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ASTRO

NEWSLETTER

Volume 11, Issue 11

May 16, 2018

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First CubeSat to Deep Space

The rocket that launched InSight also launched a separate NASA technology experiment: two mini-spacecraft called Mars Cube One, or MarCO.

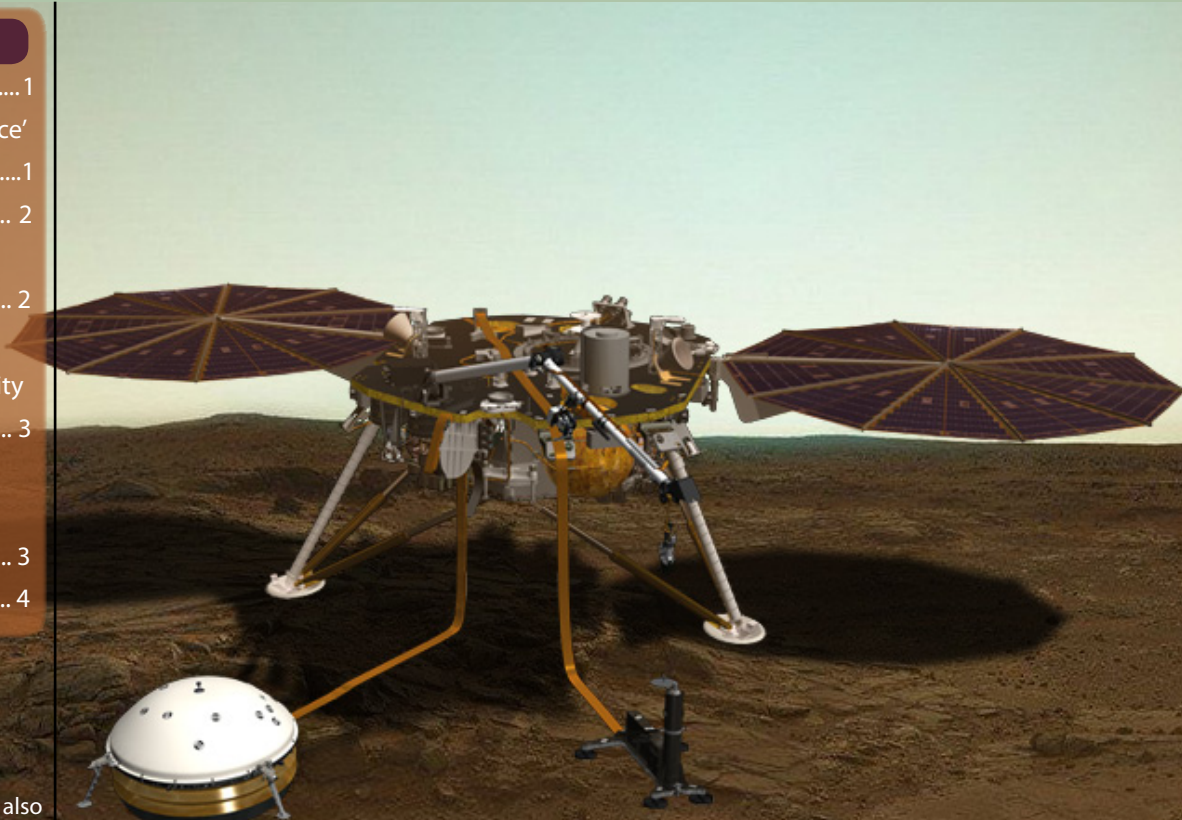
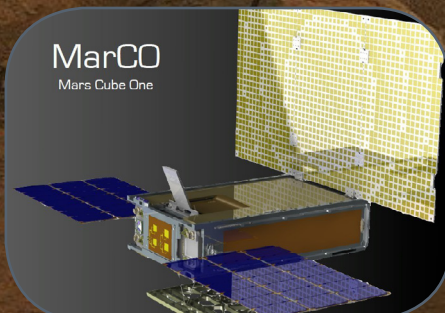
These briefcase-sized CubeSats fly on their own path to Mars behind InSight. Their goal is to test new miniaturized deep space communication equipment and, if the MarCOs make it to Mars, may relay back InSight data as it enters the Martian atmosphere and lands.

This is the first test of miniaturized CubeSat technology at another planet, which researchers hope can offer new capabilities to future missions.

If successful, the MarCOs could represent a new kind of communication capability to Earth. InSight's success is independent of its CubeSat tag-alongs.

www.nasa.gov

MarCO
Mars Cube One



InSight - Studying the 'Inner Space' of Mars

InSight, short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport, is a Mars lander designed to give the Red Planet its first thorough checkup since it formed 4.5 billion years ago. It is the first outer space robotic explorer to study in-depth the "inner space" of Mars: its crust, mantle, and core. Studying Mars' interior structure answers key questions about the early formation of rocky planets in our inner solar system - Mercury, Venus, Earth, and Mars - more than 4 billion years ago, as well as rocky exoplanets. InSight also measures tectonic activity and meteorite impacts on Mars today.

The lander uses cutting edge instruments, to delve deep beneath the surface and seek the fingerprints of the processes that formed the terrestrial planets. It does so by measuring the planet's "vital signs": its "pulse" (seismology), "temperature" (heat flow), and "reflexes" (precision tracking).

This mission is part of NASA's Discovery Program for highly focused science missions that ask critical questions in solar system science.

Why Mars?

Previous missions to Mars have investigated the surface history of the Red Planet by examining features like canyons, volcanoes, rocks and soil. However, signatures of the planet's formation can only be found by sensing and studying its "vital signs" far below the surface.

In comparison to the other terrestrial planets, Mars is neither too big nor too small. This means that it preserves the record of its formation and can give us insight into how the terrestrial planets formed. It is the perfect laboratory from which to study the formation and evolution of rocky planets. Scientists know that Mars has low levels of geological activity. But a lander like InSight can also reveal just how active Mars really is.

www.nasa.gov



Robonaut Returns to Earth

The world's first humanoid robot in space splashed down on Earth on Saturday (May 5), 57 years to the day after the first American astronaut did the same.

Robonaut 2, or R2 for short, returned to the planet aboard SpaceX's fourteenth Dragon cargo spacecraft to land from the International Space Station. Unlike Alan Shepard, who came away from his 1961 Mercury spaceflight unscathed, R2 came home damaged and partially disassembled.

Launched in 2011 in an effort to create a robotics research platform on the space station, the two-handed, dexterous Robonaut 2 ceased working three years later as it was just gaining its "space legs" — literally, a new pair of climbing manipulators. It was packed up and brought back to Earth after the upgrades needed to support its new appendages began causing significant problems.

Short circuit

From the first time that it was powered aboard the station on Aug. 22, 2011 through a series of two years of periodic tests, R2 showed that a humanoid robot could potentially assist a human space crew, freeing astronauts from having to perform basic maintenance activities.

Working with a task board, R2 demonstrated it was able to press buttons, flip switches and turn knobs, as well handle crew tools, including an RFID inventory scanner and an air flow meter. A space station crew member was also able to teleoperate R2, commanding it to catch an object floating inside the orbiting laboratory.

www.space.com



NASA is Sending a Helicopter to Mars

The Mars Helicopter's development began in 2013 at NASA's Jet Propulsion Laboratory (JPL) in California. It's just under 4 lbs. (1.8 kilograms), and its body is about the size of a softball, NASA officials said in the statement. It will carry solar cells to charge up in the light of the sun and a heating mechanism to endure cold nights on the Red Planet. The helicopter's twin blades will whirl at about 10 times the rate of a helicopter's blades on Earth — at 3,000 rpm — to stay aloft in Mars' thin atmosphere.

"The altitude record for a helicopter flying here on Earth is about 40,000 feet [12,000 meters]," MiMi Aung, Mars Helicopter project manager at JPL, said in the statement. "The atmosphere of Mars is only one percent that of Earth, so when our helicopter is on the Martian surface, it's already at the Earth equivalent of 100,000 feet [30,000 m] up. "To make it fly at that low atmospheric density, we had to scrutinize everything, make it as light as possible while being as strong and as powerful as it can possibly be," she added. Mars 2020 is slated to launch in July of that year on United Launch Alliance's Atlas V rocket from Cape Canaveral Air Force Station in Florida, and the mission should arrive at Mars in February 2021. The six-wheeled rover will hunt for signs of habitable environments as well as sites that may have once hosted microbial life, examining the Red Planet with 23 cameras, a microphone and a drill to collect samples. The helicopter will ride to Mars attached to the rover's belly pan, officials said. Once the rover reaches the planet's surface, it will place the helicopter

on the ground and move to a safe distance to relay commands; controllers on Earth will direct it to take its first autonomous flight.

"We don't have a pilot, and Earth will be several light-minutes away, so there is no way to joystick this mission in real time," Aung said. "Instead, we have an autonomous capability that will be able to receive and interpret commands from the ground, and then fly the mission on its own." The helicopter will attempt up to five flights, going farther and operating for longer each time — up to a few hundred meters and 90 seconds, officials said. It will also climb to 10 feet (3 m) and hover for about 30 seconds. The Mars Helicopter is considered a high-risk, high-reward project, according to NASA: If the helicopter fails, it won't affect the rest of the Mars 2020 rover's mission, but if it succeeds, the agency will have a powerful new tool to survey the planet and access currently unreachable locations. "Exploring the Red Planet with NASA's Mars Helicopter exemplifies a successful marriage of science and technology innovation and is a unique opportunity to advance Mars exploration for the future," Thomas Zurbuchen, the associate administrator for NASA's Science Mission Directorate at the agency's headquarters in Washington, D.C., said in the statement. "After the Wright Brothers proved 117 years ago that powered, sustained, and controlled flight was possible here on Earth, another group of American pioneers may prove the same can be done on another world.

www.space.com



SpaceX targeting 24-hour turnaround in 2019, full reusability still in the works

SpaceX has set an ambitious goal for 2019: using the same Falcon 9 booster to conduct two launches in 24 hours.

Such a feat would require more than just the rapid turnaround of Falcon 9's reusable first-stage booster. It would also require a rapid turnaround of Air Force range support and some speedy payload integration — assuming SpaceX doesn't want to launch an empty fairing second time around.

But Elon Musk, SpaceX's founder and chief executive, has never been shy about setting bold goals.

Musk mentioned the goal in the hours leading up to the first launch attempt of the Block 5 Falcon 9, which is designed with a first stage that can launch 10 times without refurbishment. That launch, carrying Bangladesh's first telecom satellite, Bangabandhu-1, was rescheduled for today after a last-minute glitch scrubbed the countdown with 58 seconds left on the clock.

"Next year is when we intend ... [to do] the same-day reflight of the same rocket," Musk said. "I think that's really a key milestone."

The ability to relaunch the same first stage in a single day would help SpaceX bolster its case that a used rocket is more reliable than a new one. SpaceX executives often reference air travel as a model for future launch activity. Musk reiterated that point. "Would you rather be flying in an aircraft that's never had a test flight before, or would you rather fly in an aircraft that has flown many times successfully?" he said. Musk said he thinks customers eventually

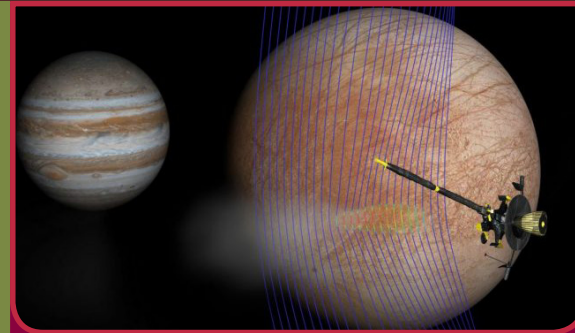
"will actually prefer to fly on a flight-proven rocket than one that has never flown."

SpaceX has given discounts to some early customers of Falcon 9 rockets with used first stages to ease their acceptance, particularly among risk-averse satellite operators who might otherwise be reluctant to launch a spacecraft costing \$100 million or more on rocket booster already subjected to the rigors of launch and landing.

Musk said SpaceX lowered prices from "about \$60 million to about \$50 million for a reflown booster," and expects "to see a steady reduction in prices" going forward. He cautioned though that SpaceX has lots of fixed costs, its future Starlink satellite internet constellation and development of the Big Falcon Rocket (BFR) that require revenue from launches, meaning prices can only go so low. Ocean recoveries, which require sending drone ships out to sea for landing Falcon 9 first stages, also cost "a few million dollars," he said.

Given the extensive modifications made to Block 5, SpaceX will take extra time after the Bangabandhu-1 launch to disassemble and inspect the rocket.

Musk estimated the Falcon 9 Block 5 will make "something on the order of 300 flights," before retiring. SpaceX plans to succeed the Falcon 9 and Falcon Heavy with the BFR, and is targeting a cargo mission to Mars with the larger rocket in 2022.



Hubble, Galileo data provide more evidence of plumes over Europa

After reviewing data from a previous mission to the Jovian system, scientists found evidence of a plume erupting from Jupiter's moon Europa, which NASA said indicates that the moon's subsurface ocean may indeed be venting water vapor through cracks in its icy surface.

In 2012, NASA revealed ultraviolet images captured by the Hubble Space Telescope that suggested the presence of plumes that erupted from the surface of Europa. It was the first strong evidence of such eruptions from the icy world.

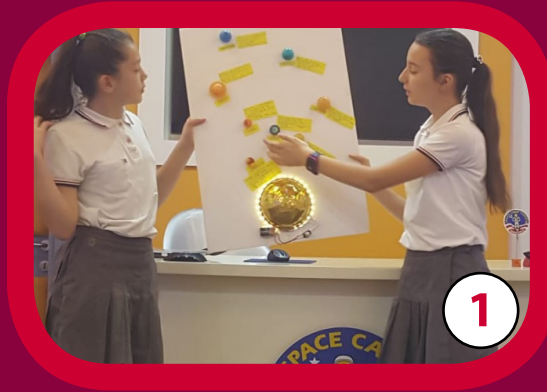
However, after recently re-examining magnetometer data from a 1997 Europa flyby that saw the Galileo spacecraft, which orbited Jupiter between 1995 and 2003, fly within about 124 miles (200 kilometers) of the surface of the moon, scientists put that information through "new and advanced computer models" to better understand an unexplained "bend" in the planet's magnetic field. The new analysis, combined with 2012 Hubble images, is considered "strong and corroborating support for plumes," NASA said.

OLD DATA PROVIDES NEW INSIGHTS

Scientists say Europa is an important exploration destination because it could contain the three ingredients known to be required for life: liquid water; chemistry necessary for life, including carbon, hydrogen, nitrogen, oxygen, phosphorous, and sulfur; and energy. The presence of plumes on Europa offers evidence for the third ingredient—energy—in the form of heat.

Schools in Action

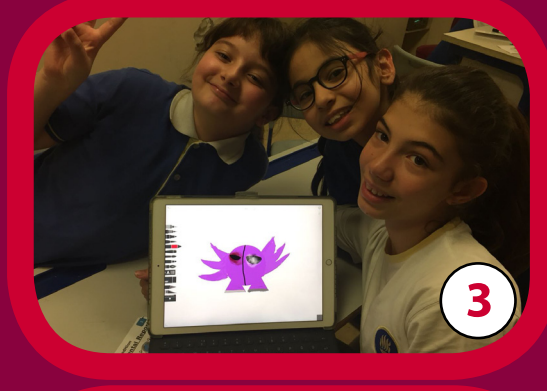
Summer is right around the corner. As we all know, summer is the time to relax for everyone. But for students, it's a different story. They continue to work hard on their projects and come up with absolutely amazing stuff. In order to learn more about space, they do their best to finish up their current projects and start new ones. Thank you kids!



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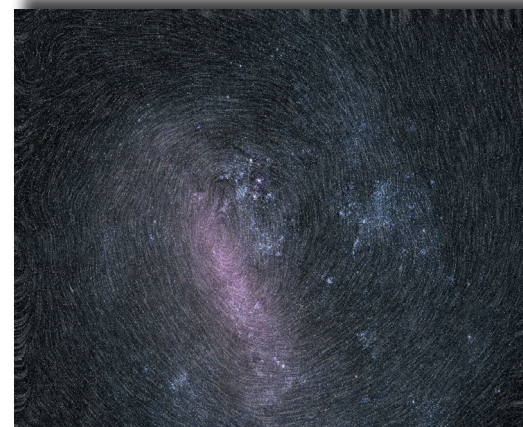
1- Turk Collage - IZMIR, 2- Yane Sandanski, Gotse Delchev - BULGARIA, 3- FMV Schools - ISTANBUL, 4- Istek Schools - IZMIR, 5- Velzys Gymnasium - LITHUANIA, 6- Rota Schools - IZMIR

Astronomy Picture of the Day

Magellanic Mountain

This image is not blurry. It shows in clear detail that the largest satellite galaxy to our Milky Way, the Large Cloud of Magellan (LMC), rotates. First determined with Hubble, the rotation of the LMC is presented here with fine data from the Sun-orbiting Gaia satellite. Gaia measures the positions of stars so accurately that subsequent measurements can reveal slight proper motions of stars not previously detectable. The featured image shows, effectively, exaggerated star trails for millions of faint LMC stars. Inspection of the image also shows the center of the clockwise rotation: near the top of the LMC's central bar. The LMC, prominent in southern skies, is a small spiral galaxy that has been distorted by encounters with the greater Milky Way Galaxy and the lesser Small Magellanic Cloud (SMC).

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