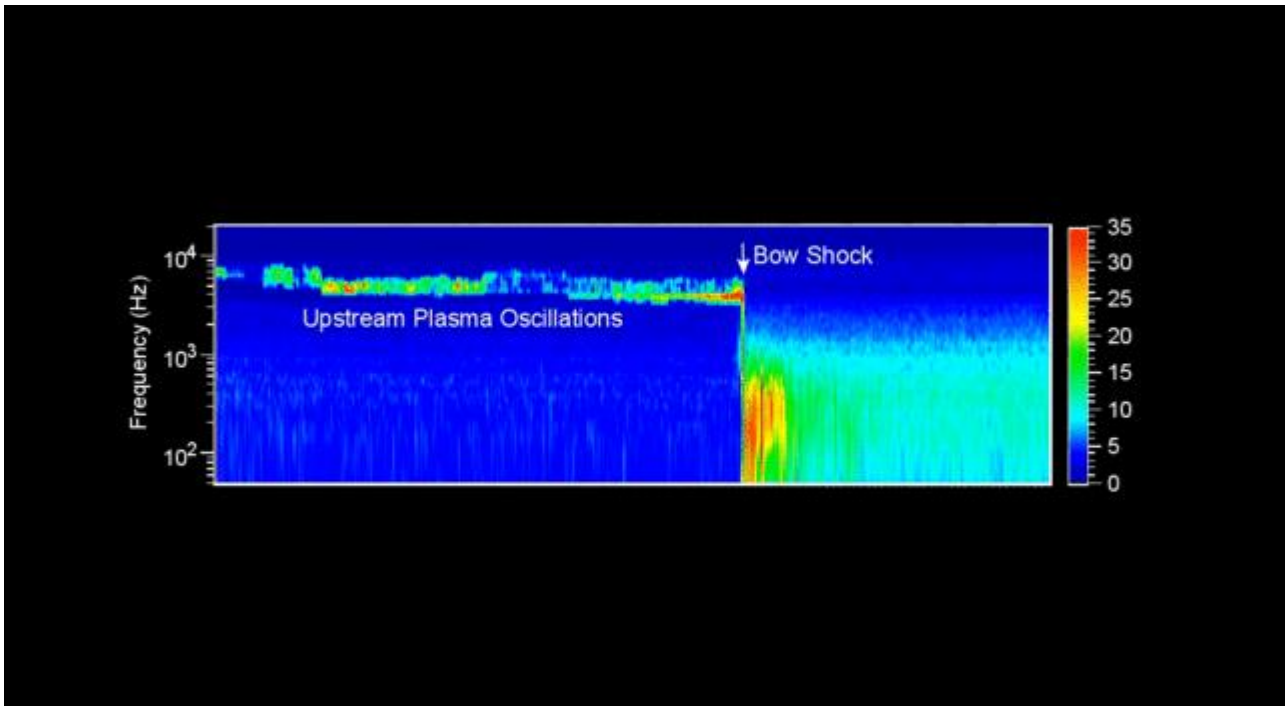


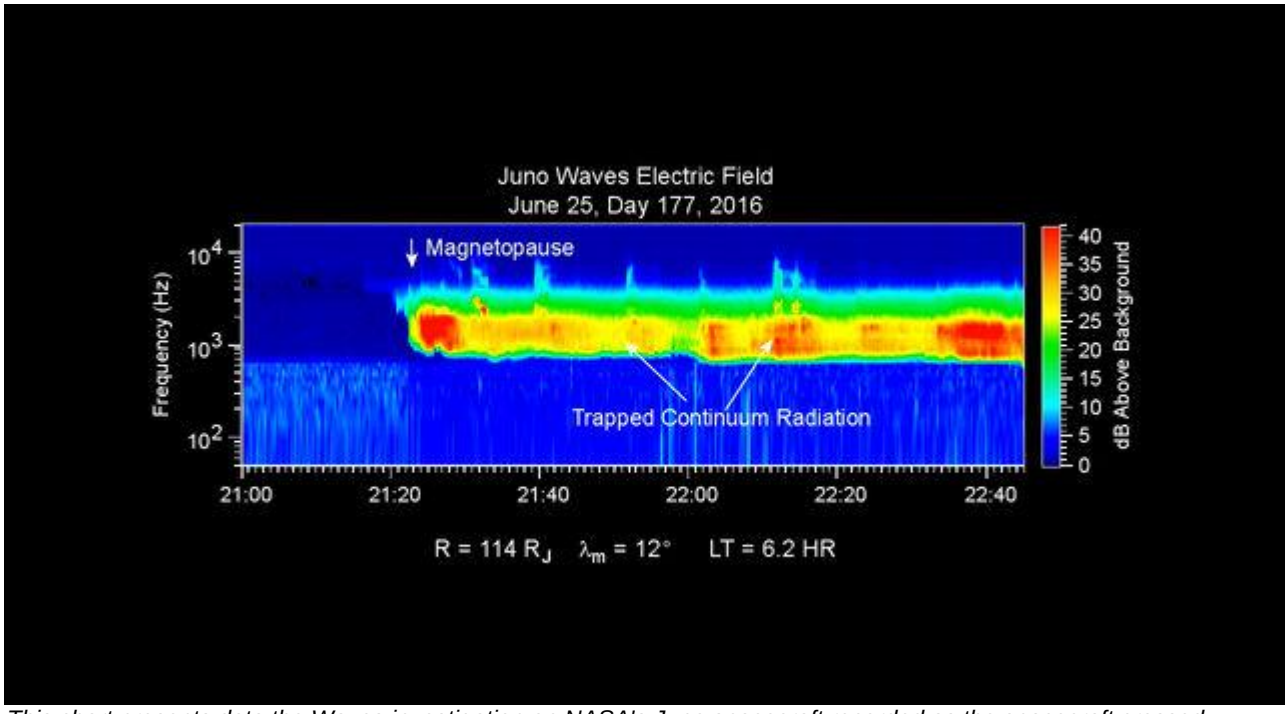
LISA Technology Package

At the precision reached by LISA Pathfinder, a full-scale gravitational wave observatory in space would be able to detect fluctuations caused by the mergers of supermassive black holes in galaxies anywhere in the Universe. These results demonstrate that LISA Pathfinder has proven the key technologies and paved the way for such an observatory, as the third ‘Large-class’ (L3) mission in ESA’s Cosmic Vision programme.
LISA Pathfinder exceeds expectations (7 June 2016)

NASA'S JUNO SPACECRAFT ENTERS JUPITER'S MAGNETIC FIELD

This artist's rendering shows NASA's Juno spacecraft making one of its close passes over Jupiter.
Credits: NASA/JPL-Caltech





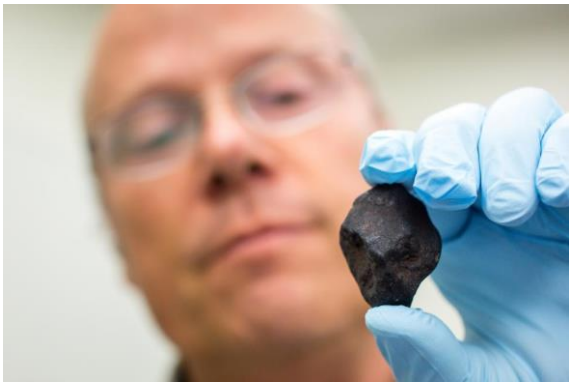
This chart presents data the Waves investigation on NASA's Juno spacecraft recorded as the spacecraft crossed the bow shock just outside of Jupiter's magnetosphere on June 24, 2016.
Credit: NASA/JPL-Caltech/SwRI/Univ. of Iowa

NASA's Jupiter-bound Juno spacecraft was launched on Aug. 5, 2011, from Cape Canaveral, Florida and has now entered the planet's magnetosphere, where the movement of particles in space is controlled by what's going on inside Jupiter. Juno is on course to swing into orbit around Jupiter on July 4. Science instruments on board detected changes in the particles and fields around the spacecraft as it passed from an environment dominated by the interplanetary solar wind into Jupiter's magnetosphere. Data from Juno's Waves investigation, presented as audio stream and colour animation, indicate the spacecraft's crossing of the bow shock just outside the magnetosphere on June 24 and the transit into the lower density of the Jovian magnetosphere on June 25.

The bow shock is analogous to a sonic boom. The solar wind blows past all the planets at a speed of about a million miles per hour, and where it hits an obstacle, there's all this turbulence. The obstacle is Jupiter's magnetosphere, which is the largest structure in the solar system. If Jupiter's magnetosphere glowed in visible light, it would be twice the size of the full moon as seen from Earth. And that's the shorter dimension of the teardrop-shaped structure; the dimension extending outward behind Jupiter has a length about five times the distance between Earth and the sun.

Out in the solar wind a few days ago, Juno was speeding through an environment that has about 16 particles per cubic inch (one per cubic centimetre). Once it crossed into the magnetosphere, the density was about a hundredfold less. The density is expected to climb again, inside the magnetosphere, as the spacecraft gets closer to Jupiter itself. The motions of these particles traveling under the control of Jupiter's magnetic field will be one type of evidence Juno examines for clues about Jupiter's deep interior. While this transition from the solar wind into the magnetosphere was predicted to occur at some point in time, the structure of the boundary between those two regions proved to be unexpectedly complex, with different instruments reporting unusual signatures both before and after the nominal crossing.
Juno spacecraft enters Jupiter's magnetic field (30 June 2016)

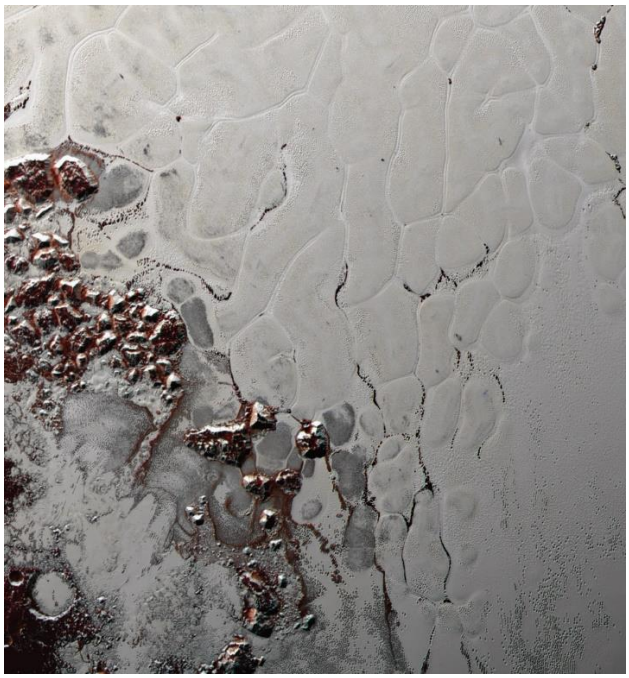
TRACKING DOWN THE ARIZONA FIREBALL



Laurence Garvie, curator of ASU's Center for Meteorite Studies, displays the meteorite he found on his recent trek into the White Mountain Apache tribal area. His team found 15 meteorites from the June 2 fireball that broke up over Arizona. Photo by Charlie Leight/ASU Now

On June 2, a chunk of rock the size of a Volkswagen Beetle hurtled into the atmosphere over the desert Southwest at 40,000 miles per hour and broke apart over the White Mountains of eastern Arizona. A week later, one of Arizona State University's top meteorite experts was off on a team expedition in the Arizona wilderness on an Apache homeland, braving bug bites, bears and mountainous terrain. After three nights and 132 hours of searching, ASU team - in partnership with White Mountain Apaches - locates meteorites on tribal land. (Arizona State University).
Tracking down the Arizona fireball | ASU Now: Access, Excellence, Impact (28 June 2016)

PLUTO'S HEART: LIKE A COSMIC 'LAVA LAMP'



Scientists from NASA's New Horizons mission used state-of-the-art computer simulations to show that the surface of Pluto's informally named Sputnik Planum is covered with churning ice "cells" that are geologically young and turning over due to a process called convection. The scene above, which is about 250 miles (400 kilometers) across, uses data from the New Horizons Ralph/Multispectral Visible Imaging Camera (MVIC), gathered July 14, 2015. ***Credits: NASA/JHUAPL/SwRI***

Like a cosmic lava lamp, a large section of Pluto's icy surface is being constantly renewed by a process called convection that replaces older surface ices with fresher material. Combining computer models with topographic and compositional data gathered by NASA's New Horizons spacecraft last summer, New Horizons team members have determined the depth of this layer of solid nitrogen ice within Pluto's distinctive "heart" feature – a large plain informally known as Sputnik Planum – and how fast that ice is flowing. The study is published in the June 2 issue of the journal Nature.

Mission scientists used state-of-the-art computer simulations to show that the surface of Sputnik Planum is covered with icy, churning, convective "cells" 10 to 30 miles (16 to 48 kilometers) across, and less than one million years old. The findings offer additional insight into the unusual and highly active geology on Pluto and, perhaps, other bodies like it on the outskirts of the solar system.

"For the first time, we can determine what these strange welts on the icy surface of Pluto really are," said William B. McKinnon, from Washington University in St. Louis, who led the study and is a co-investigator on the New Horizons science team. "We found evidence that even on a distant cold planet which is billions of miles from Earth, there is sufficient energy for vigorous geological activity, as long as you have 'the right stuff,' meaning something as soft and pliable as solid nitrogen."

McKinnon and colleagues believe the pattern of these cells stems from the slow thermal convection of the nitrogen-dominated ices that fill Sputnik Planum. A reservoir that's likely several miles deep in some places, the solid nitrogen is warmed by Pluto's modest internal heat, becomes buoyant and rises up in great blobs – like a lava lamp – before cooling off and sinking again to renew the cycle.

The computer models show that ice need only be a few miles deep for this process to occur, and that the convection cells are very broad. The models also show that these blobs of overturning solid nitrogen can slowly evolve and merge over millions of years. Ridges that mark where cooled nitrogen ice sinks back down can be pinched off and abandoned, resulting in Y- or X-shaped features in junctions where three or four convection cells once met.

"Sputnik Planum is one of the most amazing geological discoveries in 50-plus years of planetary exploration, and the finding by McKinnon and others on our science team that this vast area—bigger than Texas and Oklahoma combined – is created by current day ice convection is among the most spectacular of the New Horizons mission," said New Horizons Principal Investigator Alan Stern, of the Southwest Research Institute, Boulder, Colorado.

These convective surface motions average only a few centimeters a year – about as fast as your fingernails grow – which means cells recycle their surfaces every 500,000 years or so. While slow on human clocks, it's a fast clip on geological timescales.

"This activity probably helps support Pluto's atmosphere by continually refreshing the surface of 'the heart,'" McKinnon said. "It wouldn't surprise us to see this process on other dwarf planets in the Kuiper Belt. Hopefully, we'll get a chance to find out someday with future exploration missions there."

New Horizons could also potentially take a close-up look at a smaller, more ancient object much farther out in the Kuiper Belt – the disk-shaped region beyond the orbit of Neptune believed to contain comets, asteroids and other small, icy bodies. New Horizons flew through the Pluto system on July 14, 2015, making the first close observations of Pluto and its family of five moons. The spacecraft is on course for an ultra-close flyby of another Kuiper Belt object, 2014 MU69, on Jan. 1, 2019, pending NASA approval of funding for an extended mission.
Pluto's heart: like a cosmic 'lava lamp' (1 June 2016)

NEW SPACE LAW TO PROVIDE FRAMEWORK FOR SPACE RESOURCE UTILIZATION

The Luxembourg Government forges ahead with the SpaceResources.lu initiative by presenting an overall strategy to be implemented progressively for the exploration and commercial utilization of resources from Near Earth Objects (NEOs), such as asteroids. The new law will be based on the

findings of a study on legal and regulatory aspects for the utilization of space resources conducted by the University of Luxembourg – in cooperation with renowned space law experts in the fields of international space law and policy. The comprehensive legislation is expected to be effective 2017 and will guarantee operators the right to resources harvested in outer space in accordance with international law. Space resource-dedicated licenses will be issued under the new law, and government supervision of the activities of operators and regulating their rights and obligations will be ensured by Luxembourg in accordance with the Outer Space Treaty.
SpaceResources.lu: new space law to provide framework for space resource utilization (3 June 2016)

LINKS TO OTHER SPACE AND ASTRONOMY NEWS PUBLISHED IN JUNE 2016

ASTEROIDS

Small asteroid is Earth's constant companion (15 June 2016)
A small asteroid has been discovered in an orbit around the sun that keeps it as a constant companion of Earth, and it will remain so for centuries to come.

ASTROPHYSICS

Parkes Telescope detects key feature of life outside our solar system (15 June 2016)
Research with CSIRO's Parkes telescope has discovered the first molecule in space that has a key attribute associated with life - 'handedness' or chirality.

First detection of methyl alcohol in a planet-forming disc (15 June 2016)
The organic molecule methyl alcohol (methanol) has been found by the Atacama Large Millimeter/Submillimeter Array (ALMA) in the TW Hydrae protoplanetary disc.

ALMA observes most distant oxygen ever (16 June 2016)
A team of astronomers has used the Atacama Large Millimeter/submillimeter Array (ALMA) to detect glowing oxygen in a distant galaxy seen just 700 million years after the Big Bang.

Probing giant planets' dark hydrogen (23 June 2016)
Hydrogen is the most-abundant element in the universe. It's also the simplest—sporting only a single electron in each atom. But that simplicity is deceptive, because there is still so much we have to learn about hydrogen.

BLACK HOLES

Black hole fed by cold intergalactic deluge (8 June 2016)
An international team of astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) has witnessed a cosmic weather event that has never been seen before — a cluster of towering intergalactic gas clouds raining in on the supermassive black hole at the centre of a huge galaxy one billion light-years from Earth.

How black hole jets punch out of their galaxies (16 June 2016)
A simulation of the powerful jets generated by supermassive black holes at the centres of the largest galaxies explains why some burst forth as bright beacons visible across the universe, while others fall apart and never pierce the halo of the galaxy.

X-ray echoes of a shredded star provide close-up of 'killer' black hole (22 June 2016)
Some 3.9 billion years ago in the heart of a distant galaxy, the intense tidal pull of a monster black hole shredded a star that passed too close.

First observations of galactic centre with GRAVITY (23 June 2016)
A European team of astronomers have used the new GRAVITY instrument at ESO's Very Large

Telescope to obtain exciting observations of the centre of the Milky Way by combining light from all four of the 8.2-metre Unit Telescopes for the first time.

Newly discovered 'stealth' black hole suggests hidden population (27 June 2016)
An international group of astronomers led by UAlberta physicists have combined data from NASA's Chandra X-ray Observatory, the Hubble Space Telescope, and the National Science Foundation's Karl G. Jansky Very Large Array to conclude that a peculiar source of radio waves is a binary star system containing a low-mass star and a black hole.

COMET

Rosetta finale set for 30 September (30 June 2016)
Rosetta is set to complete its mission in a controlled descent to the surface of its comet on 30 September.

DARK MATTER

Did gravitational wave detector find dark matter? (15 June 2016)
When an astronomical observatory in the United States this winter detected a whisper of two black holes colliding in deep space, scientists celebrated a successful effort to confirm Albert Einstein's prediction of gravitational waves.

DWARF PLANETS

Moon over Makemake in the Kuiper Belt (27 June 2016)
A Southwest Research Institute-led team has discovered an elusive, dark moon orbiting Makemake, one of the "big four" dwarf planets populating the Kuiper Belt region at the edge of our solar system.

Recent hydrothermal activity may explain Ceres' brightest area (29 June 2016)
The brightest area on Ceres, located in the mysterious Occator Crater, has the highest concentration of carbonate minerals ever seen outside Earth, according to a new study from scientists on NASA's Dawn mission. (NASA Jet Propulsion Laboratory)

Dawn completes primary mission (30 June 2016)
On June 30 NASA's Dawn spacecraft completes its primary mission. The mission exceeded all expectations originally set for its exploration of protoplanet Vesta and dwarf planet Ceres.

EARTH

22 competitors rescued during the 2016 Marathon Des Sables thanks to Globalstar's SPOT Gen3 (1 June 2016)
Globalstar Europe Satellite Services today revealed that its affordable SPOT Gen3 safety device was instrumental in rescuing 22 participants in this year's Marathon Des Sables (MDS), the world's most extreme running race.

Sentinels in the fields (1 June 2016)
The unprecedented frequency of Sentinel observations capture rapid changes in agricultural production from national to field scale, serving as a major support for environmental monitoring and agricultural subsidy control.

Mapping that sinking feeling (1 June 2016)
For a low-lying, densely populated country like the Netherlands, monitoring subsidence is critical.

Seeing the satnav for the trees (15 June 2016)
ESA turned to the academic world to sharpen its understanding of how woodland vegetation can negatively affect the performance of satellite navigation systems.

'Space tsunami' causes the third Van Allen belt (20 June 2016)
Earth's magnetosphere, the region of space dominated by Earth's magnetic field, protects our planet from the harsh battering of the solar wind.

Caribbean Sea acts like a whistle and can be 'heard' from space (21 June 2016)
A study of the Caribbean Sea by University of Liverpool ocean scientists has revealed that, in the midst of all the noise of the ocean, this region behaves like a whistle, which blows so loudly that it can be 'heard' from space in the form of oscillations of the Earth's gravity field.

GHGSat launches greenhouse gas satellite (22 June 2016)
Montreal-based GHGSat has successfully launched its first satellite, named Claire, to measure greenhouse gas (GHG) emissions from industrial facilities around the world.

EXOPLANETS

Cloudy days on exoplanets may hide atmospheric water (8 June 2016)
Water is a hot topic in the study of exoplanets, including "hot Jupiters," whose masses are similar to that of Jupiter, but which are much closer to their parent star than Jupiter is to the sun.

New planet may be in slow death spiral (9 June 2016)
Astronomers searching for the galaxy's youngest planets have found compelling evidence for one unlike any other, a newborn "hot Jupiter" whose outer layers are being torn away by the star it orbits every 11 hours.

Small planets hiding in giant cloaks (14 June 2016)
Hazes and clouds high up in the atmospheres of exoplanets may make them appear bigger than they really are, according to new research by astronomers at the Space Research Institute (IWF) of the Austrian Academy of Sciences.

Unexpected excess of giant planets in star cluster (17 June 2016)
An international team of astronomers have found that there are far more planets of the hot Jupiter type than expected in a cluster of stars called Messier 67.

K2 finds newborn exoplanet around young star (20 June 2016)
Astronomers have discovered the youngest fully formed exoplanet ever detected. The discovery was made using NASA's Kepler Space Telescope and its extended K2 mission, as well as the W. M. Keck Observatory on Mauna Kea, Hawaii.

Newborn giant planet grazes its star (20 June 2016)
For the past 20 years, exoplanets known as 'hot Jupiters' have puzzled astronomers.

GALAXIES

SOFIA airborne observatory – NASA and DLR extend cooperation agreement (2 June 2016)
The SOFIA (Stratospheric Observatory for Infrared Astronomy) airborne observatory – a joint venture between the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and the United States National Aeronautics and Space Administration, NASA – explores the evolution of galaxies using the telescope.

Wasteful galaxies launch heavy elements into surrounding halos and deep space (6 June 2016)
Galaxies "waste" large amounts of heavy elements generated by star formation by ejecting them up to a million light years away into their surrounding halos and deep space, according to a new study led by the University of Colorado Boulder.

Minor mergers are major drivers of star formation (27 June 2016)
Around half of the star formation in the local Universe arises from minor mergers between galaxies, according to data from the Sloan Digital Sky Survey.

GRAVITATIONAL WAVES

Gravitational waves detected from second pair of colliding black holes (15 June 2016)
On Dec. 26, 2015 at 03:38:53 UTC, scientists observed gravitational waves -- ripples in the fabric of spacetime -- for the second time.

Star clusters a likely source of LIGO's first black holes (15 June 2016)
Northwestern University astrophysicists have predicted history. In a new study, the scientists show their theoretical predictions last year were correct: The historic merger of two massive black holes detected Sept. 14, 2015, could easily have been formed through dynamic interactions in the star-dense core of an old globular cluster.

LISA Pathfinder completes first operations phase (24 June 2016)
On Saturday 25 June, the LISA Technology Package (LTP) – a European payload on ESA's LISA Pathfinder – completes its nominal operations phase, passing the baton to the Disturbance Reduction System, an additional experiment provided by NASA.

INTERNATIONAL SPACE STATION

Cargo ship to depart from Space Station (9 June 2016)
After delivering almost 7,500 pounds of cargo to support dozens of science experiments from around the world, the Orbital ATK Cygnus cargo spacecraft is set to leave the International Space Station Tuesday, June 14.

Orbital ATK's Cygnus spacecraft begins next phase of OA-6 mission, conducting science in space (14 June 2016)
Orbital ATK today announced that the "S.S. Rick Husband" Cygnus spacecraft successfully departed from the International Space Station at 9:30 a.m. EDT, completing an 81-day stay at the orbiting laboratory.

United Launch Alliance provides update to OA-6 Cygnus launch (15 June 2016)
ULA successfully delivered the OA-6 Cygnus spacecraft to the International Space Station (ISS) on March 22.

NASA Glenn successfully ignites largest fire experiment in space (15 June 2016)
Engineers at NASA's Glenn Research Center and Orbital ATK successfully conducted the first remote Spacecraft Fire Experiment, or Saffire I, carried inside an Orbital ATK Cygnus cargo vehicle that departed the International Space Station on Tuesday, June 14.

Next International Space Station crew launch (30 June 2016)
The next three crew members bound for the International Space Station are set to launch Wednesday, July 6.

JAMES WEBB SPACE TELESCOPE

Cooler tested for James Webb Space Telescope (13 June 2016)
A first-of-its-kind cooler for NASA's James Webb Space Telescope, scheduled to launch in 2018, has completed testing at NASA's Jet Propulsion Laboratory in Pasadena, California.

JUPITER AND MOONS

New radio map of Jupiter reveals what's beneath colourful clouds (2 June 2016)
Astronomers using the upgraded Karl G. Jansky Very Large Array in New Mexico have produced the most detailed radio map yet of the atmosphere of Jupiter, revealing the massive movement of ammonia gas that underlies the colourful bands, spots and whirling clouds visible to the naked eye.

Juno spacecraft to risk Jupiter's fireworks for science (16 June 2016)
On July 4, NASA will fly a solar-powered spacecraft the size of a basketball court within 2,900 miles (4,667 kilometers) of the cloud tops of our solar system's largest planet.

MARS

Mars orbiters reveal seasonal dust storm pattern (9 June 2016)
After decades of research to discern seasonal patterns in Martian dust storms from images showing the dust, the clearest pattern appears to be captured by measuring the temperature of the Red Planet's atmosphere.

Mars rover descends plateau, turns toward mountain (13 June 2016)
NASA's Curiosity Mars rover has analysed its 12th drilled sample of Mars.

Unexpected mineral on Mars (22 June 2016)
Scientists have discovered an unexpected mineral in a rock sample at Gale Crater on Mars.

NASA weighs use of rover to image potential Mars water sites (24 June 2016)
Ever since it was announced that there may be evidence of liquid water on present-day Mars, NASA scientists have wondered how best to further investigate these long, seasonally changing dark streaks in the hope of finding evidence of life -- past or present -- on the Red Planet.

Rover findings point to a more Earth-like Martian past (27 June 2016)
Chemicals found in Martian rocks by NASA's Curiosity Mars rover suggest the Red Planet once had more oxygen in its atmosphere than it does now.

Rover's sand-dune studies yield surprise (30 June 2016)
Some of the wind-sculpted sand ripples on Mars are a type not seen on Earth, and their relationship to the thin Martian atmosphere today provides new clues about the atmosphere's history.

METEORITES

New type of meteorite linked to ancient asteroid collision (15 June 2016)
An ancient space rock discovered in a Swedish quarry is a type of meteorite never before found on Earth, scientists reported June 14 in the journal Nature Communications.

Opal discovered in Antarctic meteorite (27 June 2016)
Planetary scientists have discovered pieces of opal in a meteorite found in Antarctica, a result that demonstrates that meteorites delivered water ice to asteroids early in the history of the solar system.

MISCELLANEOUS

UW works with NASA to protect astronauts from kidney stones (24 June 2016)
Team building ultrasonic device to safeguard long-distance missions

NEPTUNE

Hubble confirms new dark spot on Neptune (23 June 2016)
New images obtained on May 16, 2016, by NASA's Hubble Space Telescope confirm the presence of a dark vortex in the atmosphere of Neptune.

PLUTO

Research bolsters case for a present-day subsurface ocean on Pluto (21 June 2016)
When the NASA's New Horizons spacecraft buzzed by Pluto last year, it revealed tantalizing clues

that the dwarf planet might have — or had at one time — a liquid ocean sloshing around under its icy crust.

SATURN AND MOONS

An ocean lies a few kilometers beneath Enceladus's icy surface (21 June 2016)
With eruptions of ice and water vapour, and an ocean covered by an ice shell, Saturn's moon Enceladus is one of the most fascinating in the Solar System, especially as interpretations of data provided by the Cassini spacecraft have been contradictory until now.

STARS AND STAR CLUSTERS

Milky Way's missing red giants (7 June 2016)
New computer simulations from the Georgia Institute of Technology provide a conclusive test for a hypothesis of why the centre of the Milky Way appears to be filled with young stars but has very few old ones.

NICER mission arrives at Kennedy Space Center (8 June 2016)
An upcoming NASA astrophysics mission will uncover the physics governing the ultra-dense interiors of neutron stars.

Failed star creates its own spotlight in the universe (13 June 2016)
Although astronomers often refer to brown dwarfs as "failed stars," scientists at the University of Delaware have discovered that at least one of these dim celestial objects can emit powerful flashes of light.

Gluttonous star may hold clues to planet formation (14 June 2016)
In 1936, the young star FU Orionis began gobbling material from its surrounding disk of gas and dust with a sudden voraciousness.

Astronomers find the first 'wind nebula' around a magnetar (21 June 2016)
Astronomers have discovered a vast cloud of high-energy particles called a wind nebula around a rare ultra-magnetic neutron star, or magnetar, for the first time.

Rotating ring of complex organic molecules discovered around newborn star (28 June 2016)
Researchers using the Atacama Large Millimeter/submillimeter Array (ALMA) have discovered a rotating ring containing large organic molecules around a protostar.

SUPERNOVA

3-D simulations illuminate supernova explosions (2 June 2016)
Despite their fundamental role in cosmology, the mechanisms that drive supernova explosions are still not well understood.

TECHNOLOGY

Moon plays lead role in new astronomical technique (1 June 2016)
A University of Alabama in Huntsville (UAH) professor and astrophysicist has detected the first high-energy astrophysical source from the moon.

NASA extends Hubble Space Telescope science operations contract (23 June 2016)
NASA is contractually extending science operations for its Hubble Space Telescope an additional five years.

Complex material engineering of NASA's Webb Telescope sunshield (23 June 2016)
The shiny silver material of the five-layer sunshield that will fly aboard NASA's James Webb Space Telescope is a complex and innovative feat of material science and engineering.

OrbitOutlook integrates largest and most diverse network of space sensors ever to help avoid collisions in space (29 June 2016)
More than 500,000 pieces of manmade space debris—including spent rocket stages, defunct satellites, and fragments as small as flecks of paint—currently hurtle around the Earth at roughly 17,000 miles per hour.

Blue Canyon Technologies' XACT attitude control system delivers precision pointing for MINXSS cubesat (30 June 2016)
In its first ever flight, the XACT attitude control system from Blue Canyon Technologies (BCT) is providing high-performance guidance, navigation, and control to the orbiting Miniature X-ray Solar Spectrometer (MinXSS) spacecraft.

VENUS

Venus has potential - but not for water (20 June 2016)
ESA's Venus Express may have helped to explain the puzzling lack of water on Venus.

Pat Williams. June 2016