

# Space News Update

– April 11, 2017 –

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# 1. NASA Astronaut Peggy Whitson Adds Three Months to Record-Breaking Mission



Already poised to break the record for cumulative time spent in space by a U.S. astronaut, Peggy Whitson is set to extend her mission with an additional three months at the International Space Station.

NASA and the Russian space agency Roscosmos, signed an agreement to extend Peggy Whitson's stay on the space station into Expedition 52. Rather than returning to Earth with her Expedition 51 crew mates Oleg Novitsky of Roscosmos and Thomas Pesquet of ESA (European Space Agency), in June as originally planned, Whitson will remain on the space station and return home with NASA's Jack Fischer and Roscosmos' Fyodor Yurchikhin. That landing is targeted for September.

"This is great news," Whitson said. "I love being up here. Living and working aboard the space station is where I feel like I make the greatest contribution, so I am constantly trying to squeeze every drop out of my time here. Having three more months to squeeze is just what I would wish for."

The arrangement takes advantage of a Soyuz seat left empty by the Roscosmos decision to temporarily reduce their crew complement to two cosmonauts. Whitson's extension will ensure a full complement of six astronauts on board the station and increase the amount of valuable astronaut time available for experiments on board the station.

This is Whitson's third long-duration stay onboard the space station. She launched on Nov. 17 with 377 days in space already under her belt, and on April 24 will break Jeff Williams' standing United States record of 534 cumulative days in space. In 2008, Whitson became the first woman to command the space station, and on April 9 will become the first woman to command it twice. In addition, she holds the record for most spacewalks by a female.

Source: [NASA](#)

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## Russia Open to Extending Life of International Space Station to 2028

Russia is ready to discuss extending the life of the International Space Station (ISS) to 2028, said Igor Komarov, director general of the Russian national space agency, Roscosmos.

Here at the 33rd annual Space Symposium yesterday (April 4), Komarov spoke about the need to maintain a research station in low Earth orbit if humans hope to eventually travel to Mars. He also discussed the agency's plans to send a new module to the space station in 2018, when the agency will also re-add a third crew member to the station.

In what he said was his first visit to the U.S. while serving in his current position, Komarov confirmed a proposal within the agency to build a new space station if the ISS is retired after 2024. Currently, the U.S. and Russia each manage and support half of the station, and other international collaborators contribute. Those countries have committed to financial support and maintenance of the station through 2024.

But Komarov also said Roscosmos is "ready to discuss" the possibility of extending the life of the station through 2028 with those international partners. "I think we need to prolong our collaboration in low Earth orbit," Komarov said.

If the station were to be retired and no substitute were established, research taking place in low Earth orbit would take a significant hit. The loss of the station would more or less wipe out investigations into how the space environment affects the human body over long periods, which many space experts, including Komarov, agree is necessary if humans are to make the long journey to Mars.

Roscosmos has been working on an additional module for the space station, called the Multipurpose Laboratory Module (MLM), that the agency plans to launch in 2018, Komarov said. (A recent article in Popular Mechanics suggests there may be problems with the module, which was originally scheduled for launch in 2007 and again in 2013.) Once that module launches, Komarov said, the agency plans to raise the number of Russian cosmonauts on board the station from two to three; the agency recently reduced its crewmember count from three to two.

Roscosmos is also working on a science module and a docking module, Komarov said, and together, these three space rooms could form the core of an independent Russian station, SpaceNews reported in September of last year.

Komarov said the possibility of building a new station from the three modules is being discussed as a possible means of avoiding the loss of a laboratory in low Earth orbit if the ISS is retired in 2024.

"It doesn't mean we don't want to continue cooperation [with other countries]," he said.

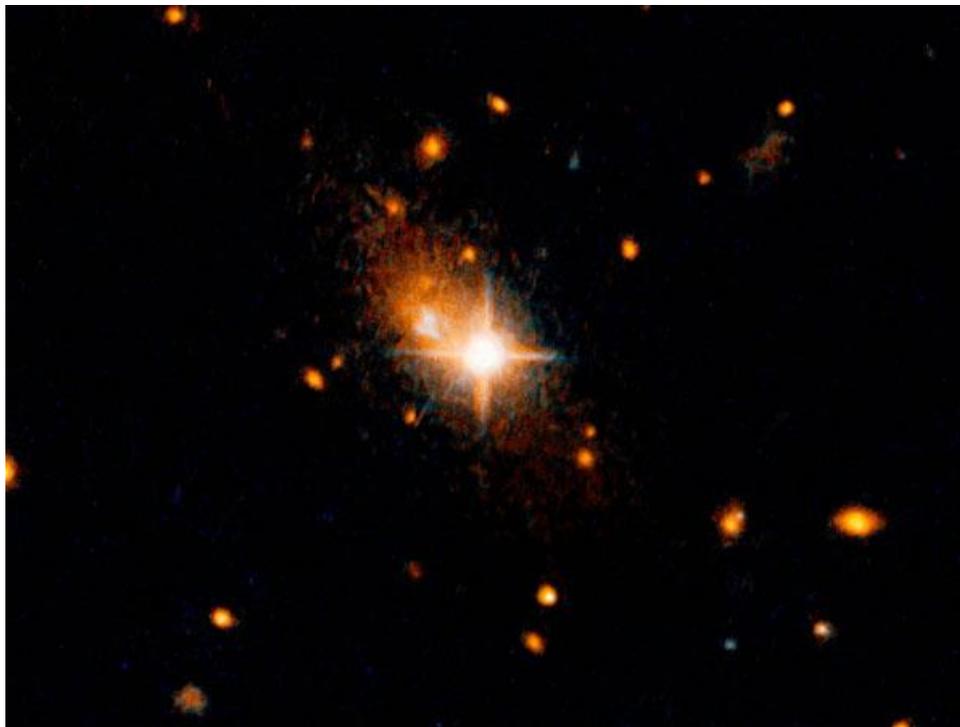


*Igor Komarov (right), director general for the Russian national space agency Roscosmos, at the 33rd National Space Symposium in Colorado Springs, Colorado on April 4, 2017. Credit: Space Foundation/Tom Kimmel Photography*

Source: [Space.com](http://Space.com)

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## 2. Gravitational Waves Dethrone Supermassive Black Hole



*The bright, star-like quasar 3C 186 and its former host galaxy, the faint, extended object behind it, sit at the center of a galaxy cluster. The quasar was probably ejected following a long-ago galaxy merger.*

*NASA / ESA / M. Chiaberge (STScI / ESA)*

A billion years ago in a universe far away, two galaxies collided. Stars swirled into new orbits and gas clouds slammed into each other. New stars were born and gas funneled into the two galaxies' centers, feeding the two supermassive black holes lurking there.

Then, about 5 million years ago, these black holes fused into one. As they whirled around each other, they radiated energy in the form of gravitational waves — a signal that a space-based detector such as LISA might one day detect — and those waves gave the final product a real kick in the pants. The merged supermassive black hole, an object with a mass roughly 3 billion times the Sun's, hastened away from the new galaxy center at millions of miles per hour.

This is the picture that Marco Chiaberge (Space Telescope Science Institute and Johns Hopkins University) and colleagues have painted to explain the unique observations of the quasar known as 3C 186. The results were presented in the April 2017 [\*Astronomy & Astrophysics\*](#).

### **The Evidence**

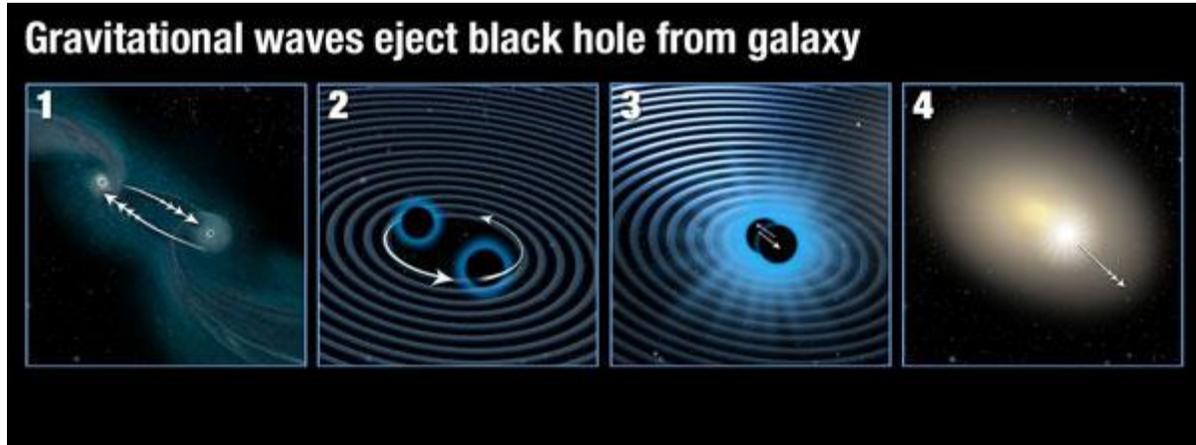
The quasar itself is a brilliant beacon of light emitted by gas that's plummeting down into the central black hole. Now, new Hubble Space Telescope images for the first time reveal the galaxy that hosts this point of light. And, surprisingly, the images show that the quasar is offset from the galaxy center by about 1.3 arcsecond.

That's a tiny angle on the sky — equivalent to the width of a human hair held 10 meters away. But in a galaxy so far away that its light must travel 8 billion years to get here, 1.3 arcseconds translates to a distance of 35,000 light-years. For comparison, the Sun sits only 26,000 light-years from our galaxy's center.

The team also carefully analyzed the quasar's visible-light spectrum, revealing the chemical signature of gas speeding out of the host galaxy. (Earlier, automated analyses of the spectrum had missed the signature.) The signature is that of a black hole and its surrounding gas buffet flying away from the galaxy center at 2,140

kilometers per second (4.8 million mph). The black hole will shine brightly as long as it holds onto its gas disk, probably another 100 million years or so according to the researchers' calculations.

Together, the quasar's incredible speed and its offset from the galaxy's center point to one likely conclusion: this black hole is the product of two unequal black holes, whose lopsided merger emitted asymmetric gravitational waves and ultimately kicked the black hole out of its central galactic home. This isn't the first such candidate discovered, but it's the first to have *two* signatures of gravitational wave recoil — previous candidates have shown [spatial offset](#) or [incredible speed](#) but not both.



*As two galaxies interact and merge, their central black holes are gravitationally attracted to each other (first panel). When the two black holes become close enough together, they send out gravitational waves, shrinking their orbit over time (panel 2). Eventually, they merge (panel 3). Since the black holes were initially different masses, and their gravitational waves correspondingly lopsided, the merger will give the new, more massive black hole a firm kick out of the galaxy.*

*NASA / ESA / Hubble / A. Feild / STScI*

"3C 186 is an exciting candidate for a gravitational wave recoiling supermassive black hole, which have proven very difficult to find," says Julie Comerford (University of Colorado, Boulder), who was not involved in the study.

But, as both Chiaberge's team and Comerford point out, this candidate isn't a shoo-in just yet. There's a chance, for example, that the quasar lies in a second, less luminous galaxy that's in the background of the galaxy that Hubble imaged. So Chiaberge and colleagues are already planning follow-up observations with Hubble in combination with the Atacama Large Millimeter/submillimeter Array (ALMA) in Chile to rule out alternative possibilities.

### **The Final Parsec Problem**

Astronomers are pretty sure black holes merge on a regular basis — otherwise, it's awfully hard to explain how we see billion-solar-mass black holes just a billion years after the Big Bang. Astronomers also know that galaxy collisions can deliver two supermassive black holes pretty close to each other. And they have calculated that gravitational waves can radiate away enough energy to bring about the final union.

But galaxies don't deliver their central black holes quite close enough together for gravitational waves to do the rest of the work. There must be something that gets the black holes the light-year or three closer to each other to complete the merger process. This conundrum is known as the Final Parsec Problem. If 3C 186 really is the final product of two supermassive black holes, it could serve as the perfect testbed for how such fusions happen.

"The observations provide strong evidence that supermassive black holes can actually merge," says study coauthor Stefano Bianchi (Roma Tre University, Italy).

Source: [Sky and Telescope](#)

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### 3. NASA's MAVEN Reveals Mars Has Metal in its Atmosphere



*This artist concept shows the MAVEN spacecraft and the limb of Mars. Credits: NASA's Goddard Space Flight Center*

Mars has electrically charged metal atoms (ions) high in its atmosphere, according to new results from NASA's MAVEN spacecraft. The metal ions can reveal previously invisible activity in the mysterious electrically charged upper atmosphere (ionosphere) of Mars. "MAVEN has made the first direct detection of the permanent presence of metal ions in the ionosphere of a planet other than Earth," said Joseph Grebowsky of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "Because metallic ions have long lifetimes and are transported far from their region of origin by neutral winds and electric fields, they can be used to infer motion in the ionosphere, similar to the way we use a lofted leaf to reveal which way the wind is blowing." Grebowsky is lead author of a [paper on this research](#) appearing April 10 in *Geophysical Research Letters*.

MAVEN (Mars Atmosphere and Volatile Evolution Mission) is exploring the Martian upper atmosphere to understand how the planet lost most of its air, transforming from a world that could have supported life billions of years ago into a cold desert planet today. Understanding ionospheric activity is shedding light on how the Martian atmosphere is being lost to space, according to the team.

The metal comes from a constant rain of tiny meteoroids onto the Red Planet. When a high-speed meteoroid hits the Martian atmosphere, it vaporizes. Metal atoms in the vapor trail get some of their electrons torn away by other charged atoms and molecules in the ionosphere, transforming the metal atoms into electrically charged ions.

MAVEN has detected iron, magnesium, and sodium ions in the upper atmosphere of Mars over the last two years using its Neutral Gas and Ion Mass Spectrometer instrument, giving the team confidence that the metal ions are a permanent feature. "We detected metal ions associated with the close passage of Comet Siding Spring in 2014, but that was a unique event and it didn't tell us about the long-term presence of the ions," said Grebowsky.

The interplanetary dust that causes the meteor showers is common throughout our solar system, so it's likely that all solar system planets and moons with substantial atmospheres have metal ions, according to the team.

Sounding rockets, radar and satellite measurements have detected metal ion layers high in the atmosphere above Earth. There's also been indirect evidence for metal ions above other planets in our solar system. When spacecraft are exploring these worlds from orbit, sometimes their radio signals pass through the planet's atmosphere on the way to Earth, and sometimes portions of the signal have been blocked. This has been interpreted as interference from electrons in the ionosphere, some of which are thought to be associated with metal ions. However, long-term direct detection of the metal ions by MAVEN is the first conclusive evidence that these ions exist on another planet and that they are a permanent feature there.

The team found that the metal ions behaved differently on Mars than on Earth. Earth is surrounded by a global magnetic field generated in its interior, and this magnetic field together with ionospheric winds forces the metal ions into layers. However, Mars has only local magnetic fields fossilized in certain regions of its crust, and the team only saw the layers near these areas. "Elsewhere, the metal ion distributions are totally unlike those observed at Earth," said Grebowsky.

The research has other applications as well. For example it is unclear if the metal ions can affect the formation or behavior of high-altitude clouds. Also, detailed understanding of the meteoritic ions in the totally different Earth and Mars environments will be useful for better predicting consequences of interplanetary dust impacts in other yet-unexplored solar system atmospheres. "Observing metal ions on another planet gives us something to compare and contrast with Earth to understand the ionosphere and atmospheric chemistry better," said Grebowsky.

The research was funded by the MAVEN mission. **MAVEN's principal investigator is based at the University of Colorado's Laboratory for Atmospheric and Space Physics, Boulder.** The university provided two science instruments and leads science operations, as well as education and public outreach, for the mission. NASA Goddard manages the MAVEN project and provided two science instruments for the mission. The University of California at Berkeley's Space Sciences Laboratory also provided four science instruments for the mission. **Lockheed Martin built the spacecraft and is responsible for mission operations.** NASA's Jet Propulsion Laboratory in Pasadena, California, provides navigation and Deep Space Network support, as well as the Electra telecommunications relay hardware and operations.

Source: [NASA](#)

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# The Night Sky

## April 11

- At this time of year, the two Dog Stars stand vertically aligned around the end of twilight. Look southwest. Brilliant Sirius in Canis Major is below, and Procyon in Canis Minor is high above.

## Wednesday, April 12

- Right after dark, the Sickle of Leo stands vertical high in the south. Its bottom star is Regulus, Leo's brightest. Leo himself is walking horizontally westward, with the Sickle forming his front leg, chest, mane, and part of his head.

## Thursday, April 13

- This is the time of year when, as the last of twilight fades away, the bowl of the dim Little Dipper extends straight to the right of Polaris. High above the end-stars of the Little Dipper's bowl, you'll find the end-stars of the Big Dipper's bowl.

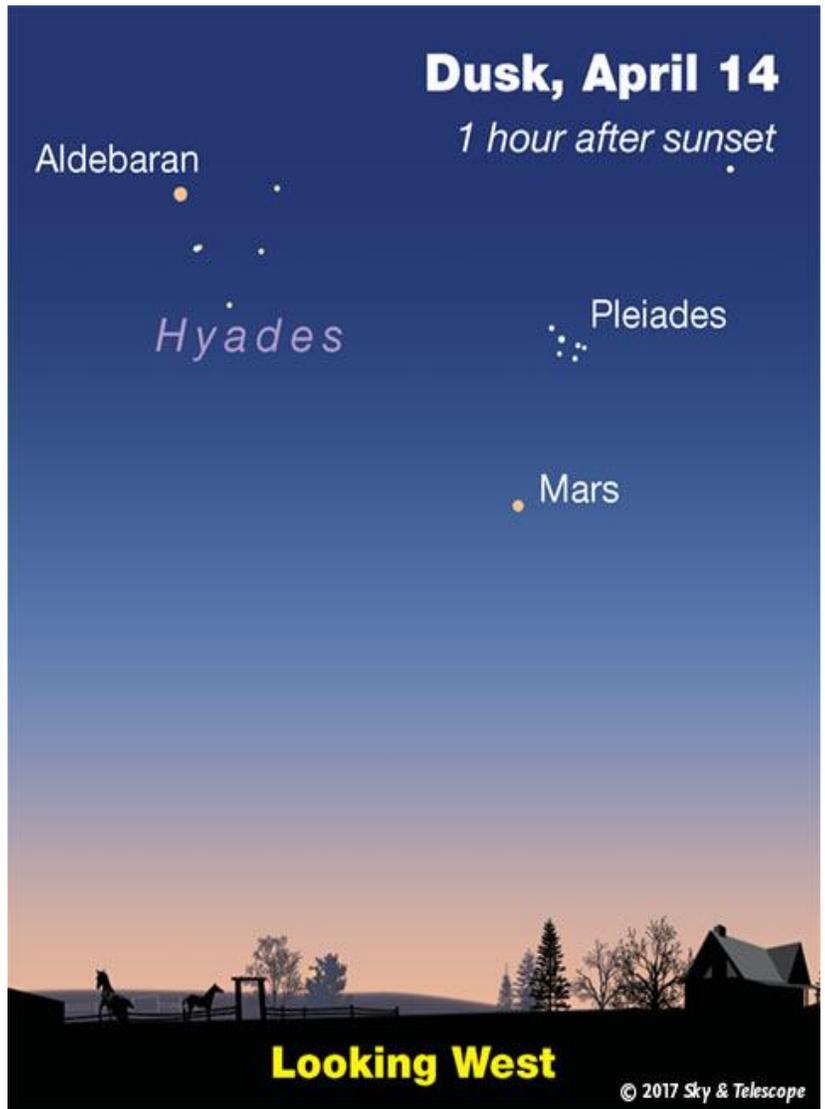
## Friday, April 14

- Arcturus shines brightly in the east these evenings, to the left or upper left of even brighter Jupiter (by about three fists at arm's length). Arcturus forms the pointy end of a long, narrow kite asterism formed by the brightest stars of Bootes, the Cowherd. The kite is currently lying on its side to Arcturus's left. The head of the kite, at the far left, is bent slightly upward. The kite is 23° long: about two fists.

## Saturday, April 15

- Before and during early dawn Sunday morning, look for Saturn below or lower left of the waning gibbous Moon.

Source: [Sky and Telescope](#)



*Mars, just a trace redder than Aldebaran, is approaching the Pleiades. It'll pass closest to the lower left of them April 19–21.*

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## ISS Sighting Opportunities (from Denver)

Date	Visible	Max Height	Appears	Disappears
Tue Apr 11, 9:25 PM	1 min	60°	29° above NW	60° above WNW
Wed Apr 12, 8:32 PM	4 min	49°	22° above NNW	20° above ESE
Wed Apr 12, 10:08 PM	< 1 min	11°	10° above W	11° above W
Thu Apr 13, 9:17 PM	2 min	31°	19° above W	30° above SSW
Fri Apr 14, 8:25 PM	4 min	66°	44° above WNW	12° above SE

Sighting information for other cities can be found at [NASA's Satellite Sighting Information](#)

## NASA-TV Highlights (all times Eastern Time Zone)

### **Tuesday, April 11**

- 12 p.m., 4 p.m., 8 p.m. and 10 p.m. - Replay of the NASA Television Video File Feed of the ISS Expedition 50/Soyuz MS-02 Post-Landing Activities in Kazakhstan and Interview; scheduled to include a post-landing interview with ISS Expedition 50 Commander Shane Kimbrough of NASA and the return of cosmonauts Sergey Ryzhikov and Andrey Borisenko (all channels)

### **Wednesday, April 12**

- 11 a.m. - ISS Expedition 51 In-Flight Media Interviews with the CBS Newspath Syndication Service and CNN with ISS Commander Peggy Whitson of NASA (Starts at 11:15 a.m.) (all channels)
- 1 p.m. - Smithsonian National Air and Space Museum's STEM in 30: The Women Who Are Paving the Way to Mars (all channels)

### **Thursday, April 13**

- 1:30 p.m. - ISS Expedition 51 In-Flight Interviews with ABC News and the Associated Press with ISS Commander Peggy Whitson (starts at 1:40 p.m.) (all channels)
- 2 p.m. - NASA Oceans Beyond Earth News Conference (all channels)
- 3 p.m. - Video File of the ISS Expedition 51-52 Crew's Pre-Launch Activities at the Baikonur Cosmodrome in Kazakhstan (Fischer, Yurchikhin; recorded from April 5-13) – JSC via Baikonur, Kazakhstan (all channels)

### **Friday, April 14**

- 2 p.m., - Video File of the ISS Expedition 51-52 Crew's Pre-Launch Final Soyuz Fit Check and Launch Site Activities at the Baikonur Cosmodrome in Kazakhstan (Fischer, Yurchikhin; recorded April 14) (all channels)

Watch NASA TV online by going to the [NASA website](#).

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# Space Calendar

- Apr 11 - [Comet 230P/LINEAR](#) At Opposition (3.110 AU)
- Apr 11 - [Comet C/2017 D3 \(ATLAS\)](#) At Opposition (4.023 AU)
- Apr 11 - [Comet 206P/Barnard-Boattini](#) At Opposition (4.299 AU)
- Apr 11 - [Asteroid 17427 Poe](#) Closest Approach To Earth (2.848 AU)
- Apr 11 - [Wes Huntress'](#) 75th Birthday (1942)
- Apr 11 - [Anatoly Berezovoy's](#) 75th Birthday (1942)
- Apr 11 - [William Campbell's](#) 155th Birthday (1862)
- Apr 12 - [International Day of Human Space Flight](#)
- Apr 12 - [Yuri's Night: World Space Party](#)
- **Apr 12 - [Cassini](#), Distant Flyby of Mimas, Aegaeon, Janus, Atlas & Prometheus**
- Apr 12 - [Comet 182P/LONEOS](#) Perihelion (1.008 AU)
- Apr 12 - [Comet 41P/Tuttle-Giacobini-Kresak](#) Perihelion (1.045 AU)
- Apr 12 - [Comet C/2017 D3 \(ATLAS\)](#) Closest Approach To Earth (4.023 AU)
- Apr 12 - [Apollo Asteroid 2017 GP4](#) Near-Earth Flyby (0.029 AU)
- Apr 12 - [Apollo Asteroid 2017 GN5](#) Near-Earth Flyby (0.029 AU)
- Apr 12 - [Apollo Asteroid 2017 FH1](#) Near-Earth Flyby (0.053 AU)
- Apr 12 - [Asteroid 2224 Tucson](#) Closest Approach To Earth (1.886 AU)
- Apr 12 - [Asteroid 498 Tokio](#) Closest Approach To Earth (2.078 AU)
- Apr 12 - [Asteroid 1815 Beethoven](#) Closest Approach To Earth (2.119 AU)
- Apr 12 - **Shijian 13 Launch, Long March 3B**
- Apr 13 - [Comet C/2016 A3 \(PANSTARRS\)](#) Perihelion (4.790 AU)
- Apr 13 - [Apollo Asteroid 2017 FF128](#) Near-Earth Flyby (0.017 AU)
- Apr 13 - [Aten Asteroid 2017 GO5](#) Near-Earth Flyby (0.052 AU)
- Apr 13 - [Amor Asteroid 2017 FX2](#) Near-Earth Flyby (0.064 AU)
- Apr 13 - [Asteroid 7010 Locke](#) Closest Approach To Earth (1.594 AU)
- Apr 13 - [Asteroid 10217 Richardcook](#) Closest Approach To Earth (2.230 AU)
- Apr 13 - [Asteroid 2315 Czechoslovakia](#) Closest Approach To Earth (2.307 AU)
- Apr 13 - [Asteroid 3866 Langley](#) Closest Approach To Earth (2.617 AU)
- Apr 13 - [Dwarf Planet 136108 Haumea](#) At Opposition (49.693 AU)
- Apr 14 - [Comet 144P/Kushida](#) At Opposition (1.675 AU)
- Apr 14 - [Comet P/2007 T2 \(Kowalski\)](#) At Opposition (3.369 AU)
- Apr 14 - [Comet 304P/Ory](#) At Opposition (4.084 AU)
- Apr 14 - [Amor Asteroid 2017 FH63](#) Near-Earth Flyby (0.092 AU)
- Apr 14 - [Atira Asteroid 2014 FO47](#) Closest Approach To Earth (1.418 AU)
- Apr 14 - [Asteroid 327 Columbia](#) Closest Approach To Earth (1.795 AU)
- Apr 14 - [Asteroid 5682 Beresford](#) Closest Approach To Earth (1.851 AU)
- Apr 14 - [Valentin Lebedev's](#) 75th Birthday (1942)

Source: [JPL Space Calendar](#)

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# Food for Thought

## NASA Officials Expect Fewer Earth Science Missions in Coming Years



*This plankton bloom in the Barents Sea is a colorful example of the microscopic ocean life that the PACE satellite is designed to observe globally. PACE is one of four Earth science missions identified for cancellation in the White House's budget blueprint. Credits: NASA's Earth Observatory*

Expect fewer missions to study planet Earth in NASA's future, agency officials told an advisory group last week.

A blueprint of the Trump administration's proposed NASA budget would cancel four Earth science missions already in the agency's portfolio and slash research funding geared toward future projects. NASA officials said last week that the proposal, if enacted, will reduce the scope of the agency's Earth science program, but still continue development of many key missions.

"I'd say science funding was stable at the top line," said Robert Lightfoot, NASA's acting administrator. "Some missions in development will clearly not go forward in the Earth science arena."

The White House's budget document released March 16 was light on details, but the Trump administration proposed a \$19.1 billion budget for NASA in fiscal year 2018, which begins Oct. 1. The agency's Earth science division would get \$1.8 billion, roughly 6 percent less than enacted in fiscal year 2016.

"We continue to be committed to studying our home planet," Lightfoot said Thursday in an address to the NASA Advisory Council. "We'll reshape our focus based on the resources available to us, and the budget, while it's lower, is still in pretty good shape for us, for what we're going to do in Earth science."

Four Earth science missions are singled out for cancellation in the preliminary budget blueprint.

The Earth-observing component of the Deep Space Climate Observatory, a mission led by NOAA, is on the cutting block. The DSCOVR spacecraft, stationed at the L1 Lagrange point nearly a million miles from Earth, is primarily used by NOAA to produce space weather warnings, but it also hosts two Earth science instruments that fall under NASA management.

The budget overview released last month proposes the end of analysis and support work for the NASA-managed Earth science sensors on DSCOVR, which include a camera looking back at Earth providing multiple color images of the “blue marble” every day. DSCOVR launched in February 2015 aboard a SpaceX Falcon 9 rocket.

The analysis work conducted by NASA on DSCOVR’s Earth science instruments include “mission operations and algorithm monitoring, calibration and validation,” said Michael Freilich, NASA’s Earth science division director.

The other three Earth science missions that could be canceled include Orbiting Carbon Observatory-3, or OCO-3, an instrument built from spares developed for NASA’s OCO-2 satellite. The OCO-3 instrument was planned to launch as soon as next year inside a commercial resupply ship for attachment to the International Space Station, where it was designed to monitor concentrations of greenhouse gases in Earth’s atmosphere.

Another mission NASA recently approved to start development could also be ended. A demonstration of sensor technology for the Climate Absolute Radiance and Refractivity Observatory, or CLARREO, was scheduled for launch to the space station in 2020. The CLARREO Pathfinder project, identified for cancellation in the White House budget overview, would have reduced technical risk for a future satellite mission in the 2020s aimed at detecting changing climate trends.

The fourth project that would fall victim to the Trump administration’s proposed cuts is PACE, short for the Plankton, Aerosol, Cloud and ocean Ecosystem mission, set for launch around 2022. PACE is being developed as a standalone satellite to examine the interactions between Earth’s atmosphere and oceans, with an emphasis on monitoring ocean color to study marine food webs, harmful algal blooms and other aquatic organisms.

NASA’s planetary science division, which oversees the agency’s robotic probes sent throughout the solar system, would fare better under President Trump’s budget, which calls for \$1.9 billion for interplanetary exploration next year. That is an increase of nearly 17 percent over the planetary science budget approved by Congress for fiscal year 2016.

NASA would see a 0.8 percent reduction in its overall budget from this year under the Trump proposal.

Thomas Zurbuchen, head of NASA’s science mission directorate, said March 28 that the budget proposal would still offer a “sizable” level of funding in Earth science. “What you see is the first step of the process that always happens,” Zurbuchen told members of the National Academy of Science’s Space Studies Board. “The first step of a process that, based on normal circumstances in the past, changes.”

The White House budget office is expected to submit a more detailed line-by-line budget request to Congress in May. The “skinny” budget document released last month offers few details on Trump’s vision for the federal budget, but it would cut most discretionary spending programs and seeks a \$54 billion uptick in military spending.

“That will be what goes to Congress,” Freilich said March 28. “That will represent the input to the congressional process to come up with an appropriations bill.” Lawmakers will write a budget for NASA later this year, or vote on a continuing resolution to keep the government’s agencies operating with minor funding modifications.

“We have every expectation that the detailed FY18 budget proposal that will be coming out in May puts flesh on the ‘skinniness’ of the blueprint,” said Freilich, who added that NASA expects the detailed proposal to hold to the \$1.8 billion top line number for the Earth science division included in last month’s White House budget overview.

The budget blueprint did not mention any changes in funding for other major NASA Earth science missions, such as the ICESat 2 satellite scheduled for launch in late 2018 to track changes in Earth’s polar ice. The Earth science division’s new “Earth Venture” initiative to select relatively low-cost research missions through competitions also remained untouched.

The Earth Venture program was pioneered by the development and launch of NASA’s eight CYGNSS hurricane research satellites in December.

## Space Image of the Week



### Zeta Oph: Runaway Star

Credits: NASA, JPL-Caltech, Spitzer Space Telescope

**Explanation:** Like a ship plowing through cosmic seas, runaway star Zeta Ophiuchi produces the arcing interstellar bow wave or bow shock seen in this stunning infrared portrait. In the false-color view, bluish Zeta Oph, a star about 20 times more massive than the Sun, lies near the center of the frame, moving toward the left at 24 kilometers per second. Its strong stellar wind precedes it, compressing and heating the dusty interstellar material and shaping the curved shock front.

What set this star in motion? Zeta Oph was likely once a member of a binary star system, its companion star was more massive and hence shorter lived. When the companion exploded as a supernova catastrophically losing mass, Zeta Oph was flung out of the system. About 460 light-years away, Zeta Oph is 65,000 times more luminous than the Sun and would be one of the brighter stars in the sky if it weren't surrounded by obscuring dust. The image spans about 1.5 degrees or 12 light-years at the estimated distance of Zeta Ophiuchi.

Source: [NASA APOD](#)

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