

“Every one is a moon, and has a dark side which he never shows to anybody” – Mark Twain



# Astro

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### Fast-Track to the Moon: NASA Opens Call for Artemis Lunar Landers

NASA is seeking proposals for human lunar landing systems designed and developed by American companies for the Artemis program, which includes sending the first woman and next man to the surface of the Moon by 2024.

The final call to industry comes after NASA issued two drafts on July 19 and Aug. 30, encouraging companies to send comments to help shape a key component of the agency’s human exploration Artemis partnerships. NASA is expected to make multiple awards to industry to develop and demonstrate a human landing system. The first company to complete its lander will carry astronauts to the surface in 2024, and the second company will land in 2025.

[NASA.gov](https://www.nasa.gov)

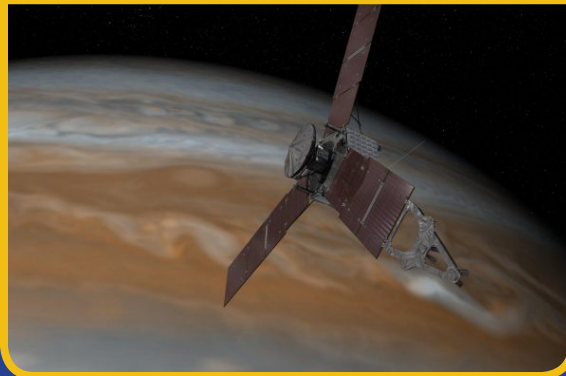
### SpaceX Falcon 9 Rocket Will Launch Private Moon Lander in 2021

A private lunar lander now has a rocket ride for its first moon mission.

The robotic Nova-C lander, built by Houston-based Intuitive Machines, will launch atop a SpaceX Falcon 9 rocket on a NASA-sponsored flight in 2021, representatives of both companies announced on October 2.

In May of this year, NASA’s Commercial Lunar Payload Services (CLPS) program tapped Intuitive Machines and two other companies, Orbit Beyond and Astrobotic, to build landers to take agency payloads to the lunar surface. Intuitive Machines got \$77 million, Astrobotic received \$79.5 million, and Orbit Beyond netted \$97 million.

[Space.com](https://www.space.com)

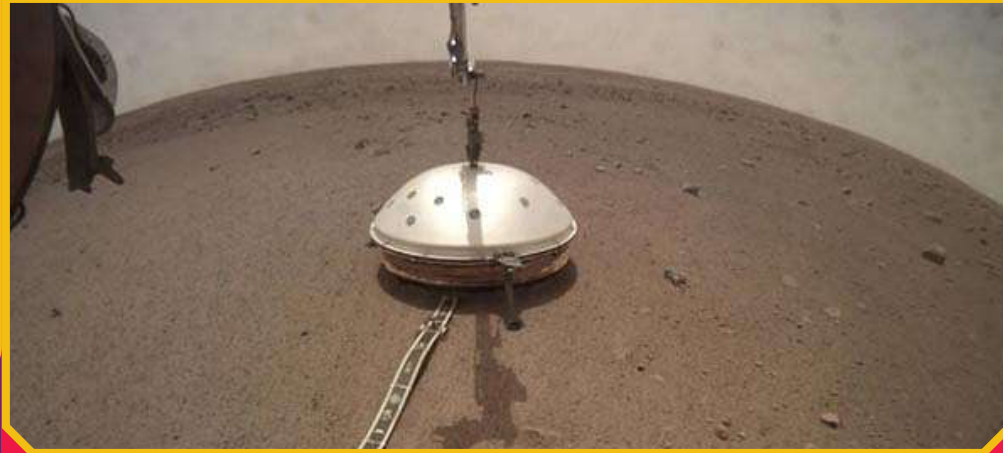


### NASA's Juno Prepares to Jump Jupiter's Shadow

Last night, NASA's Juno mission to Jupiter successfully executed a 10.5-hour propulsive maneuver – extraordinarily long by mission standards. The goal of the burn, as it's known, will keep the solar-powered spacecraft out of what would have been a mission-ending shadow cast by Jupiter on the spacecraft during its next close flyby of the planet on Nov. 3, 2019.

Juno began the maneuver yesterday, on Sept. 30, at 7:46 p.m. EDT (4:46 p.m. PDT) and completed it early on Oct. 1. Using the spacecraft's reaction-control thrusters, the propulsive maneuver lasted five times longer than any previous use of that system. It changed Juno's orbital velocity by 126 mph (203 kph) and consumed about 160 pounds (73 kilograms) of fuel. Without this maneuver, Juno would have spent 12 hours in transit across Jupiter's shadow – more than enough time to drain the spacecraft's batteries. Without power, and with spacecraft temperatures plummeting, Juno would likely succumb to the cold and be unable to awaken upon exit.

Juno has been navigating in deep space since 2011. It entered an initial 53-day orbit around Jupiter on July 4, 2016.



### InSight 'Hears' Peculiar Sounds on Mars

Put an ear to the ground on Mars and you'll be rewarded with a symphony of sounds. Granted, you'll need superhuman hearing, but NASA's InSight lander comes equipped with a very special "ear."

The spacecraft's exquisitely sensitive seismometer, called the Seismic Experiment for Interior Structure (SEIS). SEIS was designed to listen for marsquakes. Scientists want to study how the seismic waves of these quakes move through the planet's interior, revealing the deep inner structure of Mars for the first time. But after the seismometer was set down by InSight's robotic arm, Mars seemed shy. It didn't produce its first rumbling until this past April, and this first quake turned out to be an odd duck. It had a surprisingly high-frequency seismic signal compared to what the science team has heard since then. Out of more than 100 events detected to date, about 21 are strongly considered to be quakes. The remainder could be quakes as well, but the science team hasn't ruled out other causes.

#### Quakes

Put on headphones to listen to two of the more representative quakes SEIS has detected.

These occurred on May 22, 2019 (the 173rd Martian day, or sol, of the mission) and July 25, 2019 (Sol 235). Far below the human range of hearing, these sonifications from SEIS had to be speeded up and slightly processed to be audible through headphones. Both were recorded by the "very broad band sensors" on SEIS, which are more sensitive at lower frequencies than its short period sensors.

#### Mechanical Sounds and Wind Gusts

SEIS has no trouble identifying quiet quakes, but its sensitive ear means scientists have lots of other noises to filter out.

Over time, the team has learned to recognize the different sounds. And while some are trickier than others to spot, they all have made InSight's presence on Mars feel more real to those working with the spacecraft.





## How Long Will the Hubble Space Telescope Last?

NASA's Hubble Space Telescope (HST) was launched into orbit on the space shuttle Discovery on April 24, 1990. Thanks to its perch above most of Earth's turbulent atmosphere, the telescope's relatively modest 2.4-meter mirror has given us an unprecedented window on the universe for nearly 30 years. But just how much longer will Hubble last?

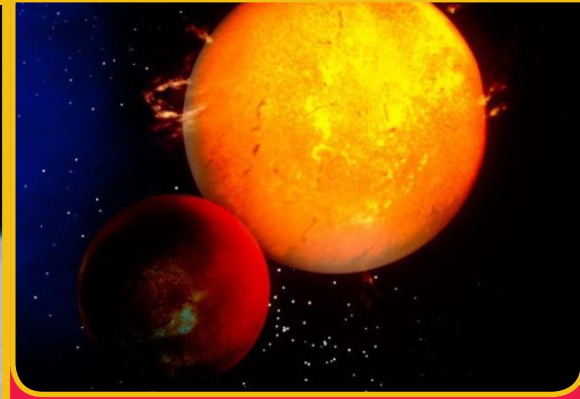
Unless the telescope suffers a catastrophic failure that renders all its instruments unusable or eliminates the telescope's ability to point at targets, HST will continue operating at least through June 30, 2021. That's how long NASA has officially funded its operations.

There's another consideration: HST is not completely above Earth's atmosphere. It's in low Earth orbit, which means it still experiences some drag, or friction, from air particles as it circles Earth. HST

will eventually experience enough atmospheric drag that it will crash to Earth; this is projected to occur by the mid-2030s, regardless of the telescope's operational status. But if Hubble gets a boost, perhaps from one of the many private spacecraft currently under development, it could be back in business.

Currently, NASA plans to use a rocket to perform a controlled deorbit, which will ensure any debris that doesn't burn up will land in an uninhabited area when HST's mission is finally complete.

Ultimately, Hubble's future is still unclear. According to the European Space Agency's HST website, "There is no set date for Hubble's retirement. Hubble will continue to work for as long as its components operate and it provides a good service to the scientific community."



## 1<sup>st</sup> Planet Orbiting a Sunlike Star

On October 6, 1995, astronomers Michel Mayor and Didier Queloz announced the momentous discovery of the 1st planet in orbit around a distant sunlike star. 51 Pegasi b has about half the mass of Jupiter. It orbits a star not unlike our sun.

October 6, 1995. On this date, astronomers Michel Mayor and Didier Queloz announced the discovery of the first planet in orbit around a distant sunlike star. They later published their finding in the journal *Nature*, in a paper titled simply A Jupiter-Mass Companion to a Solar-type Star.

The star was 51 Pegasi, located about 50 light-years away in the direction of our constellation Pegasus the Flying Horse. Astronomers officially designated the new planet as 51 Pegasi b, in accordance with nomenclature already decided upon for extrasolar planets. The b means that this planet was the first discovered orbiting its parent star. If additional planets are ever found for the star 51 Pegasi, they'll be designated c, d, e, f, and so on. So far, this planet is the only one known in this system.





## Astronomy Picture of the Day

### Orion Rising over Brazil

Image Credit & Copyright: Carlos Fairbairn

Have you seen Orion lately? The next few months will be the best for seeing this familiar constellation as it rises continually earlier in the night. However, Orion's stars and nebulas won't look quite as colorful to the eye as they do in this fantastic camera image. In the featured image, Orion was captured by camera showing its full colors last month over a Brazilian copal tree from Brazil's Central-West Region. Here the cool red giant Betelgeuse takes on a strong orange hue as the brightest star on the far left. Otherwise, Orion's hot blue stars are numerous, with supergiant Rigel balancing Betelgeuse at the upper right, Bellatrix at the upper left, and Saiph at the lower right. Lined up in Orion's belt (bottom to top) are Alnitak, Alnilam, and Mintaka all about 1,500 light-years away, born of the constellation's well studied interstellar clouds. And if a "star" toward the upper right Orion's sword looks reddish and fuzzy to you, it should. It's the stellar nursery known as the Great Nebula of Orion.

[apod.nasa.gov](http://apod.nasa.gov)



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