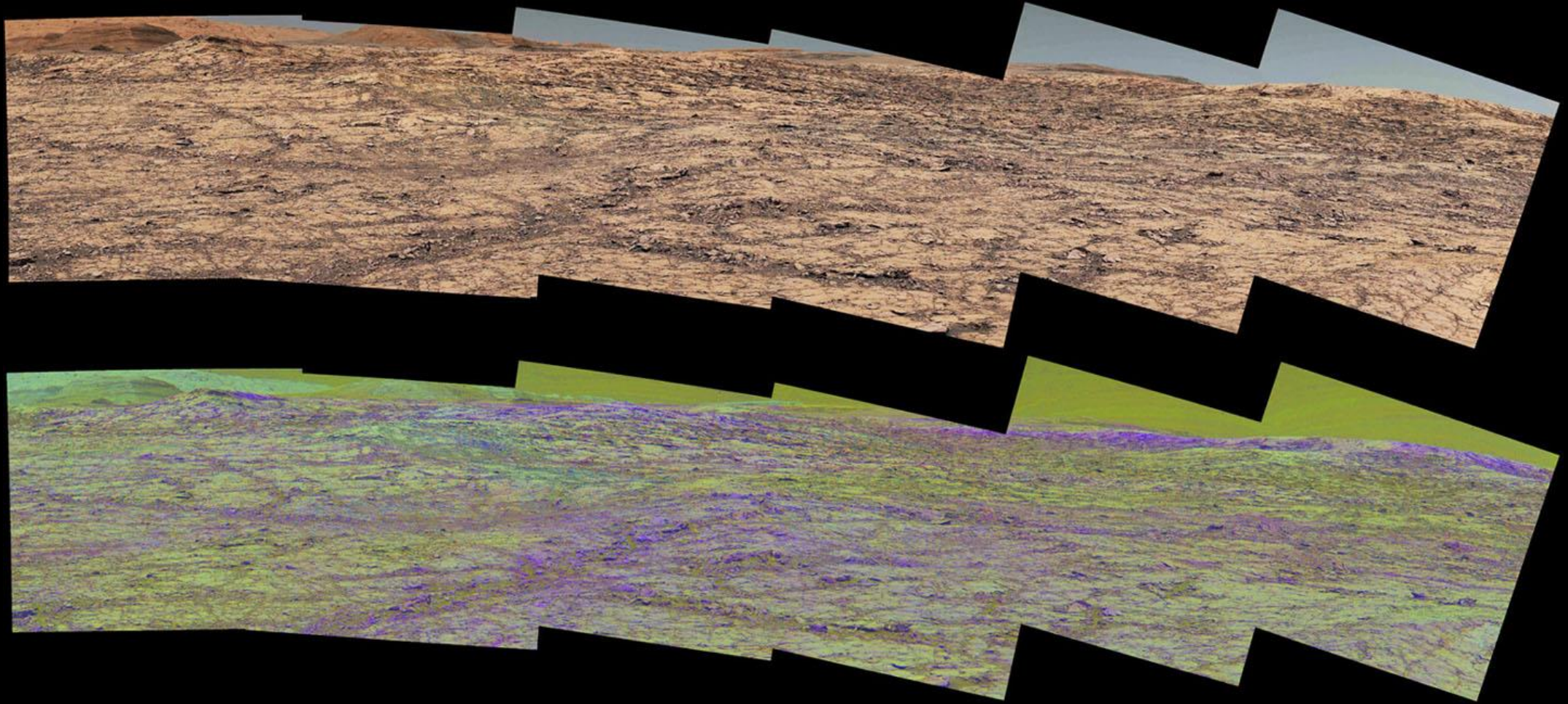


# The **Aerospace Update**

A photograph of a reddish-brown rock with a prominent white fracture line, surrounded by other rocks of various colors and sizes on a dark surface. The rock in the center is oval-shaped and has a distinct white line running across it. The surrounding rocks are smaller and more irregular in shape, with colors ranging from dark brown to light tan. The background is a dark, textured surface.

**Revealing What Lies Beneath**

# Mastcam Special Filters Help Locate Variations Ahead

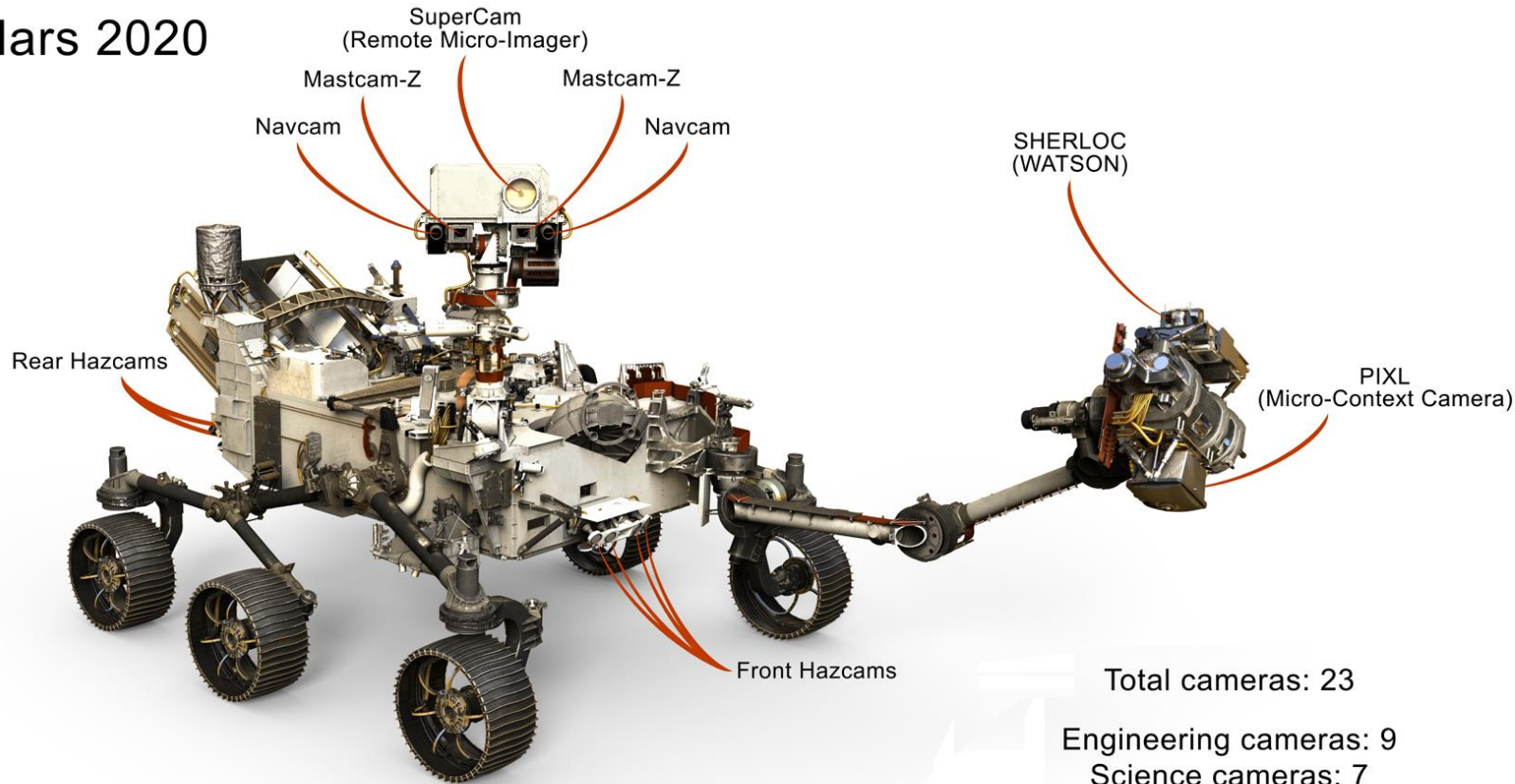


This pair of images from the Mast Camera (Mastcam) on NASA's Curiosity rover illustrates how special filters are used to scout terrain ahead for variations in the local bedrock. The upper panorama is in the Mastcam's usual full color, for comparison. The lower panorama of the same scene, in false color, combines three exposures taken through different "science filters," each selecting for a narrow band of wavelengths. Filters and image processing steps were selected to make stronger signatures of hematite, an iron-oxide mineral, evident as purple. Hematite is of interest in this area of Mars -- partway up "Vera Rubin Ridge" on lower Mount Sharp -- as holding clues about ancient environmental conditions under which that mineral originated.

*Source & Image Credit: NASA/JPL-Caltech/MSSS/ASU*

# Next Mars Rover Will Have 23 'Eyes'

Mars 2020



Total cameras: 23  
Engineering cameras: 9  
Science cameras: 7  
Entry, descent and landing cameras: 7

NASA's Mars 2020 mission will have more "eyes" than any rover before it: a grand total of 23, to create sweeping panoramas, reveal obstacles, study the atmosphere, and assist science instruments. They will provide dramatic views during the rover's descent to Mars and be the first to capture images of a parachute as it opens on another planet. There will even be a camera inside the rover's body, which will study samples as they're stored and left on the surface for collection by a future mission.

# *China Returns Long March 3B Rocket to Service After June Failure*



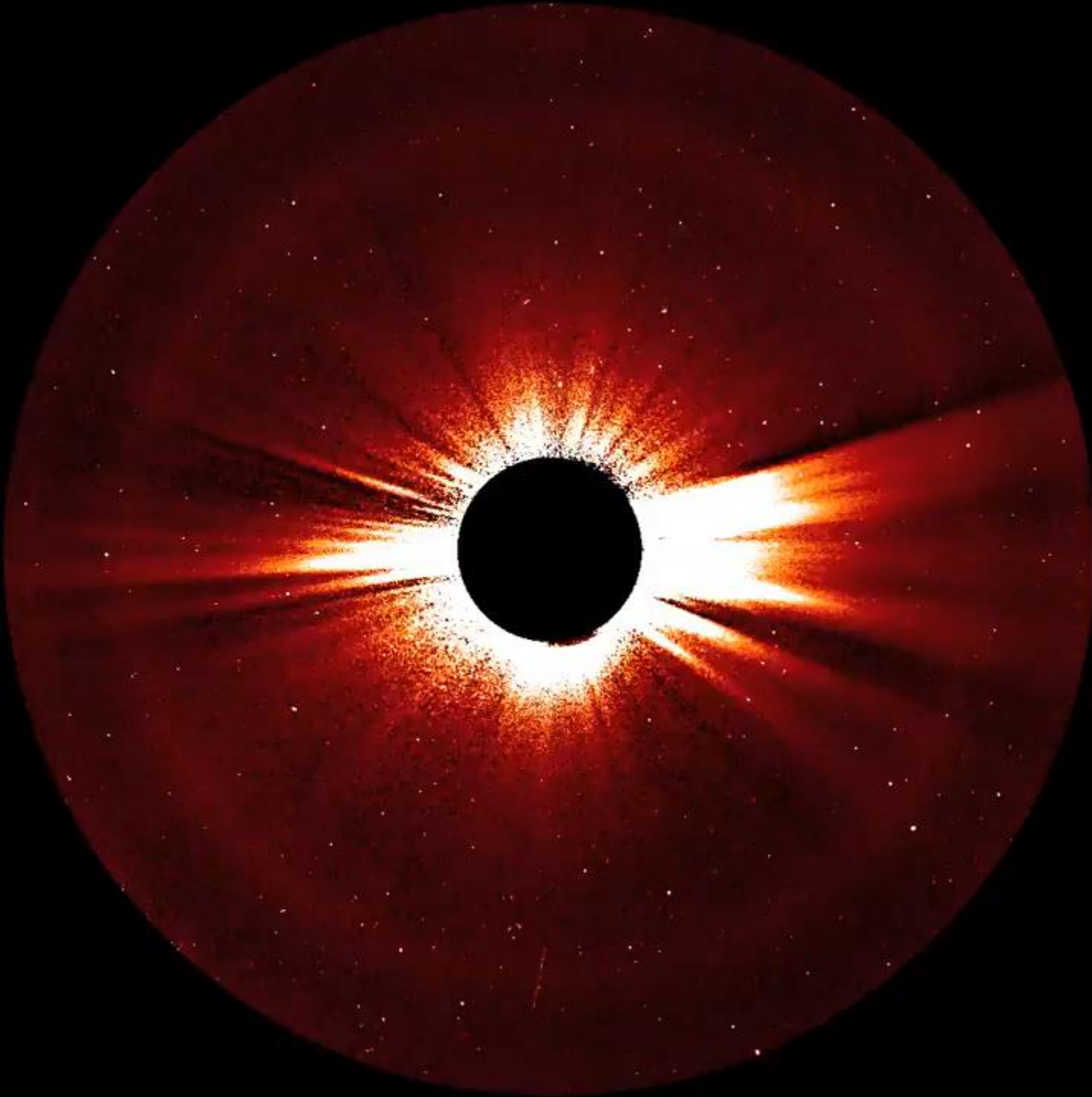
China's Long March 3B rocket, used to power navigation and communications satellites into high-altitude orbits, launched for the first time in nearly five months Sunday with two spacecraft for the country's Beidou positioning network. The satellites launched Sunday are the 24th and 25th to join the Beidou fleet, which currently includes around 15 operational navigation craft. When complete, the Beidou system will join the U.S. Air Force's Global Positioning System, Russia's Glonass satellite network, and Europe's Galileo fleet — which is still being deployed — as the world's four navigation services with global reach.

# Morocco's First High-Resolution Surveillance Satellite Launched Aboard Vega Rocket



00:15

A reconnaissance satellite built in secrecy in France for the Moroccan government launched Tuesday, Nov 7<sup>th</sup> on top of a Vega rocket from the Guiana Space Center in South America. The Mohammed VI-A optical imaging craft, named for the Moroccan king, lifted off from the European-run spaceport in Kourou, French Guiana. The Mohammed VI-A satellite is designed for civilian and military uses, but little information about the spacecraft's capabilities has been released. It was only known by the codename MN35-13, and the satellite's end user was undisclosed until an official announcement of the impending launch last week.



# Return of the Comet: 96P

## Spotted by ESA, NASA

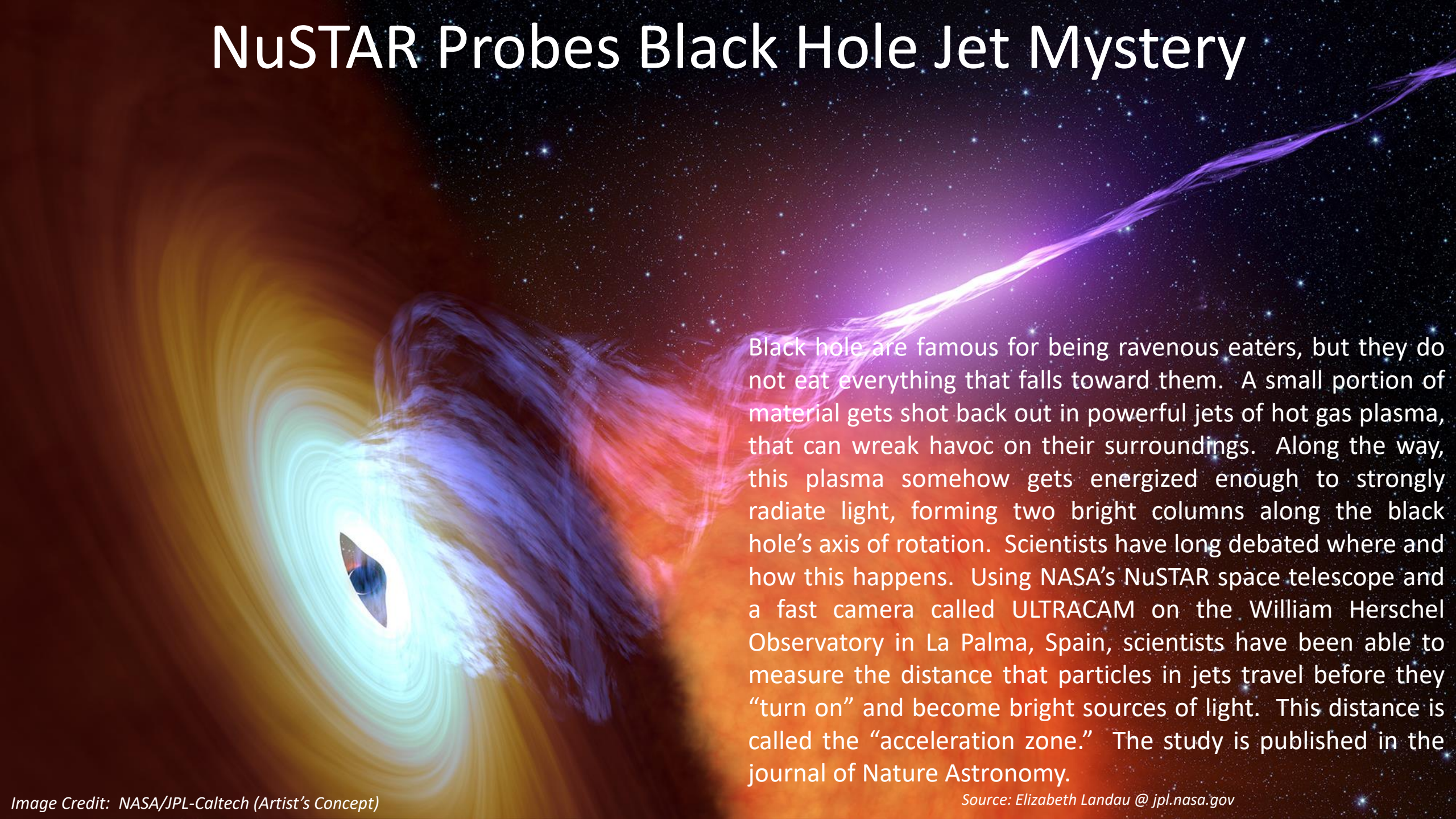
### Satellites

Comet 96P — also known as comet Machholz, for amateur astronomer Don Machholz's 1986 discovery of the comet — completes an orbit around the Sun every 5.24 years. It makes its closest approach to the Sun at a toasty 11 million miles — a very close distance for a comet. On its most recent pass in late October, it was seen by both the ESA (European Space Agency) and NASA mission SOHO (short for Solar and Heliospheric Observatory) and NASA's STEREO mission (short for Solar and Terrestrial Relations Observatory). It is extremely rare for comets to be seen simultaneously from two different locations in space, and these are the most comprehensive parallel observations of comet 96P yet. This video shows the comet as it entered the bottom of STEREO's view and crossed it diagonally before leaving on Oct. 28. Most of the corona has been suppressed in order to bring out the comet, leaving only the dynamic flow of the solar wind.

*Source: NASA.gov*

*Video Credit: NASA's Goddard Space Flight Center/STEREO/Bill Thompson/Joy Ng*

# NuSTAR Probes Black Hole Jet Mystery

An artist's concept of a black hole. The central black hole is surrounded by a glowing accretion disk with concentric rings of light. Two powerful jets of hot gas plasma are shown extending from the poles of the black hole, appearing as bright, multi-colored streams of light against a starry background.

Black holes are famous for being ravenous eaters, but they do not eat everything that falls toward them. A small portion of material gets shot back out in powerful jets of hot gas plasma, that can wreak havoc on their surroundings. Along the way, this plasma somehow gets energized enough to strongly radiate light, forming two bright columns along the black hole's axis of rotation. Scientists have long debated where and how this happens. Using NASA's NuSTAR space telescope and a fast camera called ULTRACAM on the William Herschel Observatory in La Palma, Spain, scientists have been able to measure the distance that particles in jets travel before they "turn on" and become bright sources of light. This distance is called the "acceleration zone." The study is published in the journal of Nature Astronomy.

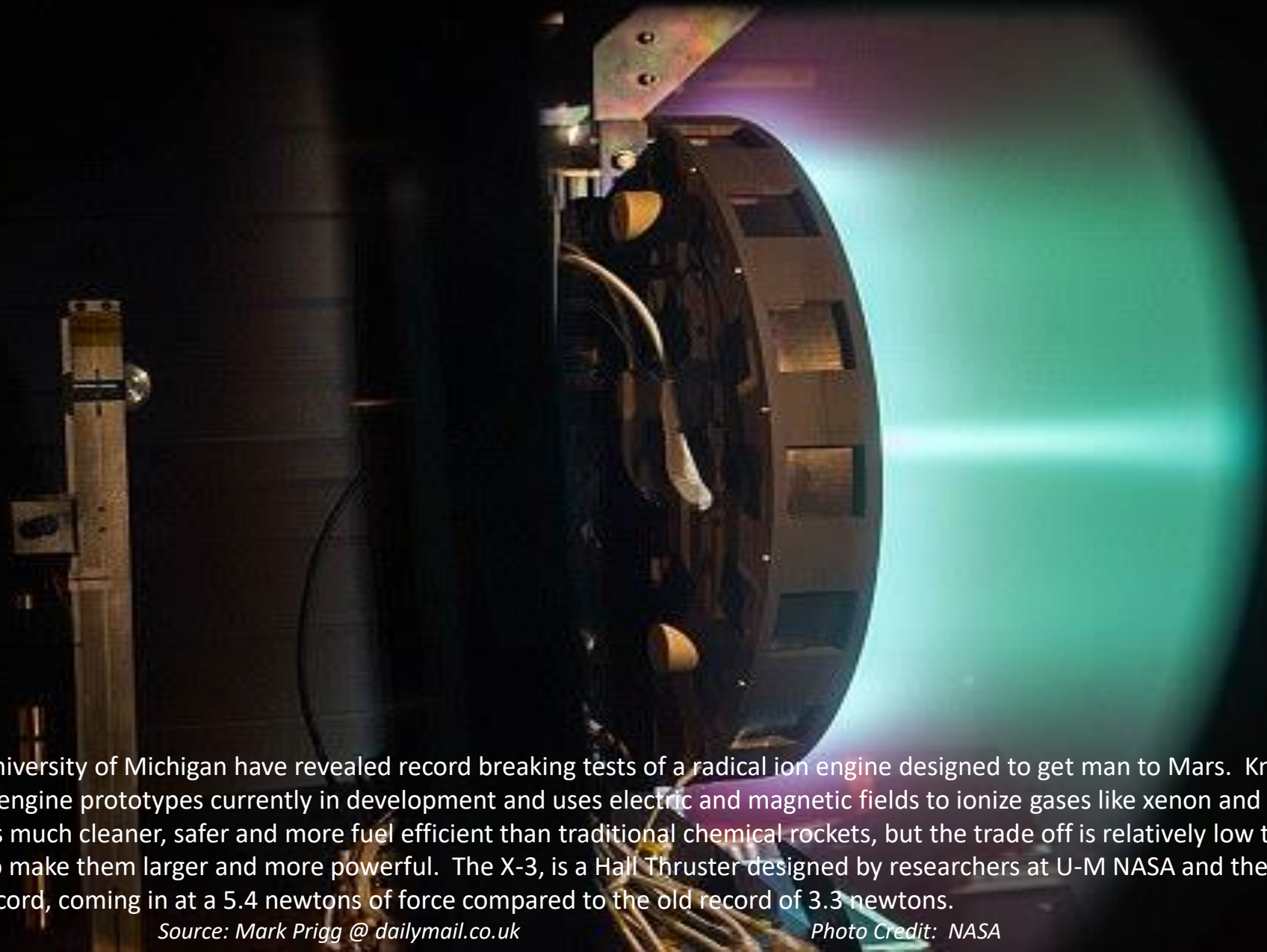
# Warm Air Helped Make 2017 Ozone Hole Smallest Since 1988



Measurements from satellites this year showed the hole in Earth's ozone layer that forms over Antarctica each September was the smallest observed since 1988. According to NASA, the ozone hole reached its peak extent on Sept. 11, covering an area about two and a half times the size of the United States – 7.6 million square miles in extent - and then declined through the remainder of September and into October. NOAA ground- and balloon-based measurements also showed the least amount of ozone depletion above the continent during the peak of the ozone depletion cycle since 1988. NOAA and NASA collaborate to monitor the growth and recovery of the ozone hole every year.

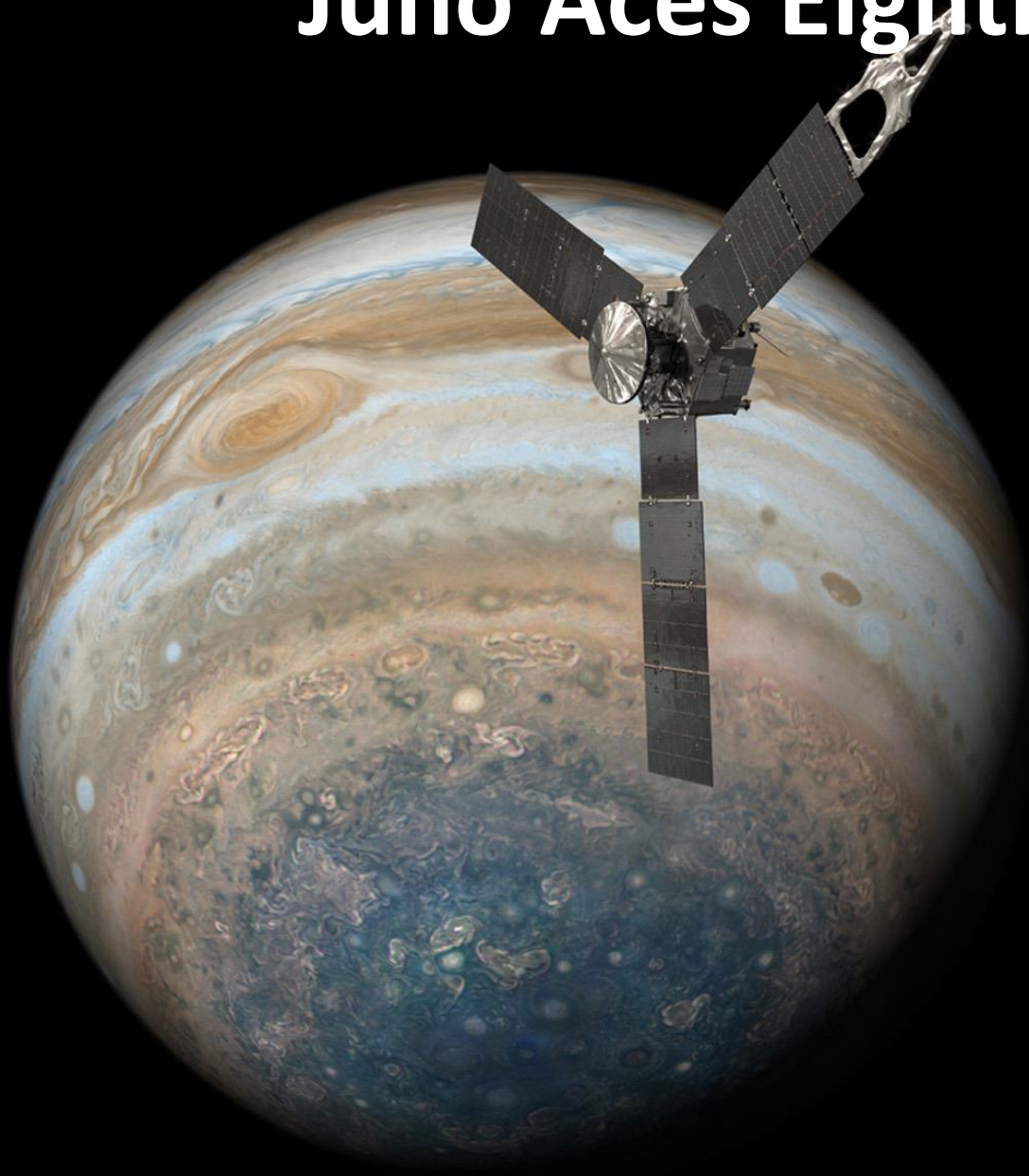


# NASA Reveals Record-Setting Tests of Radical Ion Engine



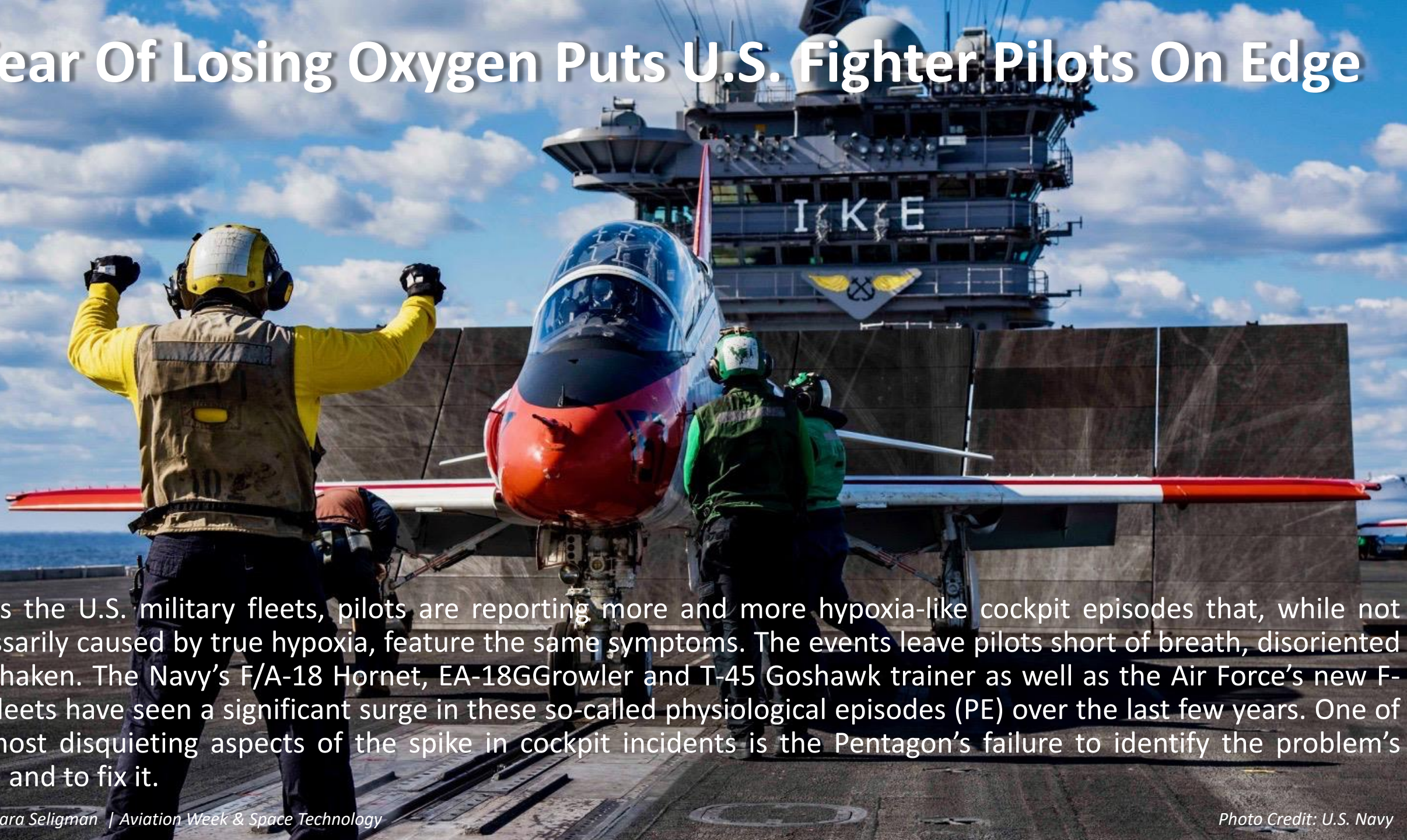
Engineers from NASA and the University of Michigan have revealed record breaking tests of a radical ion engine designed to get man to Mars. Known as a Hall Thruster, it is one of three Mars engine prototypes currently in development and uses electric and magnetic fields to ionize gases like xenon and expels the ions to product thrust. The technique is much cleaner, safer and more fuel efficient than traditional chemical rockets, but the trade off is relatively low thrust and acceleration. The challenge is to make them larger and more powerful. The X-3, is a Hall Thruster designed by researchers at U-M NASA and the U.S. Air Force, shattered the previous thrust record, coming in at a 5.4 newtons of force compared to the old record of 3.3 newtons.

# Juno Aces Eighth Science Pass of Jupiter



Data returned Tuesday, Oct. 31, indicate that NASA's Juno spacecraft successfully completed its eighth science flyby over Jupiter's mysterious cloud tops on Tuesday, Oct. 24. The confirmation was delayed by several days due to solar conjunction at Jupiter, which affected communications during the days prior to and after the flyby. Solar conjunction is the period when the path of communication between Earth and Jupiter comes into close proximity with the Sun. During solar conjunction, no attempts are made to send new instructions or receive information from Juno, as it is impossible to predict what information might be corrupted due to interference from charged particles from the Sun. Instead, a transmission moratorium is put into place; engineers send instructions prior to the start of solar conjunction and store data on board for transmission back to Earth following the event.

# Fear Of Losing Oxygen Puts U.S. Fighter Pilots On Edge



Across the U.S. military fleets, pilots are reporting more and more hypoxia-like cockpit episodes that, while not necessarily caused by true hypoxia, feature the same symptoms. The events leave pilots short of breath, disoriented and shaken. The Navy's F/A-18 Hornet, EA-18G Growler and T-45 Goshawk trainer as well as the Air Force's new F-35A fleets have seen a significant surge in these so-called physiological episodes (PE) over the last few years. One of the most disquieting aspects of the spike in cockpit incidents is the Pentagon's failure to identify the problem's cause and to fix it.

# NASA Advances Concepts for Next-gen Aircraft

This is NASA's revolutionary turboelectric concept aircraft called **STARC-ABL**.



GVIS

Some of the key propulsion system advances the NASA Glenn team is pursuing converge in an aircraft concept study called STARC-ABL (single-aisle turboelectric aircraft with an aft [at the rear of the aircraft] boundary-layer propulsor). STARC-ABL's tail features a "T-tail" horizontal stabilizer configuration with a BLI ducted fan on the tail, which is driven purely by electric power derived from generators mounted to the underwing engines. The wing-mounted engines supply 80 percent of the thrust required during takeoff and 55 percent at cruise, while the tail-mounted, all-electric BLI turbofan accounts for remaining thrust. Researchers predict a potential fuel consumption improvement of roughly 10 percent using this innovative system.

# November 9, 1967, Apollo 4 Launch

The unmanned Saturn/Apollo 4 (AS-501) mission was the first all-up test of the three stage Saturn V rocket. It carried a payload of an Apollo Command and Service Module (CSM) into Earth orbit. The successful objectives of the mission included (1) flight information on launch vehicle and spacecraft structural integrity and compatibility, flight loads, stage separation, subsystem operation, and (2) evaluation of the Apollo Command Module heat shield under conditions encountered on return from a moon mission. The flight orbited three times and lasted for about eight and a half hours. It was also the first spacecraft to reenter the earth's atmosphere at a speed close to the lunar return speed.

*Sources: NASA.gov & airandspace.si.edu*

# Apollo 12 Astronaut Richard 'Dick' Gordon Passes Away



Photo Credit: NASA

Seattle-native, University of Washington Alum, NASA Gemini 11 and Apollo 12 astronaut Capt. Dick Gordon has "gone west" at age 88. Capt. Gordon died yesterday at his home in California. He was a great friend of the Museum. We will miss him.

Source: Museum of Flight Facebook Page

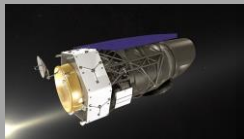
# In The News



**NASA Looking for Private Organizations to Take Over Spitzer Mission.** NASA is considering handing over operations of one of its flagship “Great Observatories” to a private organization that would also be responsible for funding the spacecraft. NASA’s current plans call for operating Spitzer through March of 2019 to perform preparatory observations for the James Webb Space Telescope. That schedule was based on plans for a fall 2018 launch of JWST, which has since been delayed to the spring of 2019. Under that plan, NASA would close out the Spitzer mission by fiscal year 2020. *(Jeff Foust @ SpaceNews.com)*



**China's Reusable Spacecraft to be Launched in 2020.** China plans to launch its reusable spacecraft in 2020, according to a statement from China Aerospace Science and Technology Corporation Tuesday. Unlike traditional one-off spacecraft, the new spacecraft will fly into the sky like an aircraft, said Chen Hongbo, a researcher from the corporation. The spacecraft can transport people or payload into the orbit and return to Earth. *(SpaceDaily.com)*



**WFIRST Astronomy Mission Faces Cuts to Contain Rising Costs.** NASA has directed the team developing the Wide-Field Infrared Survey Telescope, a flagship astronomy mission set for launch in the mid-2020s to study dark energy and exoplanets, to reduce the observatory’s scientific capabilities and keep it under a \$3.2 billion cost cap. Fresh off their experience with cost growth on the James Webb Space Telescope, the huge observatory that precedes WFIRST in NASA’s line of flagship-class space telescopes, officials do not want a repeat experience with the infrared surveyor that is just getting under development. *(Stephen Clark @ SpaceFlightNow.com)*



**Lockheed F-35 Deliveries Were Halted for 30 Days.** The Pentagon halted shipments of Lockheed Martin Corp’s F-35 fighter jets for 30 days this fall after it discovered corrosion around fasteners and a fix was devised, the Pentagon and Lockheed said on Wednesday. The fastener issue on the current F-35 fleet is not affecting flights, nor is it a safety concern the Pentagon said. Lockheed is investigating the extent of the corrosion across the fleet of more than 250 jets deployed to the U.S. military and its allies. *(Mike Stone @ reuters.com)*