Space News Update

— May 4, 2018 —

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1. NASA’s First Mission to Study the Interior of Mars Awaits May 5 Launch

All systems are go for NASA’s next launch to the Red Planet.

The early-morning liftoff on Saturday of the Mars InSight lander will mark the first time in history an interplanetary launch will originate from the West Coast. InSight will launch from the U.S. Air Force Vandenberg Air Force Base Space Launch Complex 3E. The two-hour launch window will open on May 5 at 4:05 a.m. PDT (7:05 a.m. EDT).

InSight, for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport, will launch aboard a United Launch Alliance (ULA) Atlas V rocket. InSight will study the deep interior of Mars to learn how all rocky planets formed, including Earth and its Moon. The lander's instruments include a seismometer to detect marsquakes, and a probe that will monitor the flow of heat from the planet's interior.

The ULA rocket will carry the spacecraft over the Channel Islands just off the California Coast and continue climbing out over the Pacific, shadowing the coastline south beyond Baja California. InSight’s Atlas will reach orbit about 13 minutes after launch, when the rocket is about 1,200 miles (1,900 kilometers) northwest of Isabella Island, Ecuador.

“For those Southern Californians who are interested in rockets or space exploration, or have insomnia, we hope to put on a great show this Saturday,” said Tom Hoffman, InSight project manager from NASA’s Jet Propulsion Laboratory in Pasadena, California. “But for those who want to sleep in on Saturday, there will be another opportunity to engage with this historic mission. We will be landing on Mars in the western Elysium Planitia region on Monday, Nov. 26, around noon Pacific time. You will be able to watch a live stream of this landing while working on your holiday shopping.”

Getting a Mars mission flying requires a great many milestones. Among those still to come are the official start of the countdown to launch -- which comes on Friday, May 4 at 10:14 a.m. PDT (Saturday, May 5, 1:14 a.m.

EDT). A little over an hour later, at about 11:30 p.m. PDT (May 5, 2:30 a.m. EDT), the 260-foot-tall (80-meter) Mobile Service Tower -- a structure that has been protecting the Atlas V launch vehicle and its InSight payload during their vertical assembly -- will begin a 20-minute long, 250-foot (about 80-meter) roll away from the Atlas. Four hours and 25 minutes later, the launch window will open.

“I’ve been to several rocket launches, but it is a whole different vibe when there is something you've been working on for years sitting in the nose cone waiting to get hurled beyond our atmosphere,” said Bruce Banerdt, InSight principal investigator at JPL. “But as exciting as launch day will be, it’s just a first step in a journey that should tell us not only why Mars formed the way it did, but how planets take shape in general."

InSight's launch period is May 5 through June 8, 2018, with multiple launch opportunities over windows of approximately two hours each date. Launch opportunities are set five minutes apart during each date's window. Whichever date the launch occurs, InSight's landing on Mars is planned for Nov. 26, 2018, around noon PST (3 p.m. EST).

JPL manages InSight for NASA's Science Mission Directorate. InSight is part of NASA's Discovery Program, managed by the agency's Marshall Space Flight Center in Huntsville, Alabama. The InSight spacecraft, including cruise stage and lander, was built and tested by Lockheed Martin Space in Denver. NASA's Launch Services Program at the agency's Kennedy Space Center in Florida provides launch management. United Launch Alliance of Centennial, Colorado, is NASA's launch service provider of the Atlas 5 rocket. A number of European partners, including France's Centre National d'Études Spatiales (CNES) and the German Aerospace Center (DLR), are supporting the InSight mission. In particular, CNES provided the Seismic Experiment for Interior Structure (SEIS) instrument, with significant contributions from the Max Planck Institute for Solar Systems Research (MPS). DLR provided the Heat Flow and Physical Properties Package (HP3) instrument.

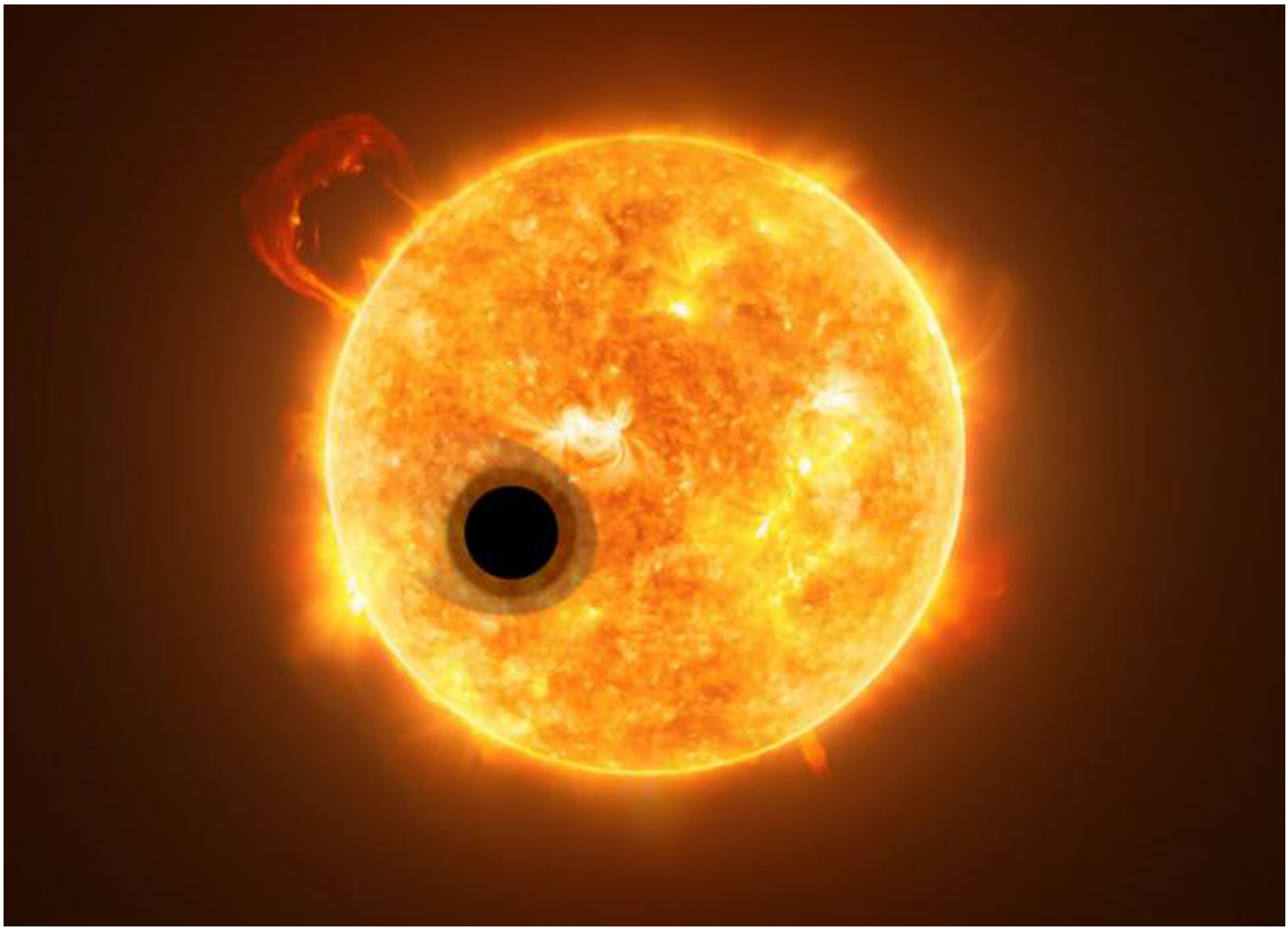
For more information about InSight, visit https://mars.nasa.gov/insight/. Live televised coverage of the launch will be available at https://www.nasa.gov/live.

For information on viewing the launch in person, visit:

https://mars.nasa.gov/insight/mission/timeline/launch/watch-in-person/

Source: NASA Return to Contents

2. Hubble Detects Helium In An Exoplanet Atmosphere For The First Time



Astronomers using the NASA/ESA Hubble Space Telescope have detected helium in the atmosphere of the exoplanet WASP-107b.

This is the first time this element has been detected in the atmosphere of a planet outside the Solar System. The discovery demonstrates the ability to use infrared spectra to study exoplanet extended atmospheres.

The international team of astronomers, led by Jessica Spake, a PhD student at the University of Exeter in the UK, used Hubble's Wide Field Camera 3 to discover helium in the atmosphere of the exoplanet WASP-107b This is the first detection of its kind.

Spake explains the importance of the discovery: "Helium is the second-most common element in the Universe after hydrogen. It is also one of the main constituents of the planets Jupiter and Saturn in our Solar System. However, up until now helium had not been detected on exoplanets - despite searches for it."

The team made the detection by analysing the infrared spectrum of the atmosphere of WASP-107b. Previous detections of extended exoplanet atmospheres have been made by studying the spectrum at ultraviolet and optical wavelengths; this detection therefore demonstrates that exoplanet atmospheres can also be studied at longer wavelengths.

"The strong signal from helium we measured demonstrates a new technique to study upper layers of exoplanet atmospheres in a wider range of planets," says Spake "Current methods, which use ultraviolet light, are limited to the closest exoplanets. We know there is helium in the Earth's upper atmosphere and this new technique may help us to detect atmospheres around Earth-sized exoplanets - which is very difficult with current technology."

WASP-107b is one of the lowest density planets known: While the planet is about the same size as Jupiter, it has only 12% of Jupiter's mass. The exoplanet is about 200 light-years from Earth and takes less than six days to orbit its host star.

The amount of helium detected in the atmosphere of WASP-107b is so large that its upper atmosphere must extend tens of thousands of kilometres out into space. This also makes it the first time that an extended atmosphere has been discovered at infrared wavelengths.

Since its atmosphere is so extended, the planet is losing a significant amount of its atmospheric gases into space -- between ~0.1-4% of its atmosphere's total mass every billion years [2].

As far back as the year 2000, it was predicted that helium would be one of the most readily-detectable gases on giant exoplanets, but until now, searches were unsuccessful.

David Sing, co-author of the study also from the University of Exeter, concludes: "Our new method, along with future telescopes such as the NASA/ESA/CSA James Webb Space Telescope/, will allow us to analyse atmospheres of exoplanets in far greater detail than ever before."

Notes

[1] The measurement of an exoplanet's atmosphere is performed when the planet passes in front of its host star. A tiny portion of the star's light passes through the exoplanet's atmosphere, leaving detectable fingerprints in the spectrum of the star. The larger the amount of an element present in the atmosphere, the easier the detection becomes.

[2] Stellar radiation has a significant effect on the rate at which a planet's atmosphere escapes. The star WASP-107 is highly active, supporting the atmospheric loss. As the atmosphere absorbs radiation it heats up, so the gas rapidly expands and escapes more quickly into space.

More information

The Hubble Space Telescope is a project of international cooperation between ESA and NASA.

The study was published in the paper "Helium in the eroding atmosphere of an exoplanet", published in Nature.

Source: Spaceref.com Return to Contents

3. Mineral in Lunar Meteorite Suggests Water Was Once on The Moon

A team of researchers led by Masahiro Kayama of Tohoku University has found evidence in a lunar meteorite that water once existed on the moon. In their paper published on the open access site *Science Advances*, the team describes their study of the meteorite and why they believe it offers evidence of water on the moon.

Water on the moon, some have suggested, would be valuable, because it could support a colony—or perhaps be used for other purposes, such as powering spacecraft. But thus far, efforts to find any below the surface in the more temperate regions have come up empty-handed. In this new effort, the researchers were studying one of the lunar meteorites found on the surface of the Earth. Such meteorites are pieces of the moon blasted into space by an impact. The fragment studied by the team in Japan turned out to be unique—it held some amount of moganite, a mineral that only forms in the presence of water.

Prior research had shown that the meteorite, named NWA 272, crashed into a northern part of Africa approximately 17,000 years ago. Comparison with other moon surface material confirmed it came from the lunar surface, as well. After finding it contained moganite, the team ran more tests to show that it had not formed after landing on Earth.

To explain the presence of the mineral, the team suggests the moon was struck by a comet or other water-bearing object. Some of the water likely evaporated, but some would also have seeped into the lunar surface. As the water sat below the surface, moganite eventually formed. Sometime thereafter, the same area was once again impacted—this time by an object that flung bits of the lunar surface containing the moganite into space. After that, it made its way to Earth.

The researchers suggest their finding is exciting because logic suggests if water were under the surface at one time, more could be there now. It would just be a matter of making the effort to find it.

Explore further: Study suggests Earth's water was present before impact that caused creation of the moon

More information: Masahiro Kayama et al. Discovery of moganite in a lunar meteorite as a trace of H 2 O ice in the Moon's regolith, *Science Advances* (2018). DOI: 10.1126/sciadv.aar4378

Source: Phys.org

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The Night Sky

Friday, May 4

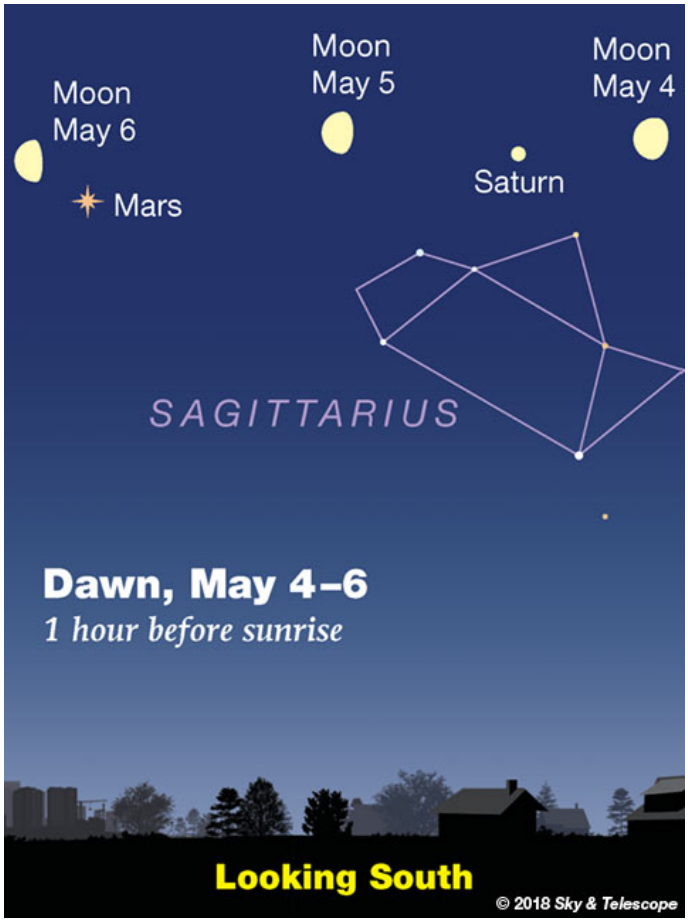
• Keep a watch on the changing patterns Venus makes with its background stars from week to week. As Aldebaran and the Pleiades sink away, Beta Tauri (El Nath) above Venus closes in.

• Summer is seven weeks off, but the Summer Triangle is making its appearance in the east, one star after another. The first in view is Vega. It's already shining low in the northeast as twilight fades out.

Next up is Deneb, lower left of Vega by two or three fists at arm's length. Deneb takes about an hour to appear after Vega does, depending on your latitude.

The third is Altair, which shows up far to their lower right by midnight.

• As dawn begins on Saturday morning May 5th, the waning gibbous Moon shines between Saturn and Mars, as shown here.



Saturday, May 5

• Jupiter's Great Red Spot crosses the planet's central meridian around 11:56 p.m. Eastern Daylight Time.

• The Eta Aquariid meteor shower should be active before the first light of dawn Sunday morning. It's usually the best shower of the year for the Southern Hemisphere, but northerners have a poorer view of it. Moreover, the light of the waning gibbous Moon will interfere.

• On Sunday morning May 6th the Moon shines with Mars, as shown here.

Sunday, May 6

• Here's a challenge: With Jupiter just two days from opposition, it's currently casting its shadow in space almost exactly away from us. But not *precisely* so. An eclipse of Io tonight offers a test. At 1:35 a.m. EDT (10:35 p.m. PDT), Io disappears into eclipse by Jupiter's shadow while hanging smack on Jupiter's western (preceding) edge. In your telescope, can you detect that Io fades out just barely off Jupiter's limb rather than behind the limb itself?

Monday, May 7

• Last-quarter Moon tonight (exact at 10:09 p.m. EDT). The Moon rises around 3 a.m. daylight-saving time. By early dawn Tuesday morning, it's far left of Saturn and Mars.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver: No sighting opportunities

Date	Visible	Max Height	Appears	Disappears
Sat May 5, 3:13 AM	< 1 min	12°	12° above E	10° above E
Sat May 5, 4:45 AM	3 min	45°	21° above W	24° above NNE
Sun May 6, 3:55 AM	1 min	78°	78° above NE	29° above NE
Sun May 6, 5:30 AM	2 min	16°	10° above WNW	16° above NNW
Mon May 7, 3:05 AM	1 min	18°	18° above ENE	10° above ENE
Mon May 7, 4:37 AM	3 min	23°	15° above WNW	17° above NNE

Sighting information for other cities can be found at NASA's Satellite Sighting Information

NASA-TV Highlights

(all times Eastern Daylight Time)

Saturday, May 5

2:30 a.m., NASA EDGE coverage of InSight Rollback -- Vandenberg Air Force Base, California (all channels)

3:30 a.m., Replay of the Pre-launch briefing for InSight Mars Lander (all channels)

5:30 a.m., InSight Mars Lander Programming (all channels)

6:30 a.m., InSight Mars Lander launch coverage from Vandenberg Air Force Base in California (Launch scheduled for 7:05 a.m.) (all channels)

9 a.m., Coverage of the Release of the SpaceX/Dragon CRS-14 Cargo Craft from the ISS (Release is scheduled at 9:24 a.m. EDT) (all channels)

1 p.m., Replay of the RNASA Space Awards Gala 2018 (all channels)

3 p.m., Replay of the Pre-Launch Briefing on NASA's Next Earth-Observing Mission: The Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) Mission (all channels)

4 p.m., 2018 Astronaut Hall of Fame Induction Ceremony (all channels)

5:30 p.m., Replay of the InSight Mars Lander launch (all channels)

6 p.m., Replay of SpaceCast Weekly (all channels)

7 p.m., Replay of the Pre-Launch Briefing on NASA's Next Earth-Observing Mission: The Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) Mission (all channels)

Saturday, May 5

8 p.m., Replay of the RNASA Space Awards Gala 2018 (all channels)

Watch NASA TV on the Net by going to the NASA website.

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Space Calendar

- May 04 - Comet 37P/Forbes Perihelion (1.610 AU)
- May 04 - Comet 30P/Reinmuth At Opposition (1.816 AU)
- May 04 - Apollo Asteroid 2018 HR1 Near-Earth Flyby (0.044 AU)
- May 04 - Apollo Asteroid 2017 WY14 Near-Earth Flyby (0.052 AU)
- May 04 - Apollo Asteroid 2012 SR56 Near-Earth Flyby (0.064 AU)
- May 04 - Apollo Asteroid 2018 HC Near-Earth Flyby (0.076 AU)
- May 04 - Asteroid 17898 Scottsheppard Closest Approach To Earth (1.101 AU)
- May 04 - Jean-Charles de Borda's 285th Birthday (1733)
- May 04 - Jean-Philippe de Cheseaux's 300th Birthday (1718)
- May 05 - 

[May 03] InSight/ Mars Cube One 1 & 2 Atlas 5 Launch (Mars Lander)
- May 05 - 

[May 02] CRS-14 Return To Earth (International Space Station)
- May 05 - 

[Apr 29] National Astronaut Day
- May 05 - Eta Aquarids Meteor Shower Peak
- May 05 - Amor Asteroid 2018 GW Near-Earth Flyby (0.056 AU)
- May 05 - Asteroid 8299 Tealeoni Closest Approach To Earth (0.956 AU)
- May 05 - Asteroid 9342 Carygrant Closest Approach To Earth (1.568 AU)
- May 05 - Asteroid 12846 Fullerton Closest Approach To Earth (2.095 AU)
- May 05 - Homolovi State Park Star Party, Homolovi State Park, Arizona
- May 05 - Albert Marth's 190th Birthday (1828)
- May 06 - Apstar 6C CZ-3B/E Launch
- May 06 - Comet 107P/Wilson-Harrington Closest Approach To Earth (1.688 AU)
- May 06 - Comet 304P/Ory At Opposition (3.926 AU)
- May 06 - Apollo Asteroid 2018 HV1 Near-Earth Flyby (0.061 AU)
- May 06 - Apollo Asteroid 1685 Toro Closest Approach To Earth (0.972 AU)
- May 06 - Asteroid 8283 Edinburgh Closest Approach To Earth (2.037 AU)
- May 06 - Asteroid 2476 Andersen Closest Approach To Earth (2.212 AU)
- May 06 - Carl Hergenrother's 45th Birthday (1973)
- May 06 - Grove Gilbert's 175th Birthday (1843)
- May 07 - 

[Apr 28] Bangabandhu-1 Falcon 9 Launch
- May 07 - Comet 143P/Kowal-Mrkos Perihelion (2.532 AU)
- May 07 - Comet P/2000 R2 (LINEAR) Closest Approach To Earth (2.591 AU)
- May 07 - Comet 350P/McNaught Closest Approach To Earth (2.753 AU)
- May 07 - Comet 350P/McNaught At Opposition (2.753 AU)
- May 07 - Comet C/2016 S1 (PANSTARRS) At Opposition (3.266 AU)
- May 07 - Comet C/2017 A1 (PANSTARRS) At Opposition (3.787 AU)
- May 07 - Apollo Asteroid 1999 FN19 Near-Earth Flyby (0.025 AU)
- May 07 - Apollo Asteroid 2018 GX Near-Earth Flyby (0.065 AU)
- May 07 - Asteroid 4433 Goldstone Closest Approach To Earth (1.499 AU)
- May 07 - Apollo Asteroid 11311 Peleus Closest Approach To Earth (1.742 AU)
- May 07 - Kuiper Belt Object 2010 FX86 At Opposition (45.160 AU)

Source: JPL Space Calendar

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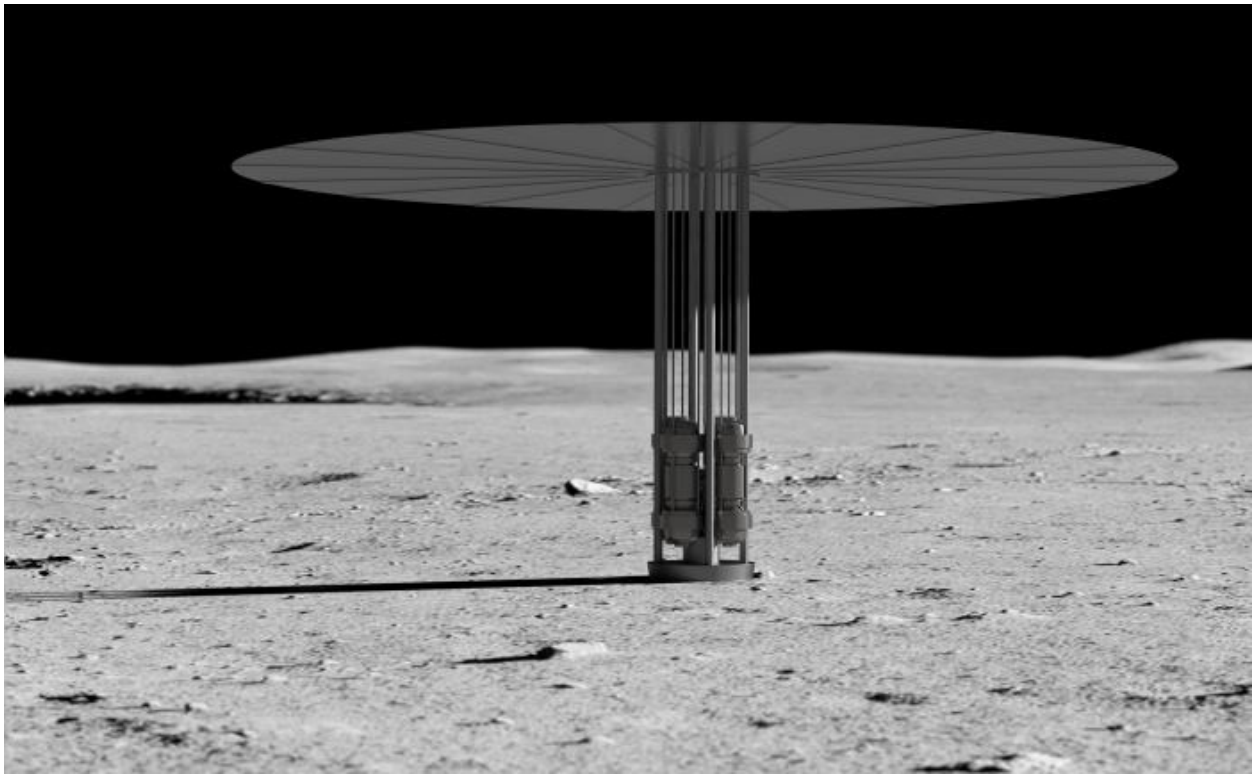
Food for Thought

NASA Has Tested a New Fission Space Reactor that Could be Used in Future Missions



Looking to the future of crewed space exploration, it is clear to NASA and other space agencies that certain technological requirements need to be met. Not only are a new generation of launch vehicles and space capsules needed (like the SLS and Orionspacecraft), but new forms of energy production are needed to ensure that long-duration missions to the Moon, Mars, and other locations in the Solar System can take place.

One possibility that addresses these concerns is Kilopower, a lightweight fission power system that could power robotic missions, bases and exploration missions. In collaboration with the Department of Energy's National Nuclear Security Administration (NNSA), NASA recently conducted a successful demonstration of a new nuclear reactor power system that could enable long-duration crewed missions to the Moon, Mars, and beyond.

Known as the Kilopower Reactor Using Stirling Technology(KRUSTY) experiment, the technology was unveiled at a recent news conference on Wednesday, May 2nd, at NASA's Glenn Research Center. According to NASA, this power system is capable of generating up to 10 kilowatts of electrical power – enough power several households continuously for ten years, or an outpost on the Moon or Mars.

As Jim Reuter, NASA's acting associate administrator for the Space Technology Mission Directorate (STMD), explained in a recent NASA press release:

"Safe, efficient and plentiful energy will be the key to future robotic and human exploration. I expect the Kilopower project to be an essential part of lunar and Mars power architectures as they evolve."

The prototype power system employs a small solid uranium-235 reactor core and passive sodium heat pipes to transfer reactor heat to high-efficiency Stirling engines, which convert the heat to electricity. This power

system is ideally suited to locations like the Moon, where power generation using solar arrays is difficult because lunar nights are equivalent to 14 days on Earth.

In addition, many plans for lunar exploration involve building outposts in the permanently-shaded polar regions or in stable underground lava tubes. On Mars, sunshine is more plentiful, but subject to the planet's diurnal cycle and weather (such as dust storms). This technology could therefore ensure a steady supply of power that is not dependent on intermittent sources like sunlight. As Marc Gibson, the lead Kilopower engineer at Glenn, said:

"Kilopower gives us the ability to do much higher power missions, and to explore the shadowed craters of the Moon. When we start sending astronauts for long stays on the Moon and to other planets, that's going to require a new class of power that we've never needed before."

The Kilopower experiment was conducted at the NNSA's Nevada National Security Site (NNSS) between November and March of 2017. In addition to demonstrating that the system could produce electricity through fission, the purpose of the experiment was also to show that it is stable and safe in any environment. For this reason, the Kilopower team conduct in the experiment in four phases.

The first two phases, which were conducted without power, confirmed that each component in the system functioned properly. For the third phase, the team increased power to heat the core slowly before moving on to phase four, which consisted of a 28-hour, full-power test run. This phase simulated all stages of a mission, which included a reactor startup, ramp up to full power, steady operation and shutdown.

Throughout the experiment, the team simulated various system failures to ensure that the system would keep working – which included power reductions, failed engines and failed heat pipe. Throughout, the KRUSTY generator kept on providing electricity, proving that it can endure whatever space exploration throws at it. As Gibson indicated:

"We put the system through its paces. We understand the reactor very well, and this test proved that the system works the way we designed it to work. No matter what environment we expose it to, the reactor performs very well."

Looking ahead, the Kilopower project will remain a part of NASA's Game Changing Development (GCD) program. As part of NASA's Space Technology Mission Directorate (STMD), this program's goal is to advance space technologies that may lead to entirely new approaches for the Agency's future space missions. Eventually, the team hopes to make the transition to the Technology Demonstration Mission (TDM) program by 2020.

If all goes well, the KRUSTY reactor could allow for permanent human outposts on the Moon and Mars. It could also offer support to missions that rely on In-situ Resource Utilization (ISRU) to produce hydrazine fuel from local sources of water ice, and building materials from local regolith.

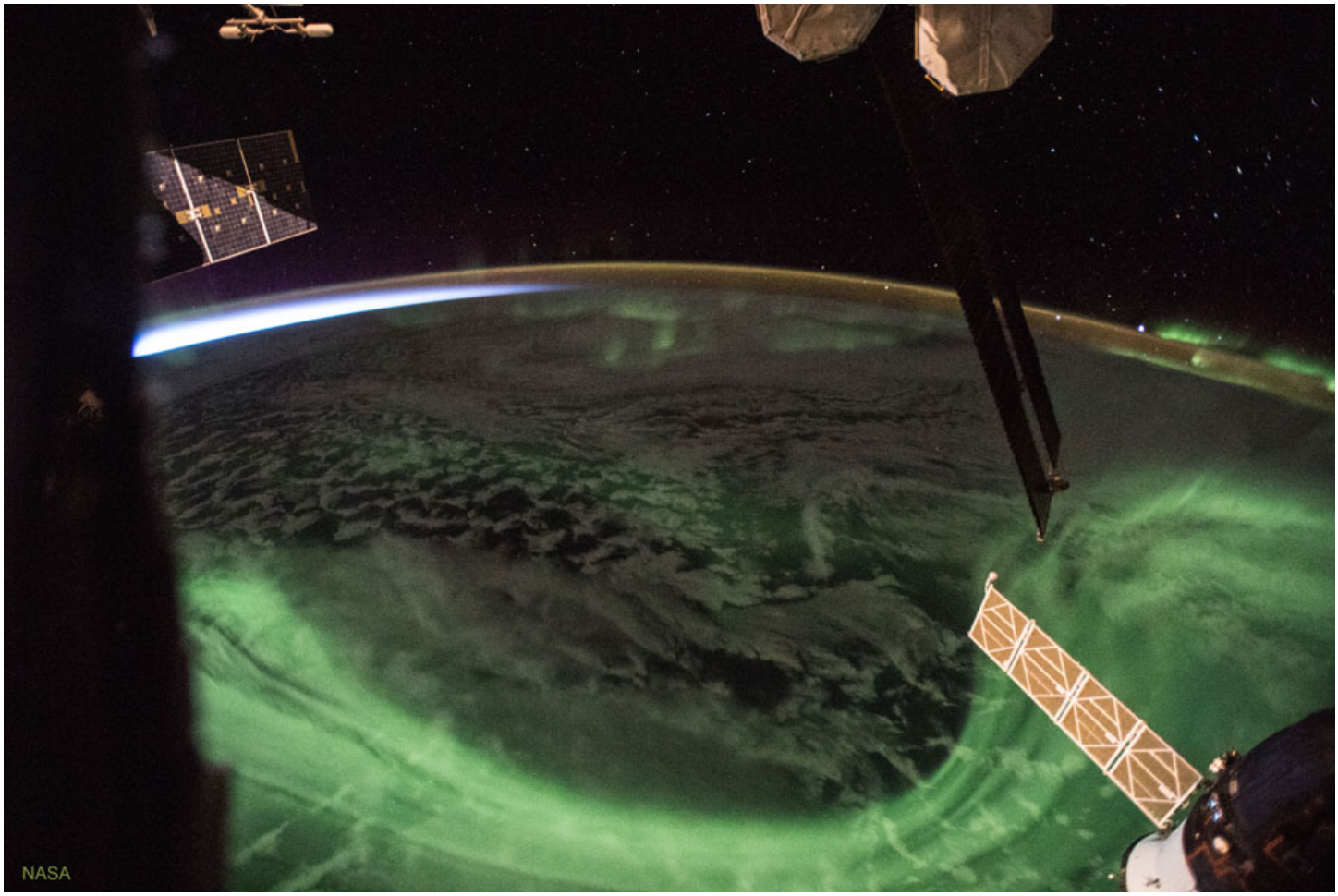
Basically, when robotic missions are mounted to the Moon to 3D print bases out of local regolith, and astronauts begin making regular trips to the Moon to conduct research and experiments (like they do today to the International Space Station), it could be KRUSTY reactors that provide them will all their power needs. In a few decades, the same could be true for Mars and even locations in the outer Solar System.

This reactor system could also pave the way for rockets that rely on nuclear-thermal or nuclear-electric propulsion, enabling missions beyond Earth that are both faster and more cost-effective!

And be sure to enjoy this video of the GCD program, courtesy of NASA 360.

Source: Universe Today Return to Contents

Space Image of the Week



The Aurora and the Sunrise

Explanation On the International Space Station (ISS), you can only admire an aurora until the sun rises. Then the background Earth becomes too bright. Unfortunately, aftersunset, the rapid orbit of the ISS around the Earth means that sunrise is usually less than 47 minutes away. In the featured image, a green aurora is visible below the ISS -- and on the horizon to the upper right, while sunrise approaches ominously from the upper left. Watching an aurora from space can be mesmerizing as its changing shape has been compared to a giant green amoeba. Auroras are composed of energetic electrons and protons from the Sun that impact the Earth's magnetic field and then spiral down toward the Earth so fast that they cause atmospheric atoms and molecules to glow. The ISS orbits at nearly the same height as auroras, many times flying right through an aurora's thin upper layers, an event that neither harms astronauts nor changes the shape of the aurora.

Image Credit: NASA**,** International Space Station**,** Ricky Arnold

Source: APOD

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