Space News Update

— June 7, 2019 —

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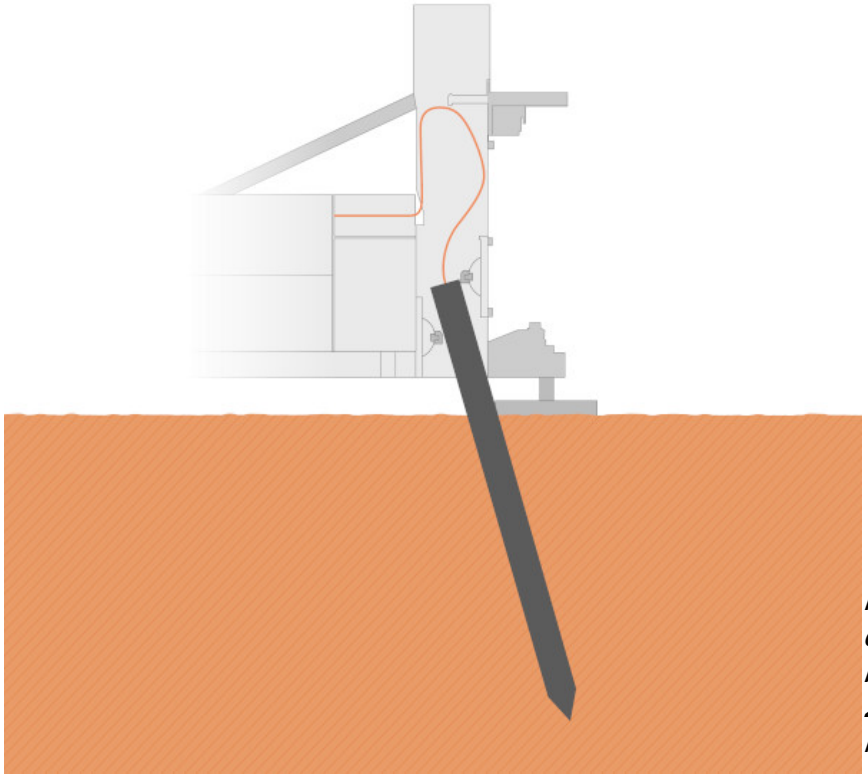
1. NASA tries new approach to fix Mars InSight instrument



The self-hammering mole, part of the Heat Flow and Physical Properties Package (HP3) on NASA's InSight lander, was only partially buried in the soil of Mars as of early June 2019, as shown in this illustration. Credit: NASA/JPL-Caltech

NASA plans to take new steps later in June to try and resolve a problem with one of the key instruments on the Mars InSight lander.

In a June 5 statement, the Jet Propulsion Laboratory said it will use the lander's robotic arm, designed to place instruments onto the Martian surface, to lift up the support structure for the Heat Flow and Physics Properties Package (HP3) as part of efforts to troubleshoot the instrument.

The instrument, placed on the Martian surface early this year, features a probe, or "mole," designed to burrow to a depth as great as five meters below the surface in order to measure the heat flow from the planet's interior. However, the probe has been stuck about 30 centimeters below the surface for the last three months.

Project scientists and engineers now believe that the mole is stuck because of a lack of friction with the surrounding regolith, which means the mole simply bounces in place when it attempts to hammer deeper into the surface. That appears to be a more likely possibility than either the mole hitting a rock it cannot push aside or a snag in the mole's tether within the instrument's housing.

"Snagging requires some specific movements of the mole that it may have performed but not likely so. Judging from the distribution of rocks on the surface, the likelihood of encountering a rock at the right depth was concluded to be only a few percent," said Tilman Spohn, lead for the HP3 instrument at the German space agency DLR, in a June 6 blog post. "So we are left with the friction hypotheses being the most likely hypothesis and — importantly — the one that we can do something about to help the mole along."

Engineers have proposed using InSight's robotic arm to press down on the surface by the instrument, believing that the force will increase the friction enough to allow the mole to gain traction. Doing so, though, requires moving the support structure.

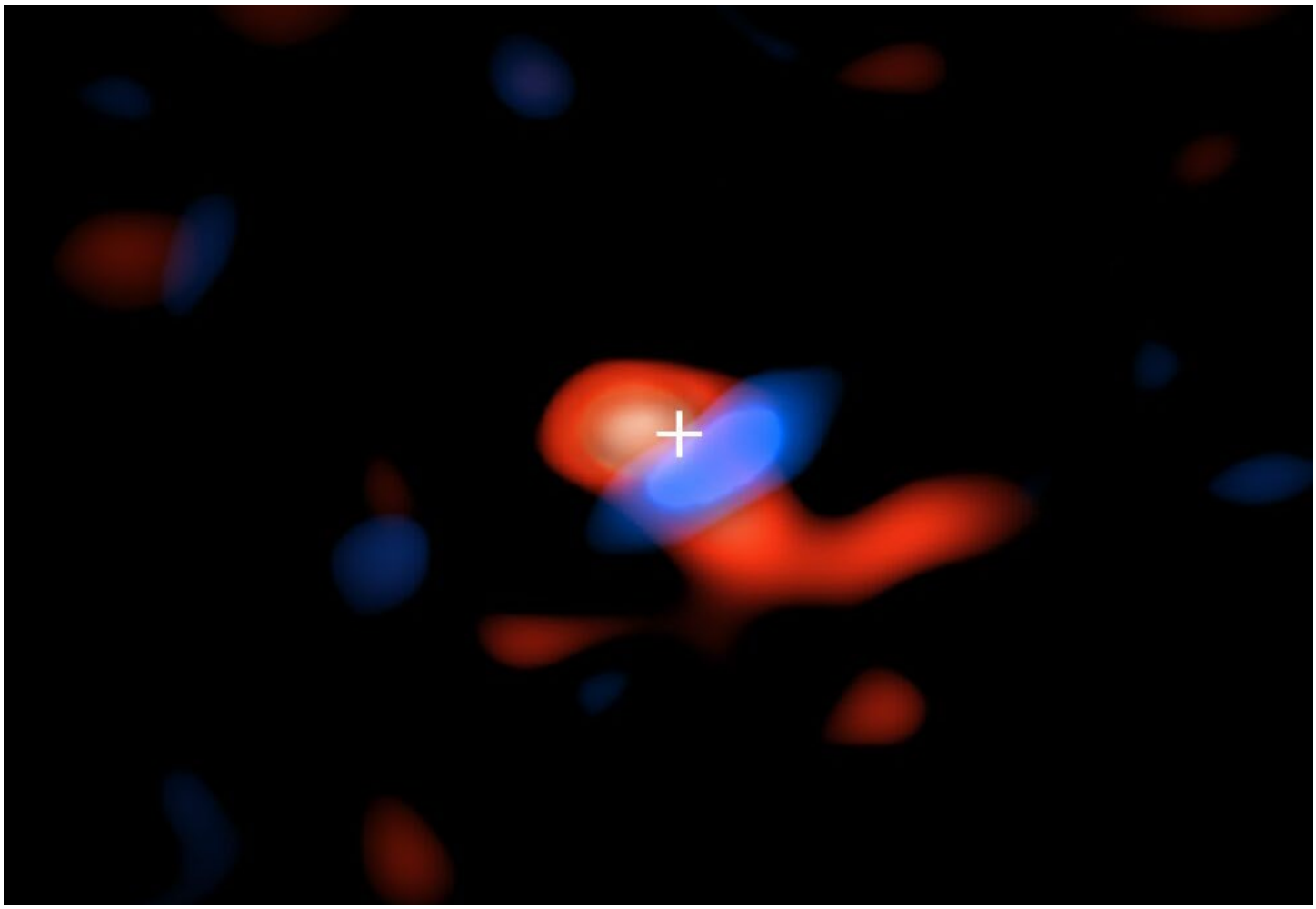
Current plans call for lifting the structure in three steps over the course of a week in late June, taking images after each step to check on the status of the mole. If the mole is removed from the ground during this process, it can't go back in, effectively ending that instrument's mission.

"We don't want to take an action that makes the situation worse, so we've been moving very carefully," said Troy Hudson, an engineer-scientist at JPL working on the mission, in a statement. "We want every action to be safe for HP3, the robotic arm and InSight's seismometer, which is very close by."

Spohn said the team hopes to have the "next steps" for troubleshooting HP3 decided by the middle of July. "After that, we will need time to run more tests."

Source: SpaceNews Return to Contents

2. Cool, nebulous ring around Milky Way's supermassive black hole



New ALMA observations reveal a never-before-seen disk of cool, interstellar gas wrapped around the supermassive black hole at the center of the Milky Way. This nebulous disk gives astronomers new insights into the workings of accretion: the siphoning of material onto the surface of a black hole. The results are published in the journal *Nature*.

Through decades of study, astronomers have developed a clearer picture of the chaotic and crowded neighborhood surrounding the supermassive black hole at the center of the Milky Way. Our galactic center is approximately 26,000 light-years from Earth and the supermassive black hole there, known as Sagittarius A* (A "star"), is 4 million times the mass of our Sun.

We now know that this region is brimming with roving stars, interstellar dust clouds, and a large reservoir of both phenomenally hot and comparatively colder gases. These gases are expected to orbit the black hole in a vast accretion disk that extends a few tenths of a light-year from the black hole's event horizon.

Until now, however, astronomers have been able to image only the tenuous, hot portion of this flow of accreting gas, which forms a roughly spherical flow and showed no obvious rotation. Its temperature is estimated to be a blistering 10 million degrees Celsius (18 million degrees Fahrenheit), or about two-thirds the temperature found at the core of our Sun. At this temperature, the gas glows fiercely in X-ray light, allowing it to be studied by space-based X-ray telescopes, down to scale of about a tenth of a light-year from the black hole.

In addition to this hot, glowing gas, previous observations with millimeter-wavelength telescopes have detected a vast store of comparatively cooler hydrogen gas (about 10 thousand degrees Celsius, or 18,000 degrees Fahrenheit) within a few light-years of the black hole. The contribution of this cooler gas to the accretion flow onto the black hole was previously unknown.

Although our galactic center black hole is relatively quiet, the radiation around it is strong enough to cause hydrogen atoms to continually lose and recombine with their electrons. This recombination produces a distinctive millimeter-wavelength signal, which is capable of reaching Earth with very little losses along the way.

With its remarkable sensitivity and powerful ability to see fine details, the Atacama Large Millimeter/submillimeter Array (ALMA) was able to detect this faint radio signal and produce the first-ever image of the cooler gas disk at only about a hundredth of a light-year away (or about 1000 times the distance from the Earth to the Sun) from the supermassive black hole. These observations enabled the astronomers both to map the location and trace the motion of this gas. The researchers estimate that the amount of hydrogen in this cool disk is about one tenth the mass of Jupiter, or one ten-thousandth of the mass of the Sun.

By mapping the shifts in wavelengths of this radio light due to the Doppler effect (light from objects moving toward the Earth is slightly shifted to the "bluer" portion of the spectrum while light from objects moving away is slightly shifted to the "redder" portion), the astronomers could clearly see that the gas is rotating around the black hole. This information will provide new insights into the ways that black holes devour matter and the complex interplay between a black hole and its galactic neighborhood.

"We were the first to image this elusive disk and study its rotation," said Elena Murchikova, a member in astrophysics at the Institute for Advanced Study in Princeton, New Jersey, and lead author on the paper. "We are also probing accretion onto the black hole. This is important because this is our closest supermassive black hole. Even so, we still have no good understanding of how its accretion works. We hope these new ALMA observations will help the black hole give up some of its secrets."

Source: Phys.org Return to Contents

3. Is Jupiter's Great Red Spot Vanishing as We Near Opposition 2019?

The Great Red Spot has seen better days… NASA Juno's 2018 view, versus what Pioneer 10 saw (inset) during its 1974 flyby. Credit: NASA/Juno/ JPL-Caltech/SwRI/MSSS/ Gerald Eichstädt /Seán Doran

Jupiter opposition season is nigh, and with it, the largest planet in our solar system and its iconic Great Red Spot present us with a key mystery.

Jupiter in 2019

Jupiter reaches opposition for 2019 on June 10th. For an outer planet with an orbit exterior to the Earth, opposition simply means it's 'opposite' to the Sun as seen from our Earthly vantage point. This means that Jupiter will rise in the east and dominate the sky throughout the June night, after the Sun sets in the west.

The precise moment of opposition in Right Ascension (that is, when Jupiter is 12 hours of R.A. from the Sun) occurs next Monday at ~15:00 UT/11:00 AM EDT. Jove is coming off of aphelion in February 2017, meaning that we're currently in a cycle of slightly more favorable oppositions over the next few years. Still, Jupiter is 641 million kilometers from the Earth during opposition in 2019, only a bit less (53 million kilometers) than average.

Now, for the bad news, at least for folks up north. A June oppositionalso means that Jupiter is currently meandering through the constellation Ophiuchus the Serpent Bearer in 2019, staying 'in the weeds' to the south for folks up north near local midnight, but riding high in the sky near the zenith down south. The very best portion of the atmosphere to peer through is always straight up as it's the thinnest, while low to the horizon nearly always affords a murky view.

The Path of Jupiter in 2019

Orbiting the Sun once every 11 years, oppositions for Jupiter are roughly 399 days apart, and move forward roughly one calendar month and one zodiacal constellation per year.

Jupiter at the eyepiece: Near opposition in 2019, Jupiter dazzles the eye at magnitude -2.6, brighter than any star in the sky. Even a small pair of hunting binoculars will easily tease out the four Galilean moons of Io, Europa, Ganymede and Callisto… we can be thankful that Galileo's suggestion of calling them the 'Medicean Moons' after his benefactors, the Florentine Medici family didn't stick. Crank up the magnification, and you'll note features such as the northern and southern equatorial belts, and the Great Red Spot. Jupiter rotates so fast (once every 10 hours) that an observer can track the planet through one full rotation in a single sleepless evening near opposition. Jupiter is a place where things are really *happening*, and the view can change from one night to the next.

In June 2019, Jupiter's disk swells to 46 arc seconds across. Only Venus can present a bigger planetary disk as seen from the Earth.

What's up with the Great Red Spot? This iconic feature has adorned Jovian cloud tops at least since it was first noted by Giovanni Cassini starting 1665, and it's perhaps much older. 16,350 kilometers across its longest axis, you could slip the Earth into the eye of this storm, with room to spare. In the 20th century, the crimson cyclone lived up to its name; in the 21st century, however, the 'Great' Red Spot has been anything but, shrinking and fading in size. To our eye, the Spot has appeared more of a pinkish salmon than truly red in recent years… amateurs have even documented great sheets flaking off of the shrinking Spot this season.

Could the Great Red Spot vanish entirely?

Losing such a recognizable symbol of Jupiter would be like Mars losing its pole caps, or Saturn losing its rings. Certainly, elementary school kids will keep dappling a red cherry oval on Jove… but viewing the gas giant just wouldn't be the same.

And we don't even quite understand *why* the Great Red Spot is so persistent. Ironically, it's embedded in the Southern Equatorial Belt, which, unlike its permanent twin the Northern Equatorial Belt, pulls a vanishing act roughly every decade or so. Looking at recent astrophotos, this disappearance may be underway in 2019, as well. The Southern Equatorial Belt last vanished in 2010.

The moons of Jupiter are always fun to follow, as they alternately cast shadows on the Jovian cloudtops, and vanish behind the giant planet. Near opposition, Jupiter and its moons cast shadows nearly straight behind them as seen from our perspective, while near quadrature 90 degrees from the Sun, they cast shadows off to one side. With a little practice, you can start to recognize which moon is casting a shadow, from the tiny, inky black dot of innermost Io, to the dusky gray patch on Callisto.

In 2019, Jupiter reaches quadrature on September 9th. The orbits of Jupiter's moons are also slightly inclined from our perspective, meaning that outermost Callisto 'misses' Jove on some years, such as most of 2019. Callisto resumes casting its shadow on Jove starting on October 15th, 2019.

Other red letter dates for opposition 2019 include the double shadow transit of Io and Ganymede on June 12th, 2019, and the occultation of Jupiter by the thin waxing crescent Moon favoring central Asia on November 28th, 2019.

Don't miss a chance to check out the largest planet in the solar system this summer, coming to a sky near you.

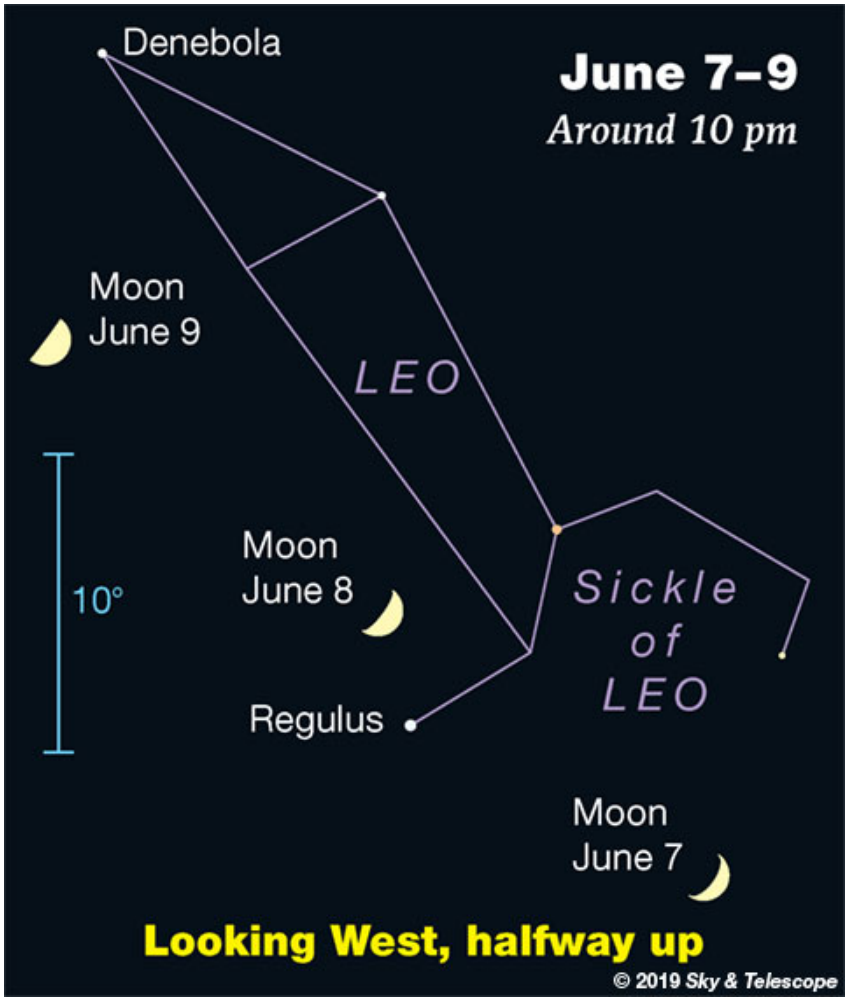
Source: Universe Today Return to Contents

The Night Sky

Friday, June 7

• Just after dark look for Regulus upper left of the Moon, as shown here. From there, trace out the rest of Leo.

• Ceres, the largest asteroid, dims from magnitude 7.3 to 7.6 this week. Find it about 9° north of Antares using the article and finder chart in the May *Sky & Telescope*, page 48.



Saturday, June 8

• Now the Moon shines closer above Regulus at nightfall, as shown here.

• The Big Dipper hangs very high in the northwest after dark. The middle star of its bent handle is Mizar, with tiny little Alcor right next to it. On which side of Mizar should you look for Alcor? As always, on the side toward Vega! Which is now the brightest star high in the east. If your eyes aren't quite sharp enough, binoculars show Alcor easily.

Sunday, June 9

• First-quarter Moon (exact at 1:59 a.m. tonight EDT). The Moon shines in the hind feet of Leo. Look 10° above it (about a fist at arm's length) for Denebola, the tip of Leo's tail.

Almost twice as far to the Moon's lower right is Regulus, Leo's forefoot.

Monday, June 10

• Jupiter is at opposition tonight, opposite the Sun as seen from Earth. It's that bright white point in the southeast after dark. It's in southern Ophiuchus, to the left of orange Antares and the other, lesser stars of upper Scorpius.

And despite an ignorant news report that's circulating all over the world, you can see Jupiter's moons with binoculars *anytime* Jupiter is up — not just at opposition! Who creates this nonsense?

Tuesday, June 11

• Spica sparkles to the lower left of the Moon this evening. More than twice as far upper left of the Moon is brighter Arcturus.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Sat Jun 8, 9:21 PM	2 min	10°	10° above WSW	10° above SW

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

NASA-TV Highlights

(all times Eastern Daylight Time)

No Special Programming

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

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Space Calendar

- Jun 07 - Comet C/2018 R3 (Lemmon) Perihelion (1.291 AU)
- Jun 07 - Comet P/2019 B2 (Groeller) Perihelion (2.419 AU)
- Jun 07 - Comet C/2018 KJ3 (Lemmon) At Opposition (2.747 AU)
- Jun 07 - Comet 113P/Spitaler At Opposition (4.177 AU)
- Jun 07 - NEW [Jun 02] Amor Asteroid 2019 KZ3 Near-Earth Flyby (0.015 AU)
- Jun 07 - NEW [Jun 03] Apollo Asteroid 2019 LA Near-Earth Flyby (0.036 AU)
- Jun 07 - Apollo Asteroid 2017 BM93 Near-Earth Flyby (0.086 AU)
- Jun 07 - Asteroid 13801 Kohlhase Closest Approach To Earth (1.685 AU)
- Jun 07 - Asteroid 4169 Celsius Closest Approach To Earth (2.750 AU)
- Jun 07 - 24th JSPS "Science in Japan" Forum, Washington DC
- Jun 08 - HOT [Jun 03] World Oceans Day
- Jun 08 - Amor Asteroid 189011 Ogmios Closest Approach To Earth (0.697 AU)
- Jun 08 - Asteroid 2322 Kitt Peak Closest Approach To Earth (1.339 AU)
- Jun 08 - Asteroid 58671 Diplodocus Closest Approach To Earth (1.345 AU)
- Jun 08 - Asteroid 70783 Kenwilliams Closest Approach To Earth (1.894 AU)
- Jun 08 - Asteroid 5035 Swift Closest Approach To Earth (1.960 AU)
- Jun 08 - Asteroid 249521 Truth Closest Appproach To Earth (2.216 AU)
- Jun 08 - Asteroid 1537 Transylvania Closest Approach To Earth (2.416 AU)
- Jun 09 - Comet 363P/Lemmon At Opposition (2.752 AU)
- Jun 09 - Comet 186P/Garradd Closest Approach To Earth (3.516 AU)
- Jun 09 - Comet 186P/Garradd At Opposition (3.516 AU)
- Jun 09 - Apollo Asteroid 2017 XY2 Near-Earth Flyby (0.074 AU)
- Jun 09 - Asteroid 5392 Parker Closest Approach To Earth (1.523 AU)
- Jun 09 - Asteroid 4628 Laplace Closest Approach To Earth (1.635 AU)
- Jun 09 - Kuiper Belt Object 2010 KZ39 At Opposition (44.988 AU)
- Jun 10 - Jupiter At Opposition
- Jun 10 - Amor Asteroid 452307 Manawydan Closest Approach To Earth (1.399 AU)
- Jun 10 - Asteroid 10916 Okina-Ouna Closest Approach To Earth (1.801 AU)
- Jun 10 - 10th Anniversary (2009), Selene (Kaguya) Spacecraft Impacted the Moon (Japan)
- Jun 10 - Richard Hill's 70th Birthday (1949)
- Jun 10 - Jim McDivitt's 90th Birthday (1929)
- Jun 10 - George Dollond's 245th Birthday (1774)
- Jun 11 - Comet C/2018 KJ3 (Lemmon) Closest Approach To Earth (2.742 AU)
- Jun 11 - NEW [Jun 02] Amor Asteroid 2019 KG3 Near-Earth Flyby (0.042 AU)
- Jun 11 - Asteroid 9387 Tweeddledee Closest Approach To Earth (1.166 AU)
- Jun 11 - Asteroid 9252 Goddard Closest Approach To Earth (2.046 AU)
- Jun 11 - Asteroid 6136 Gryphon Closest Approach To Earth (2.195 AU)
- Jun 11 - 15th Anniversary (2004), Cassini, Phoebe Flyby
- Jun 11 - 70th Anniversary (1949), Kunashak Meteorite Fall (Hit House in Russia)
- Jun 11 - William Brook's 175th Birthday (1844)
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Source: JPL Space Calendar

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Food for Thought

Watch NASA Build Its Next Mars Rover

A newly installed webcam offers the public a live, bird's-eye view of NASA's Mars 2020 rover as it takes shape at NASA's Jet Propulsion Laboratory in Pasadena, California. You can watch as JPL engineers and technicians assemble and test the rover before it embarks next year on one of the most technologically challenging interplanetary missions ever designed.

"There is so much happening and changing in the clean room, I come here every opportunity I get," said Mars 2020 project manager John McNamee of JPL. "It is great that we can share this part of our journey to the Red Planet with the public anytime they want."

Affectionately called "Seeing 2020," the webcam provides the video feed (without audio) from a viewing gallery above the clean room floor. You can also watch and participate in live webchats with members of JPL's social media team and the Mars 2020 team as they answer questions from the public about the mission. These "Seeing 2020" webchats will occur Mon.-Thu. at 11 a.m. and 4 p.m. PDT (2 p.m. and 7 p.m. EDT), with additional moderated chats when special activities (like drive tests) occur.

Continuous live video of rover construction is available at:

https://mars.nasa.gov/mars2020/mission/where-is-the-rover/

The feed is also available on YouTube with the scheduled, moderated chats at:

http://youtube.com/NASAJPL/live

Currently, work in the High Bay 1 clean room begins at 8 a.m. PDT (11 a.m. EDT) Mon.-Fri., much of it revolving around the rover. The back shell, descent stage and cruise stage have already been assembled and tested.

The clean room may be or appear to be empty when assembly activity has shifted to other JPL facilities or when work on 2020 moves out of view of the camera to other parts of the clean room. The camera may also be turned off periodically for maintenance or technical issues.

Months of final assembly and testing lie ahead before the Mars 2020 rover is ready to ship to NASA's Kennedy Space Center in Florida. The launch period begins July 17, 2020. Once the Mars 2020 rover arrives at Mars on Feb. 18, 2021, it will not only seek signs of ancient habitable conditions - and past microbial life - but collect rock and soil samples, storing them in sample tubes on the planet's surface.

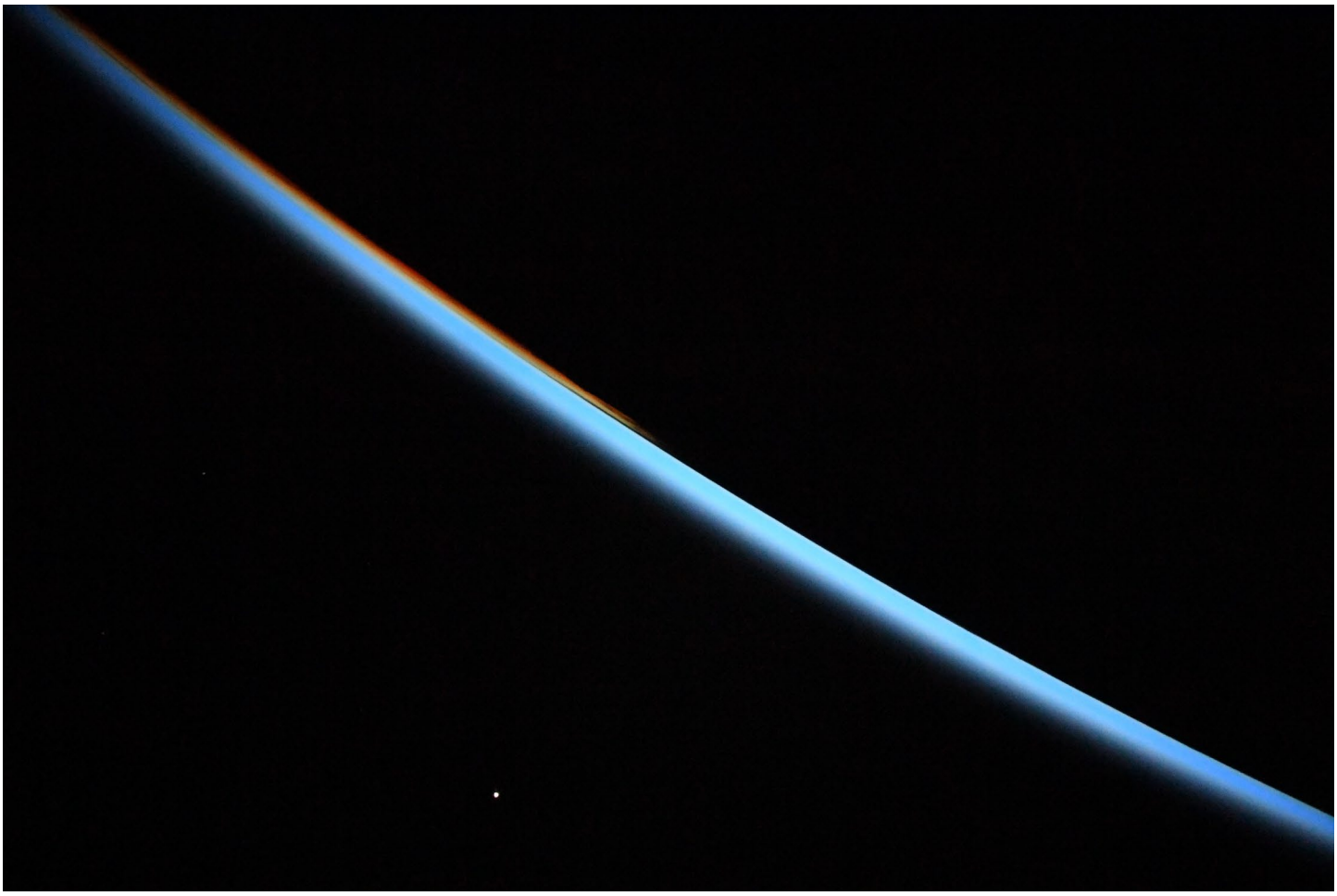
The Mars 2020 project at JPL manages rover development for NASA's Science Mission Directorate in Washington. NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, is responsible for launch management. Mars 2020 will launch from Cape Canaveral Air Force Station in Florida.

For more information on Mars 2020, visit: **https://mars.nasa.gov/mars2020/**

For more information about NASA's exploration of Mars, visit: **https://www.nasa.gov/mars**

Source: JPL Return to Contents

Space Image of the Week



Venus at Sunrise From the Space Station

From the International Space Station, NASA astronaut Christina Koch (@AstroChristina) snapped and posted this image of the planet Venus at sunrise. The blue glow of Earth's atmosphere shimmers as the station orbits our planet.

Image Credit: NASA

Source: NASA

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