

# The Aerospace Update

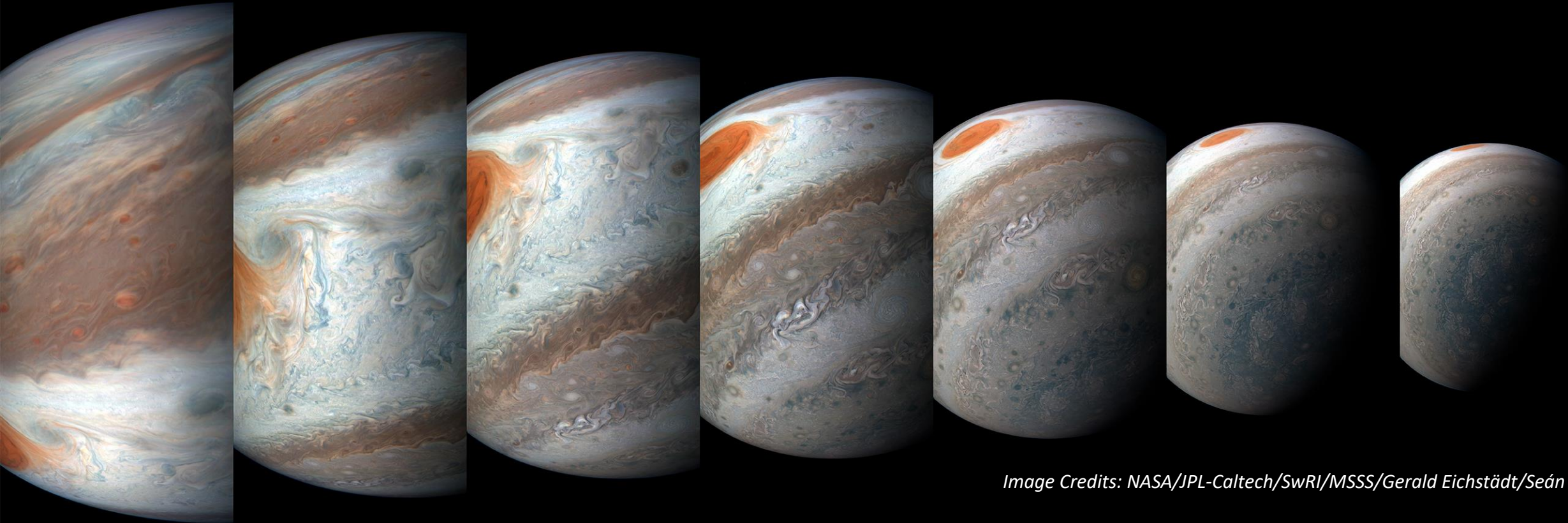


Fly Around of Jupiter

Dec. 13, 2018

Video Credit: NASA/JPL-Caltech/SwRI/MSSS/JunoCam

# Juno Mission Halfway to Jupiter Science



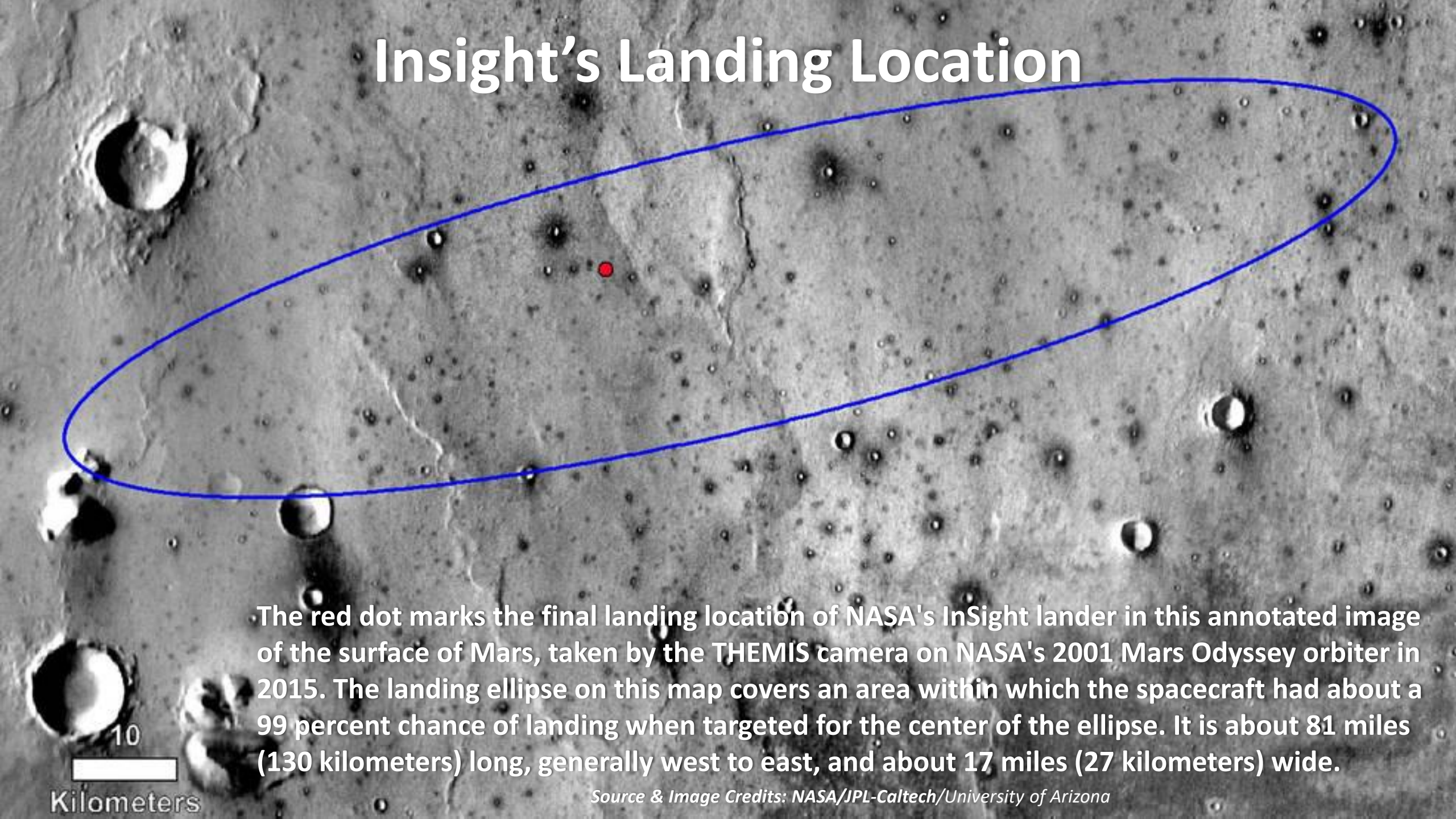
*Image Credits: NASA/JPL-Caltech/SwRI/MSSS/Gerald Eichstädt/Seán Doran*

On Dec. 21, at 8:49:48 a.m. PST (11:49:48 a.m. EST) NASA's Juno spacecraft will be 3,140 miles (5,053 kilometers) above Jupiter's cloud tops and hurtling by at a healthy clip of 128,802 mph (207,287 kilometers per hour). This will be the 16<sup>th</sup> science pass of the gas giant and will mark the solar-powered spacecraft's halfway point in data collection during its prime mission. Juno is in a highly-elliptical 53-day orbit around Jupiter. Each orbit includes a close passage over the planet's cloud deck, where it flies a ground track that extends from Jupiter's north pole to its south pole. A south tropical disturbance has just passed Jupiter's iconic Great Red Spot and is captured stealing threads of orange haze from the Great Red Spot in this series of color-enhanced images from NASA's Juno spacecraft. From left to right, this sequence of images was taken between 2:57 a.m. and 3:36 a.m. PDT (5:57 a.m. and 6:36 a.m. EDT) on April 1, 2018, as the spacecraft performed its 12th close flyby of Jupiter.

*Source: NASA/JPL-Caltech*



# Insight's Landing Location



The red dot marks the final landing location of NASA's InSight lander in this annotated image of the surface of Mars, taken by the THEMIS camera on NASA's 2001 Mars Odyssey orbiter in 2015. The landing ellipse on this map covers an area within which the spacecraft had about a 99 percent chance of landing when targeted for the center of the ellipse. It is about 81 miles (130 kilometers) long, generally west to east, and about 17 miles (27 kilometers) wide.

*Source & Image Credits: NASA/JPL-Caltech/University of Arizona*



# InSight's First Selfie

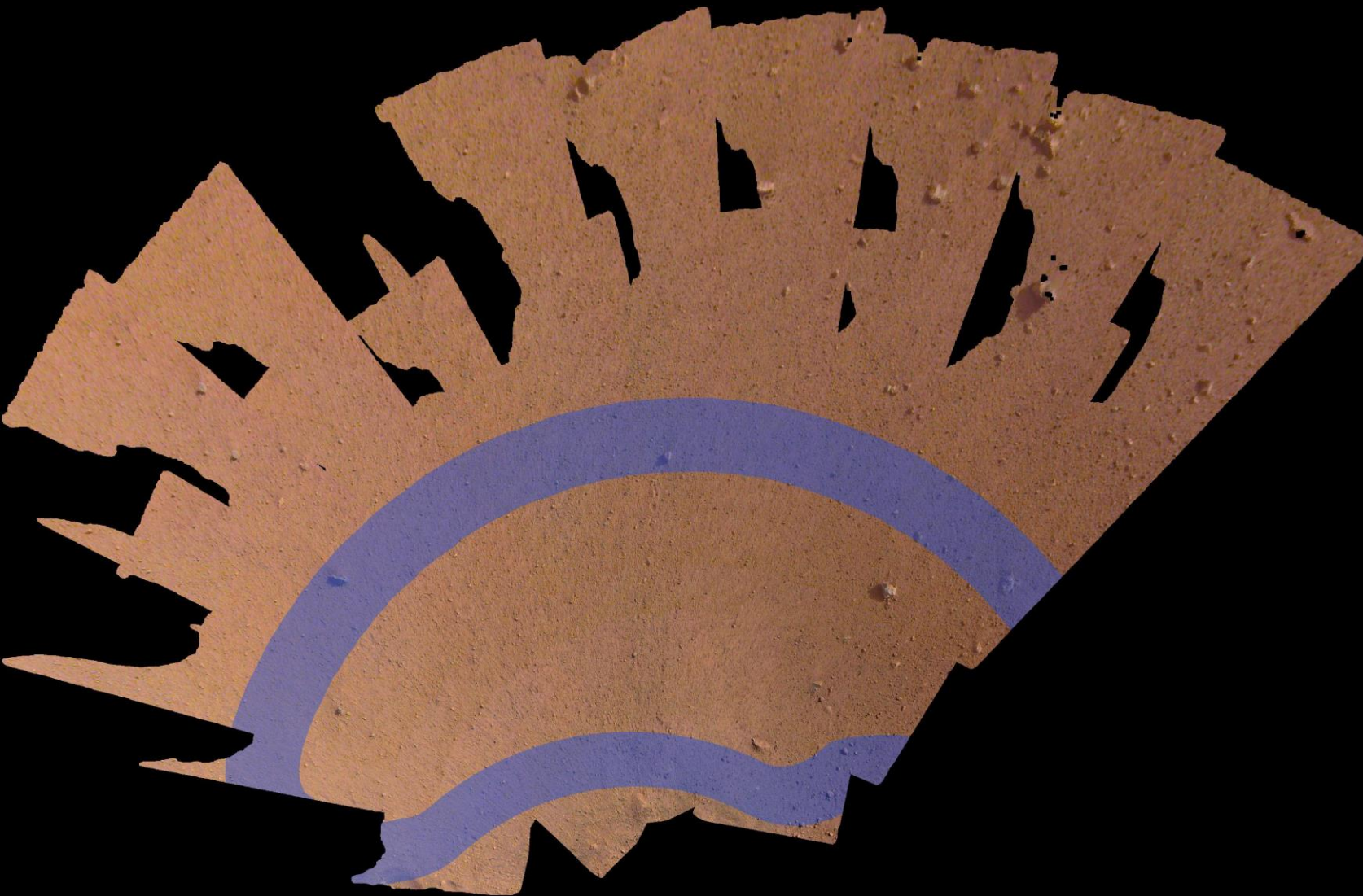


This is NASA InSight's first full selfie on Mars. It displays the lander's solar panels and deck. On top of the deck are its science instruments, weather sensor booms and UHF antenna. The selfie was taken on Dec. 6, 2018 (Sol 10). The selfie is made up of 11 images which were taken by its Instrument Deployment Camera, located on the elbow of its robotic arm. Those images are then stitched together into a mosaic.

*Source & Image Credits: NASA/JPL-Caltech*



# Mosaic of InSight's Workspace



This mosaic, made of 52 individual images from NASA's InSight lander, shows the workspace where the spacecraft will eventually set its science instruments. The workspace is roughly 14 by 7 feet (4 by 2 meters). The lavender annotation shows where InSight's seismometer (called the Seismic Experiment for Interior Structure, or SEIS) and heat flow probe (called the Heat Flow and Physical Properties Package, or HP3) can be placed.

# China Launches Historic Mission to Land on Far Side of the Moon

CGTN



A robotic lander and rover lifted off Friday, Dec. 7<sup>th</sup> (U.S. time) from China's Xichang space center, kicking off a journey that will culminate in an attempt in early January to touch down on the far side of the moon for the first time. Chang'e 4 is entered lunar orbit Tuesday, Dec. 11<sup>th</sup> after a series of course-correction maneuvers, then will use braking rockets to descend to the moon's surface, targeting a landing inside the 110-mile-wide (180-kilometer) Von Karman crater in moon's South Pole-Aitken basin region in early January.

*Source: Stephen Clark @ SpaceFlightNow.com*

*Video Credit: CGTN*

# China Launches Satellites for Saudi Arabia



Two Saudi Arabian Earth observation satellites and 10 small secondary payloads rode a Long March 2D rocket into orbit Friday from the Jiuquan space base in China's northwestern Inner Mongolia region, hours before the launch of a Chinese lunar probe targeting the first soft landing on the far side of the moon. The main payloads aboard the Long March 2D rocket were SaudiSat 5A and 5B, two Earth-imaging satellites each weighing nearly a half-ton. Ten other Chinese microsattellites and nanosatellites were also launched on the same rocket.



# 'Hold Hold Hold': NROL-71 Mission Scrubbed



Video Credits: ULA/SciNews

Just seconds before the planned liftoff of a Delta IV Heavy rocket with the NROL-71 payload for the National Reconnaissance Office, an automatic abort of the launch sequence was triggered. With only a minor issue earlier in the countdown, the Dec. 8, 2018, launch attempt of United Launch Alliance's Delta IV Heavy rocket seemed ready to fly with the classified NROL-71 payload at 8:15 p.m. PST (11:15 p.m. EST / 04:15 GMT Dec. 9) from Space Launch Complex 6 at Vandenberg Air Force Base. However, just as the engines were about to start and excess hydrogen gas burn off began—a hold was called, which would ultimately scrub the launch. “The launch of a United Launch Alliance Delta IV Heavy carrying the NROL-71 mission for the National Reconnaissance Office was scrubbed today due to an unexpected condition during terminal count at approximately 7.5 seconds before liftoff,” a ULA statement reads. “The team is currently reviewing all data and will determine the path forward.”

Source: Derek Richardson @ SpaceFlightInsider.com



# CRS-16 Dragon Arrives at ISS After Ground-Based Communications Issue



After spending three days catching up with the ISS following its Dec. 5, 2018, launch, the capsule made it to its hold point at 32 feet (10 meters) below the Destiny laboratory at about 6 a.m. EST (11:00 GMT) Dec. 8. There, it waited for the crew to use the 57.7-foot (17.6-meter) Canadarm2 to reach out and capture the spacecraft. However, a ground-based communications issue was noticed by ground teams, and mission control in Houston commanded the crew to issue a retreat command, prompting Dragon to move to a 100-foot (30-meter) hold point. According to NASA, the communications issue stemmed from a failed processor at a ground station in White Sands, New Mexico. The processor connects mission control to the Tracking and Data Relay Satellite System network. Once communications was back, the team tried again at 6:50 a.m. EST (11:50 GMT). Dragon moved away from its 100-foot (30-meter) hold point and moved slowly to its capture point 32 feet (10 meters) below the outpost. Capture officially occurred at 7:21 a.m. EST (12:21 GMT) by Expedition 57 Commander Alexander Gerst, who was at the controls of Canadarm2.



# Virgin Galactic Achieves Space on SpaceShipTwo Test Flight



With two veteran test pilots at the controls, Virgin Galactic's SpaceShipTwo rocket plane climbed to the edge of space for the first time Thursday, Dec 13<sup>th</sup> in a major achievement for Richard Branson's long-sought ambition to begin regular commercial hops with space tourists, and the first piloted flight by a U.S. vehicle above an altitude of 50 miles (80 kilometers) since the last space shuttle mission in 2011. The successful test flight Thursday propelled Virgin Galactic — founded by Branson in 2004 — closer to commercial service after a 14-year effort slowed by development problems, and a fatal crash in 2014 that set the program back more than three years.

Source: Stephen Clark @ SpaceFlightNow.com

Photo Credit: Virgin Galactic



# Russian Spacewalkers Cut into Soyuz Spaceship to Inspect Leak Repair



Clad in pressurized spacesuits, Russian cosmonauts Oleg Kononenko and Sergey Prokopyev used knives and scissors Tuesday to slice through insulation and a debris shield on a Soyuz spaceship set to return to Earth next week, finally reaching the capsule's metallic hull to examine the site of an air leak plugged in August. Tuesday's work — and the prior air leak — occurred on the Soyuz habitation module, not the landing compartment that will carry Prokopyev, Gerst and NASA astronaut Serena Auñón-Chancellor back to Earth next week. The habitation compartment will be jettisoned when the Soyuz MS-09 spacecraft heads for Earth, targeting landing on the steppe of Kazakhstan at 12:03 a.m. EST (0503 GMT; 11:03 a.m. Kazakhstan time) on Dec. 20. Prokopyev, Gerst and Auñón-Chancellor will ride inside the Soyuz descent module, covered in a heat shield to withstand the scorching temperatures of re-entry into the atmosphere.



# Crew of Aborted Soyuz Mission Reassigned



Nick Hague



Christina Koch



Aleksey Ovchinin

NASA has announced that Nick Hague will join Aleksey Ovchinin again for a launch on Feb 28, 2019, after their mission was aborted in October from the Baikonur Cosmodrome in Kazakhstan. NASA astronaut Christina Hammock Koch will join the crew on a six-month stay aboard the International Space Station. The trio is expected to launch to the outpost in a Russian Soyuz MS-12 spacecraft and be part of the outpost's Expedition 59/60 crew before returning to Earth in October 2019. According to NASA, Hague and Koch will serve as flight engineers during Expedition 59 and 60. Ovchinin will serve as a flight engineer on Expedition 59 and commander of Expedition 60.

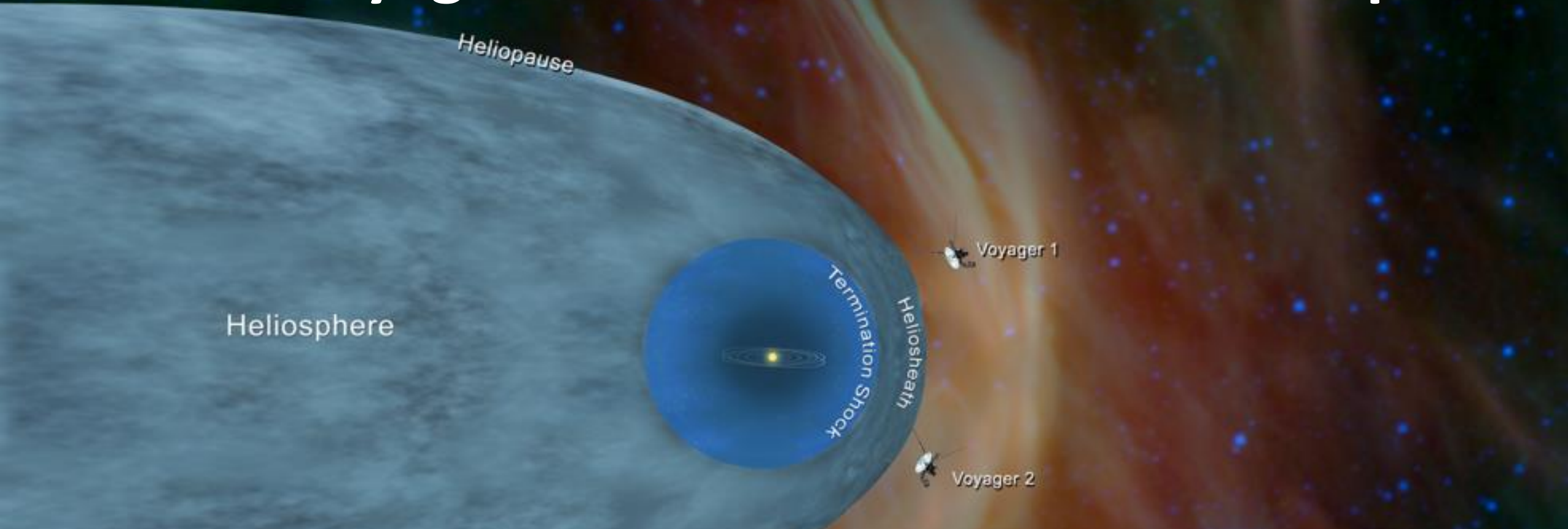




# OSIRIS-REx Spacecraft Already Discovers Water on Asteroid

Recently analyzed data from NASA's Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx) mission has revealed water locked inside the clays that make up its scientific target, the asteroid Bennu. Data obtained from the spacecraft's two spectrometers, the OSIRIS-REx Visible and Infrared Spectrometer (OVIRS) and the OSIRIS-REx Thermal Emission Spectrometer (OTES), reveal the presence of molecules that contain oxygen and hydrogen atoms bonded together, known as "hydroxyls." The team suspects that these hydroxyl groups exist globally across the asteroid in water-bearing clay minerals, meaning that at some point, Bennu's rocky material interacted with water. While Bennu itself is too small to have ever hosted liquid water, the finding does indicate that liquid water was present at some time on Bennu's parent body, a much larger asteroid.

# NASA's Voyager 2 Probe Enters Interstellar Space

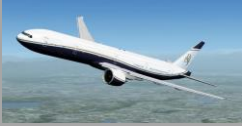


For the second time in history, a human-made object has reached the space between the stars. NASA's Voyager 2 probe now has exited the heliosphere – the protective bubble of particles and magnetic fields created by the Sun. Comparing data from different instruments aboard the trailblazing spacecraft, mission scientists determined the probe crossed the outer edge of the heliosphere on Nov. 5. This boundary, called the heliopause, is where the tenuous, hot solar wind meets the cold, dense interstellar medium. Its twin, Voyager 1, crossed this boundary in 2012, but Voyager 2 carries a working instrument that will provide first-of-its-kind observations of the nature of this gateway into interstellar space. Voyager 2 now is slightly more than 11 billion miles (18 billion kilometers) from Earth. Mission operators still can communicate with Voyager 2 as it enters this new phase of its journey, but information – moving at the speed of light – takes about 16.5 hours to travel from the spacecraft to Earth. By comparison, light traveling from the Sun takes about eight minutes to reach Earth.

*Source & Image Credits: NASA/JPL-Caltech*



# In The News



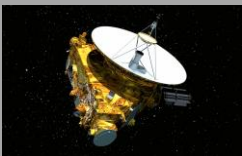
**Boeing Launches Business Jet Capable of World's Longest Flight.** Boeing has unveiled its newest line of business jets, which the company says will allow VIP travelers to fly nonstop between "any two cities on Earth." The BBJ 777X planes will have a range of 11,645 nautical miles (21,570 km), enabling them to offer the longest commercial flight in the world. *(Rob Picheta @ CNN.com)*



**NASA and SpaceX Still Aiming for January Commercial Crew Test Flight.** While a SpaceX commercial crew test flight might not launch on a date in early January previously announced NASA, both agency and company officials are optimistic the mission will still fly later in the month. The mission, known as Demo-1, will fly the spacecraft to the International Space Station but not carry any crew. *(Jeff Foust @ SpaceNews.com)*



**USAF Completes Critical Design Review of B-21 Stealth Bomber.** The US Air Force has completed its critical design review of the Northrop Grumman B-21 Raider. The technical review, completed on 30 November, ensured the proposed aircraft has a stable and mature design before the USAF moves the program into manufacturing and flight testing. *(Garrett Reim @ FlightGlobal.com)*



**New Horizons Course Correction Puts Spacecraft on Target to Ultima Thule.** NASA's New Horizons spacecraft conducted the most distant ever course-correction maneuver by any vehicle on Sunday, Dec. 2, firing its thrusters for just 105 seconds to adjust its velocity by approximately 2.2 miles per hour. Mission engineers conducted the maneuver to refine the spacecraft's course so it meets the goal of closest flyby of Kuiper Belt Object (KBO) Ultima Thule at 12:33 a.m. EST on Tuesday, Jan. 1, from a distance of just 2,200 miles (3,500 km). *(Laurel Kornfeld @ SpaceFlightInsider.com)*



**Appeals Court Overturns Ruling Blocking Boeing-Embraer Deal.** A Brazilian appeals court has overturned Wednesday's ruling by a federal judge in São Paulo granting an injunction to block Embraer's board of directors from approving the proposed deal to give Boeing an 80-percent stake in the Brazilian company. The latest ruling, revealed Monday in a U.S. Securities and Exchange Commission filing by Embraer, grants a request to overturn the injunction by Brazil's solicitor general, who argued that the original ruling violated Embraer's right under the country's constitution to engage in free enterprise, according to Reuters. *(Gregory Polek @AINOnline.com)*