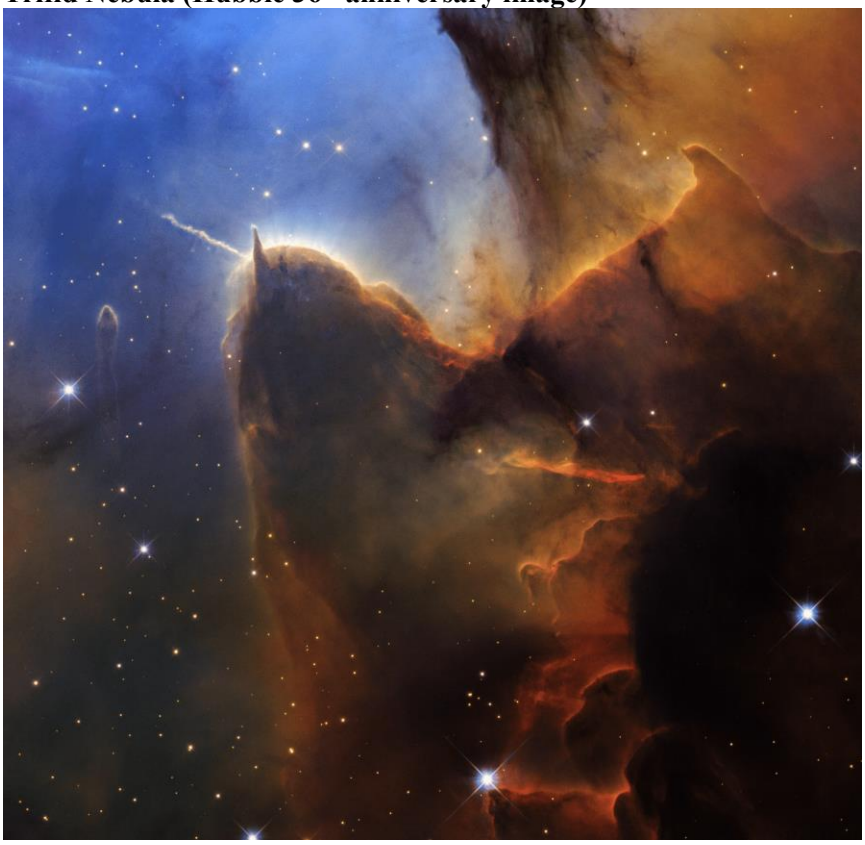
OKLAHOMA SPACE ALLIANCE

OUTREACH – May 2026

102 W. Linn #1, Norman, OK 73069

Oklahoma Space Alliance will meet at the
at Cyber Hall and Gaming Lounge next to Norman Computer
at 2:00 p.m. on May 9, details inside

Trifid Nebula (Hubble 36th anniversary image)



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OKLAHOMA SPACE ALLIANCE OUTREACH
May 2026

May Meeting

Oklahoma Space Alliance will meet at 2:00 p.m. on Saturday, May 9, at the location next to Norman Computers on West Main in Norman. Prospective members are welcome.

The meeting room is in the Cyber Hall and Gaming Lounge next to Norman Computers. Please enter through the Cyber Hall door. The Cyber Hall is at 914 W Main St, opposite Norman High School. The phone number is (405) 292-9501. To get to the meeting space from points north, take Highway 77 exit off I-35, and continue south until you reach Main Street. Norman Computers is about a block and a half west of this on the south (left) side of a small mall.

After the meeting, we will have a belated Yuri's Night pizza party the McMurray house, with a space video to celebrate. Prospective members are welcome. Their house is at 2715 Aspen Circle in Norman. To get to the meeting either: (1) Take the Lindsey Street east exit from I-35, turn right at Berry, and proceed to Imhoff Road. Turn right at Imhoff, right at Poplar Lane, left at Aspen Lane, and right at Aspen Circle. or (2) Take Highway 9 east off I-35, turn left at Imhoff Road, left at Poplar, left at Aspen Lane, and right at Aspen Circle.

Saturday, May 9, 2:00 p.m.

1. Introductions and review of Space events this past month
2. What's Happening in Space, News, Pictures, and Videos approximately one hour. See **http://osa.nss.org** before the meeting for items to be discussed.
3. Break
4. Oklahoma Space Alliance Chapter Business Discussion
   a. Review OSA treasurer's report.
   b. Minutes of April Meeting
   c. Plans for 2026
5. Video (to be announced)
6. Chat

Minutes of April 11 Oklahoma Space Alliance Meeting

Oklahoma Space Alliance met April 11, 2026, at the Cyber Hall and Gaming Lounge at Norman Computers in Norman, Oklahoma. Attending were Clifford McMurray, Mark Deaver Dave Sheely and Syd Henderson. We had postponed the Yuri's night party, and some potential attendees got confused and thought the meeting itself was also cancelled. OSA President Clifford McMurray. presided over the meeting He did an *Update* discussing links to material covered in the meeting and this is online **https://osa.nss.org/Update2604.pdf** so I'll cover the details that aren't covered there.

This was the meeting after the launch of *Artemis II*, which increased the number of living people who have been to the Moon from five to nine. There are four moon walkers still alive. [Buzz Aldrin, David Scott, Charlie Duke and Harrison Schmitt. Fred Haise of *Apollo 13* went around the Moon but didn't land for obvious reasons.] The Canadian astronaut was the first person to fly to the Moon who wasn't American.

There was a lot of publicity about the astronauts experiencing a solar eclipse as they went around the Moon. The reason this was unusual was that the astronauts went to the Moon while the Moon was full.

Note that the "ring of fire" you saw in some photographs was false because the Moon is too large at the distance they were.

The astronauts got a recording greeting from the late Jim Lovell who recorded it shortly before his death.

Carlos Garcia-Galan, former deputy manager for the defunct Lunar Gateway, is now leader of the Moon Base initiative. "The Gateway team, both NASA and industry and the international partners, were an awesome team," Garcia-Galan said in an interview afterward. "While I do believe an orbiting outpost has value in our overall exploration goals, this doesn't mean that we can't do it later. We need to be focused on the surface, and everyone wants to be on the surface. So I'm super excited, and I'm sure the rest of the Gateway team will be once they start to shift their focus." [Arstechica.com] The 362 anticipated missions to set up Moon Base include the installation of a nuclear reactor to power the Base.

NASA doesn't think any of the proposed commercial space stations are on track. They will spend $280 million on them, which would be sufficient to supply one of them.

It's not clear if the nuclear-powered SR-1 mission would go into orbit around Mars or go farther out. Power adds up to 20kW. It's very aggressive to get it done by 2008.

There are $1.1 billion cuts to the ISS budget in the proposed Administration budget (which is odd since the mission of ISS has been extended). NASA's whole budget would be cut by 23%, which is a rerun of last year's proposal. Artemis is getting nearly half the remaining budget.

We're having difficulty with the Early Warning System during the Iran War causing problems for Israel and Oman. We want satellites that can handle this from space, which will be part of the Space Force budget.

Russia anticipates a crewed mission from Baikonur to the ISS this fall.

Mark wonders how Musk is going to cool off his AI satellites. [AI processing produces a huge amount of heat.]

SpaceX's IPO is to raise $75 billion in capital. The $1.75 trillion valuation would make SpaceX #6 in the world. [If you're curious, the top five market capitalizations are Nvidoa, Apple, Alphabet. Microsoft and Amazon.] Thus, the IPO is a small part of the valuation of the company.

Space tourism is anticipated to go from $2.6 billion in 2026 to $27 billion in 2034.

In June 2025, China already achieved refueling in orbit, so the one in "Update" is the second.

Shimuzo's plan to use the Moon to produce solar power would require 6800 miles of solar panels to go around the Moon. It also appears to be pretty wide. I'm a tad skeptical.

Blue Origin has 11,000 employees and Bezos is contributing billions of his own money to keep it solvent.

Blue Ring would carry multiple cube sats and use kinetic deflection to deter dangerous asteroids. It has a "slam cam" to observe the result of the impact. [Presumably of the deflector, not the asteroid hitting the Earth.]

We watched a video of the *Tianlong 3* launch failure.

SpaceX had another Starlink satellite break up on December 17 of last year. The debris from the latest will reenter in a few weeks.

We watched a video from Moon Base detailing their ten-year plan.

Phase 1: (to 2028) 25 launches, 21 landers, two tonnes of payload to surface/ [Per spacecraft?] Communications increase to greater than 500 Mbps. VIPER will map volatiles for lunar resource prospecting.

Phase 2: (2029-32) 27 launches, 24 landings. Seven rovers include a pressurized rover. Solar panels during the day, RTGS at night.

Phase 3: (2033 -36) 29 launches and landings. Long duration, 8 metric tonnes per launch.

We watched a video on Artemis program update. *Artemis IV* will spend six days on the Moon, with the whole mission lasting 21 days. The first mission with a Centaur V upper stage will be *Artemis V*.

Minutes of March 14 Oklahoma Space Alliance Meeting

Oklahoma Space Alliance met March 14, 2026, at the Cyber Hall and Gaming Lounge at Norman Computers in Norman, Oklahoma. Attending were Clifford McMurray, Adam Hemphill, Mark Deaver (briefly), John Northcutt, Tim Scott, Dave Sheely and Syd Henderson, with Robin Scott joining us by phone. OSA President Clifford McMurray. presided over the meeting He did an *Update* discussing links to material covered in the meeting and this is online **https://osa.nss.org/Update2603.pdf** so I'll cover the details that aren't covered there.

We are still waiting for *Artemis II* to go back to the launch pad. Syd remarked that the Artemis launches seem to be referred to alternately with Roman numerals or Arabic numerals depending on the source. [The same seems to have been true for the Gemini and Apollo missions. Hence the movie *Apollo 13* although the mission patch says Apollo XIII. From that I conclude NASA itself uses Roman numerals, as confirmed by the *Artemis II* mission patch and who am I to say otherwise?--Syd]

NASA is revising its Moon plans. They are not talking about using SLS beyond *Artemis V*. There is speculation that the office handling the Lunar Gateway will be transformed into a lunar base office, [Gateway is probably dead.]

ISS will continue for at least two years beyond its previous decommission date to keep a permanent human presence in space and allow time to transfer to commercial space stations. I note that this means a permanent American human presence; the Chinese may well intend to have their own.

The impact of *DART* with Dimorphos also changed the orbital speed of its parent Didymos around the Sun by several microns per second. The orbital period of Dimorphos around Didymos was changed by thirty minutes. I don't know how much the change to Didymos changes the orbital period around the Sun.

The upgrade to *Artemis IV* was not going to happen because we now have viable alternatives. Specifically, the Centaur V upper stage.

A science payload on MTN (Mars Telecommunications Network) is not precluded but not necessary.

Astrolab/Interlune anticipate a fleet of lunar harvesters. Is Astrobot a part of Astrolab?

RocketLab may have a mission to Venus this year, perhaps via Neutron rocket. But this may get delayed because Neutron is.

Vast will have the sixth (?) private mission to the ISS and Haven-1 next year.

The March 4 Kairos flight failed two minutes after launch. One of the previous Kairos made it to orbit but the satellites were lost. The March 4 flight was the third failure of Kairos in three tries.

Mauve, the first commercial space telescope, was spawned out of University College in London.

"The Year of the Horse calls for the vigor of a galloping steed:" commentator on *Shenzhou 21*. We watched videos from the Tiangong Space Station.

After the meeting on April 11, we will adjourn to Kip McMurray's for a Yuri's Night pizza party.

Project Hail Mary debuts on March 20. Shall we put a group together a week later to see it?

We watched a video on Haven-2, VAST's project to replace the ISS. They start off with four modules linked in a row that will separate to form an X-shaped space station around a central core. They can attach several modules to each wing.

We watched a video on SpaceX unveiling VAST's Haven-1.

Vast's Spinning Stick will use 6-8 modules end-to-end to generate artificial gravity to go to Mars.

We watched a video on life within SpaceX's Dragon capsule. Dragon has seven launch spots in Florida alone.

Minutes by OSA Secretary Syd Henderson

Space News

This month's cover is a spectacular photograph of the Trifid Nebula taken by the Hubble Space telescope, which was launched on April 24, 1990. The Trifid ("three-lobed) Nebula is an active star-forming region with some hundred newborn stars which, with more mature stars, form an open cluster with perhaps 3100 members . The brightest of these is HD 164492A, which has more than twenty times the mass of the Sun and illuminates the Nebula. However, since it is 4100 light-years away, the nebula is on the bare threshold of being visible to the naked eye, but it is a favorite object for amateur astronomers.

You may have heard that *Artemis II* was launched on April 1, with only a few minutes delay that didn't threaten the mission. After all the waiting, this was a very smooth mission, going on a long loop around the Moon much as *Apollo 13* did, but this time it was intentional from the start. We got to learn more about the zero-gee toilet than we wanted to, but now we have our first space plumber, (I believe Christina Koch.) When that is the major snag of the mission, the flight went very well.

When Jared Isaacman restructured the upcoming Artemis missions, the first moon landing in the program was moved to *Artemis IV* in 2028, while *Artemis III* became a test mission that would check out either one or both of the possible Moon landers, SpaceX's *Starship HLS* and Blue Origin's *Blue Moon*. This was tentatively plugged in as occurring in mid-2027; however, as it has become apparent that neither will be ready by then, it has been moved to later in the year. The failure of an upper stage on a recent New Glenn launch, and the slight postponement of *Starship 12*, which will probably move the launch of *Starship 13*, the first orbital flight of *Starship*, as well (though SpaceX still hasn't). The hope was that the first two *Artemis* Moon landings, *Artemis IV* and *Artemis V*, would both take place in 2028, but that looks increasingly unlikely. The big hope is that both Moon craft will be ready and NASA will have two options for future missions. Also note that both spacecraft will require refueling in orbit before going to the Moon, and SpaceX is testing that late last year. See https://www.space.com/space-exploration/artemis/artemis-3-has-been-pushed-to-late-2027-can-nasa-still-land-astronauts-on-the-moon-in-2028

Artemis III will also probably also test the Axiom Extravehicular Mobility Unit (AxEMU) space suit, which is designed for operations on the Moon. (The orbital space suit, the Orion Crew Survival System was tested on *Artemis II*. This is the bright orange space suit, so colored for potential recovery of astronauts.)

Meanwhile, *New Glenn* is temporarily grounded after the latest launch sent a satellite to the wrong orbit. Apparently one of the upper stage's engines didn't produce enough thrust to put the *Bluebird 7* into the proper orbit. Since *New Glenn* is the launch vehicle for the *Blue Moon 1* lunar landing, this failure is a major concern. On the bright side, the reused first stage performed beautifully and successfully landed on the drone ship *Jacklyn*.

Astronomers using TESS have identified 10,502 new candidate planets in one go, in addition to seeing 1052 that they previously had identified. 411 of the new candidates are single-transit events. This is the largest collection of candidate planets in one single survey. As of May 3, TESS had identified 7931 candidates and confirmed 885, so this more than doubles the number of TESS's candidates, and I assume the number of confirmed is also going to more than double. https://astrobiology.com/2026/05/the-t16-planet-hunt-10000-new-planet-candidates-from-tess-cycle-1-and-the-confirmation-of-a-hot-jupiter-around-tic-183374187.html

At long last, the Nancy Grace Roman Space Telescope is ready for launch, which will take place in September. This is a wide-field infrared telescope which has a field of view 200 times greater than Hubble while keeping the same sharpness of view. Among its other abilities to search for new exoplanets and dark matter, the NGRST will be able to actually image exoplanets. It will be able to detect exoplanets a

few times the mass of the Moon (in other words a few percent that of Earth) and can use gravitational microlensing to detect "rogue" planets the size of Mars.

The Artemis Accords continue to attract countries and there were five signees during the two weeks from April 20 to March 4, bringing the total to sixty-six. The latest signees are Latvia, Jordan, Morocco, Malta and Ireland. In Europe west of the former USSR borders, the major block of states which have not signed are the former states of Yugoslavia and Albania. However, the three Baltic states, Ukraine and Armenia have signed the Accords, and those are five of the fifteen former Soviet Republics.

The rings of Uranus are becoming even stranger. The two outer rings, the μ and ν rings appear to be different colors, reflecting different compositions. The μ ring is blue, which is a sign of very small particles, like smoke, which may be coming from the tiny moon Mab. The ν ring, which is closer to Uranus, is redder, which indicates that it is composed of larger dust particles. Besides the μ ring, the only other blue ring in the Solar System in Saturn's E ring, which is fed by the geysers of Enceladus. However, Mab is far too small to have volcanic activity. For more information, see https://keckobservatory.org/uranus-two-outer-rings/ .

China and Pakistan have selected two Pakistani astronauts to undergo training in China. One of these will be the first non-Chinese mission specialist on the *Tiangong* space station.

Jared Isaacman reported that both modules of Lunar Gateway were corroded. There have been a number of similar reports including the European HALO habitation module. These are all built by Thales Alenia space, which also builds modules for Axiom and have built them for the ISS. Hardware for Gateway is being repurposed for Moon Base; it's not clear what, if any, effect this will have on that.

The famous Pleiades or "seven sisters" has six members easily visible to the naked eye (the seventh is supposedly vanished, and one of the six is Atlas—yes that Atlas), and up to a thousand members altogether. However, it is an open cluster, which means it can lose members. In fact, a new survey from astronomers at the University of North Carolina at Chapel Hill have identified a lot of these escaped stars. The "Greater Pleiades Complex" spans 1900 light-years and contains 3091 stars including those in the Pleiades themselves. Most of these are no longer bound to the main cluster but trace back there.

Sky Viewing

We just missed the Eta Aquariids, and there are no eclipses or major meteor showers until August, and no bright comets. So that just leaves the planets. At least we have one notable conjunction coming up. (See Venus.) This month also features a "Blue Moon" (by one definition) since there are Full Moons on May 1 and 31.

Mercury is in superior conjunction with the Sun on May 14, so it will not become visible until the end of the month. By May 30, Mercury will be ten degrees above the horizon a half-hour after sunset, and at magnitude -0.6, may be visible if you have a clear horizon. Since Jupiter and Venus are also in the lower western sky, you can follow the Ecliptic from Jupiter through Venus to find Mercury. Mercury doesn't reach greatest elongation from the Sun until June 15, by which time it will be magnitude 0.5, but still relatively visible, not least since the early crescent moon will be below it on the ecliptic. By the end of June, Mercury will be hard to see as it approaches inferior conjunction with the Sun on July 12.

Venus is on its way up in the western sky. It is currently magnitude -3.9 and will brighten slightly during May and June but it is still farther away from us than the Sun and will be even brighter this fall. Venus is moving up while **Jupiter** is moving down, which means a major conjunction is coming up. This occurs on June 8 and 9 when they will be 1.6° apart (about three times the apparent width of the full moon). Venus is about two magnitudes brighter than Jupiter. Incidentally, if you looked at them through a

telescope, Jupiter would look two and a half times wider, which, since it is about three times as far away on that date, shows how big it really is. However, when Venus is at its brightest, it will also look wider.

Mars, which rises an hour before the Sun is currently magnitude 1.3,is still pretty inconspicuous. It is currently in Aries but moves into Taurus in June where it will only be the second brightest "star" in that constellation. Mars will be in Taurus through July. On June 20, it will be five degrees south of the Pleiades.

Jupiter is currently magnitude -2.0 and will only dim slightly later in the month. Currently it is in Gemini south of Castor and Pollux. Jupiter will still be pretty high in the sky at the time of its conjunction with Venus but will be visible for only a couple of hours a night by June 30, as it approaches conjunction with the Sun on July 28.

Saturn is only seven degrees above the horizon an hour before sunrise, partly because the ecliptic is at a shallow angle to the horizon at that time of day. However, Saturn will get considerably easier to see in June and will eventually rise a couple of hours before sunrise. Its magnitude is around 0.7. It is currently located in Cetus, which you may notice is not one of the constellations of the Zodiac. However, the Zodiac just touches a corner of Cetus and Saturn is near that corner. It is just over the border with Pisces and will move back into that constellation in June. Barely.

Uranus is in the constellation Taurus about five degrees (half a fist-width) south of the Pleiades. It is not currently visible even with binoculars since it is in conjunction with the Sun on May 22; however, it may be possible to find it in the east in late June. Uranus will not move much from one night to the next, so if you find it one night, you're set for weeks. To search for Uranus, try https://lovethenightsky.com/see-uranus-through-a-telescope

Neptune is now in the eastern sky before sunrise, about ten degrees above and right of Saturn. It really is in Pisces and will be there for some years. By June 1, it will be rising around 2:30 a.m., and around 1:00 a.m. on June 30. Unfortunately, the region of Pisces it is in is pretty barren. At magnitude 7.8, Neptune's a difficult object to search for, but https://lovethenightsky.com/see-neptune-through-a-telescope/ should be a help. Like Uranus, Neptune has a definite blue-green tinge that will help distinguish it from background stars. Even more than Uranus, Neptune has the advantage that if you find it at all, it will be in about the same place for the next year or two.

Viewing Opportunities for Satellites (May 9 – June 9, 2026)

You can get sighting information at **www.heavens-above.com**, which gives you a constellation map showing the trajectory of the satellite.

With the addition of the solar panels, the International Space Station can be as bright as magnitude -4.0 making it brighter than all the stars other than the Sun and all the planets other than Venus. The Hubble Space Telescope can get up to magnitude 1.5, which is brighter than the stars in the Big Dipper, but magnitude 2.0 is more likely. *Tiangong* is the Chinese Space Station. It currently gets up to magnitude -2.2 after the addition of the Wentian module in July 2024.

The "mag." beside the date indicates the brightest magnitude the satellite gets during the pass. Most of the ISS passes get between -2.9 and -3.9, which is brighter than Jupiter ever gets, but not quite as bright as Venus.

Missions to and from the International Space Station and Tiangong can change their orbits. The next launch to the ISS is a SpaceX cargo module on May 12. There is a Progress cargo flight on June 16, after these viewings. There are no currently announced flights to Tiangong in May or June.

The information below is from Heavens Above. There are no passes of the Hubble Space Telescope that go above 26° and those that go that high are early in the morning.

ISS 5/9 mag. -3.7

Time	Position	Elevation
8:49 p.m.	215°	10°
8:52	135	58
8:55	55	10

Time	Position	Elevation
5:51 a.m.	290°	10°
5:54	207	68*
5:57	124	10

*Passes very close to Altair.

Tiangong 5/15 mag. -1.8

Time	Position	Elevation
Appears from Earth's shadow.		
4:49:47 .m.	306°	25°
4:51:24	21	64
4:54	405	10

Tiangong 5/19 mag. -2.2

Time	Position	Elevation
9:59 p.m.	247°	10°
10:01:58	334	85
10:03:30	63	27
Vanishes into Earth's shadow.		

Tiangong 5/20 mag. -1.9

Time	Position	Elevation
8:57 p.m.	226°	10°
9:00	150	48
9:03	75	10

Tiangong 5/21 mag. -1.4

Time	Position	Elevation
9:31 p.m.	211°	10°*
9:34	340	53
9:37	59	10**

*Passes close to Jupiter and Pollux
**Passes very close to Vega.

ISS 5/26 mag. –3.8

Time	Position	Elevation
9:53 p.m.	311°	10°
9:56.37	226	83
9:57:59	139	33*

*Vanishes into Earth's shadow

ISS 5/27 mag. -3.3

Time	Position	Elevation
9:06 p.m.	322°	10°
9:09	40	53
9:12	117	10

Tiangong 5/28 mag. -1.9

Time	Position	Elevation
10:16 p.m.	300°	10°
10:18:36	21	61
10:19:08	70	56
Vanishes into Earth's shadow.		

ISS 5/29 mag. -2.8

Time	Position	Elevation
9:07 p.m.	299°	10°*
9:10	227	42
9:13	154	10

*Passes very close to Venus

Tiangong 5/30 mag. -2.3

Time	Position	Elevation
9:46 p.m.	253°	10°
9:49:21	207	84*
9:50:54	11+	27
Vanishes into Earth's shadow.		

*Passes very close to Arcturus.

Key: Position is measured in degrees clockwise from north. That is, 0° is due north, 90° is due east, 180° is due south, and 270° is due west. Your fist held at arm's length spans about ten degrees. "Elevation" is elevation above the horizon in degrees. So, to view the Tiangong space station at 10:18:36 p.m. on May 28, measure just over two fist-widths east of due north, then just over six fist-widths above the horizon.

Programming Notice: NASA+ on the Web

NASA-TV has become NASA+ s
NASA+ live event schedules are available at https://www.nasa.gov/live/ or https://plus.nasa.gov/scheduled-events/.

Calendar of Events

Sometime in 2026: *New Glenn* launch carrying Firefly's *Elytra* orbital transfer vehicle and the *ELaNa-42* mission which will launch 42 cubesats.

Sometime in 2026: Launch of Japan's *Martian Moons Exploration* (MMX) which includes a Phobos lander and sample return. This also is carrying IDEFIX, a Mars Rover built by France and Germany. For information, see en.wikipedia.org/wiki/Martian_Moons_eXploration_(MMX).

Sometime in 2026: Second (uncrewed) *Gaganyaan* flight test. This one will carry the Vyommitra humanoid robot. For more information on the Gaganyaan program, see https://en.wikipedia.org/wiki/Gaganyaan. Note: with *Gaganyaan 1* being delayed until the second half of 2026 *Gaganyaan 2* and/or *3* will likely be moved to 2027.

Sometime in 2026: Third (uncrewed) *Gaganyaan* flight test. This one will carry the Vyommitra humanoid robot.

Sometime in 2026: Maiden flight of *Terran R* mission to Mars from Impulse Space. This includes a Mars lander. For more information, en.wikipedia.org/wiki/Terran_R.

Sometime in 2026: Maiden flight of *Volans*, the first orbital launch vehicle developed in Singapore, for Equatorial Space Systems.

Sometime in 2026]: Launch of Boeing *Starliner-1*, first operational Starliner mission.

Sometime in 2026: Maiden flight of *Aurora* rocket. First orbital flight from Spaceport Nova Scotia.

Sometime in 2026: launch of Canadensys Lunar Rover.

Second quarter of 2026 [moved from first quarter]: *Starship 13*. This will be the first orbital flight of Starship. Also, this will be the first attempt to capture the upper stage (*Ship*).

Second quarter of 2026 [moved from first quarter]: Launch by Falcon 9 Heavy of MRV which will carry DARPA's robot satellite servicer (RSGS), which will install extension pods to lengthen satellites' lifetimes.

May [moved from March]: *Starship 12*: This will be the first flight of configuration 3.

May 8: Oklahoma City Astronomy Club meets at Science Museum Oklahoma. 7:00 p.m., followed by a talk at about 7:45 p.m. See www.okcastroclub.com for details.

May 9: Oklahoma Space Alliance meeting, 2:00 p.m., Norman Computers. There will be a pizza party at Kip McMurray's afterward. Meeting and party information will be posted at http://osa.nss.org.

May 14: Mercury is in superior conjunction with the Sun.

May 22: Uranus is in conjunction with the Sun.

June 1: Swift Rescue Mission to raise the Neil Gehreis Swift Observatory to a higher orbit.

June 4 – 7: International Space Development Conference, Hilton McLean Tysons Corner, McLean, Virginia. For more information, visit https://isdc.nss.org/.

June 12: Oklahoma City Astronomy Club meets at Science Museum Oklahoma. 7:00 p.m., followed by a talk at about 7:45 p.m. See www.okcastroclub.com for details.

June 13: Oklahoma Space Alliance meeting, 2:00 p.m., Norman Computers. Meeting information will be posted at http://osa.nss.org.

June 15: Mercury is at greatest elongation, 24.5° east of the Sun (hence can be seen after sunset).

Second half of 2026: First (uncrewed) *Gaganyaan* flight test. For more information, see https://en.wikipedia.org/wiki/Gaganyaan_1.

Second half of 2026: A SpaceX *Nova-C* mission to the Moon takes Intuitive Machines' IM-3 lander, NASA's Lunar Vertex rover, and several NASA Cadre rovers. For information, en.wikipedia.org/wiki/IM-3

Third Quarter of 2026: Launch of Blue Origin's *Blue Moon* Mark 1 lunar lander. This is one of a number of missions called Pathfinder. Mark 1 is uncrewed; Mark 2 is a few years off but will carry astronauts.

Third quarter of 2026 [moved from first quarter]: Maiden flight of Spain's Miura 5 reuseable launch vehicle.

Third quarter of 2026: Launch of *RFA One* from SaxaVord Spaceport in the Shetland Islands. If successful, this will be the first orbital flight launched by the United Kingdom after several tries.

July: Launch of Astrobiotic's *Griffin Mission 1*, including lunar lander, FLIP lunar rover, and CubeRover on a Falcon Heavy. This will land at Nobile Crater near the South Pole of the Moon. For more information, https://en.wikipedia.org/wiki/Griffin_Mission_One.

July 10: Oklahoma City Astronomy Club meets at Science Museum Oklahoma. 7:00 p.m., followed by a talk at about 7:45 p.m. See www.okcastroclub.com for details.

July 11: Oklahoma Space Alliance meeting, 2:00 p.m., Norman Computers. Meeting information will be posted at http://osa.nss.org.

July 12: Mercury is inferior conjunction with the Sun.

July 20: 57th anniversary of *Apollo 11* moon landing.

July 28: Jupiter is in conjunction with the Sun.

August: China launches the lunar mission *Chang'e 7*, which includes an orbiter, a lander and a hopping probe. For more information, see https://en.wikipedia.org/wiki/Chang%27e_7.

August 2: Mercury is at greatest elongation, 19.5° west of the Sun (hence can be seen before sunrise).

August 12: Total eclipse of the Sun. This one is on an unusual curve that begins on the north central coast of Siberia, goes over Greenland and Iceland and finally ends by crossing northern Spain and a bit of northern Portugal. This is the first total eclipse in Europe since 2006. Interestingly, the next one is August 2, 2027, and starts in Spain.

August 12: Peak of Perseid meteor shower.

August 15: Venus is at greatest elongation, 45.9° east of the Sun (hence can be seen after sunset).

September 25: Neptune is at opposition.

September 28 [moved up from May 2027—it can happen]: Launch of the *Nancy Grace Roman Space Telescope* [formerly known as WFIRST] to the Earth-Sun L2 point. For more information, see https://en.wikipedia.org/wiki/Nancy_Grace_Roman_Space_Telescope.

Fourth quarter of 2026: *Starship* launch of the *Starship HLS* lunar lander and FLEX, Astrolab's demo lunar lander to the lunar south pole. *Starship HLS* is the craft SpaceX will use to transfer astronauts to the Moon.

Fourth quarter of 2026 [Moved from first quarter]: Maiden flight of Rocket Labs Neutron launcher, from Wallops Island, Virginia. For more information, https://en.wikipedia.org/wiki/Rocket_Lab_Neutron

Fourth quarter of 2026 [moved from second quarter]: second *Blue Ghost* mission, carrying *Lunar Pathfinder* to the far side of the Moon. This mission also carries the United Arab Emirates *Rashid 2* rover. *Rashid-1* was lost with the *Hakuto-R* mission in 2024.

Fourth quarter of 2026 In-flight fuel transfer from Starship to a target.

Fourth quarter of 2026: First *Dream Chaser* demonstration mission, not to ISS as originally planned.

Fourth quarter of 2026: China launches its *Xuntian* space telescope, which will orbit close to orbit close to *Tiangong* for easy servicing. For more information, visit https://en.wikipedia.org/wiki/Xuntian

Fourth quarter of 2026: Launch of *Griffin II*, the third lunar lander mission by Astrobiotics, which will land near the lunar south pole.

October 4: Saturn is at opposition.

October 12: Mercury is at greatest elongation, 25.2° east of the Sun (hence can be seen after sunset).

October 21: Peak of Orionid meteor shower. This is the second meteor shower associated with Halley's Comet.

October 23: Venus is in inferior conjunction with the Sun.

November: *Hera* arrives at the binary asteroid Didymos (the one we hit with an impactor). Somehow, this is one month earlier than previously planned.

November: *BepiColombo* enters Mercury orbit.

November 5: Peak of South Taurid meteor shower.

November 12: Peak of North Taurid meteor shower.

November 17: Peak of Leonid meteor shower.

November 20: Mercury is at greatest elongation, 19.6° west of the Sun (hence can be seen before sunrise).

November 25: Uranus is at opposition.

December 14: Peak of Geminid meteor shower.

December 22: Peak of Ursid meteor shower.

Sometime in 2027 (moved from 2026): Launch of the *Venus Life Finder Probe and Photon* relay satellite to Venus by RocketLab's Electron Booster for MIT. For more information, visit https://en.wikipedia.org/wiki/Venus_Life_Finder.

Sometime in 2027: Launch of Blue Moon Pathfinder Mission 2, which will carry VIPER to the Moon.

Sometime in 2027: Launch of the *Payload Power Thermal Module*, the first module of Axiom's space station. It will dock with ISS and await *Hab-1*, which it will dock with as part of a free-flying space station.

Sometime in 2027: India launches *Chandrayaan-4*, a lunar sample return mission. For more information, https://en.wikipedia.org/wiki/Chandrayaan-4

Sometime in 2027: First crewed mission to Vast's *Haven-1* space station. For information, en.wikipedia.org/wiki/Haven-1.

Sometime in 2027: India launches its first crewed orbital flight *Gaganyaan 4*.

Sometime in 2027: First flight of China's Long March 10 crew launch vehicle, which will carry Chinese astronauts to the Moon.

First quarter of 2027 [Moved from May 2026]: launch of Vast's *Haven-1* space station. For more information, en.wikipedia.org/wiki/Haven-1.

January 2027: Launch of PLATO, (PLAnetary Transits and Oscillations of stars—couldn't you just name it Plato and not create a pseudo-acronym?) This is a mission dedicated to finding Earth-sized exoplanets in habitable zones around nearby stars.

January 2027: *Axiom-5*, a four-person fourteen-day mission to the ISS.

January 3, 2027: Peak of Quadrantid meteor shower.

April 2, 2027: Total eclipse of the Sun, beginning off the west coast of Iberia, and crossing the Straits of Gibraltar, including southern Spain, and northern Morocco, Algeria, Libya, north and central Egypt, western Saudi Arabia, Yemen and the tip of the Horn of Africa before ending in the mid-Indian Ocean. This eclipse is dubbed the Eclipse of the Century because it has the second longest period of totality of any eclipse this century and the longest, in 2009, was almost entirely over the Pacific Ocean. Maximum totality is near Luxor, Egypt, though Benghazi and Mecca come close.

April 12, 2027: Yuri's Night. 66th anniversary of humans in space.

August 12; 2027: *Lucy* flies by asteroid 3548 Eurybates in its first encounter with a Trojan asteroid. It will fly by at least 3 more Trojans in 2027 and 2028.

August 20, 2027: 50th anniversary of launch of *Voyager 2*.

September 2027 Launch of the *NEO Surveyor* which will be able to detect more than 90% of near-earth objects greater than 460 feet in diameter. For information, see https://en.wikipedia.org/wiki/NEO_Surveyor.

September 5, 2027: 50th anniversary of launch of *Voyager 1*.

Late 2027 [Moved from mid-2027]: Launch of *Artemis 3*. This has been changed from a lunar landing to a Near-Earth mission to test out equipment for a Moon landing in 2028. For information, see en.wikipedia.org/wiki/Artemis_3.

Fourth Quarter of 2027: Launch of the *ZeusX* Orbiter and lander and *LIBER* (the Lunar Integrated Bulk Extraction Rover). The last is a lunar miner rover. These are being produced by the Singapore-based private company Qosmosys.

Sometime in 2028 [Moved from 2027]: Launch of *UUM*, the core module of the *Russian Orbital Service Station*, or *ROS*. For more information, see https://en.wikipedia.org/wiki/Russian_Orbital_Service_Station.

Sometime in 2028 [Moved from September 2027]: Launch of *Luna 26*, Russia's Luna-Resurs-Orbiter. This mission is in tandem with next year's Luna 27 lander. For more information, see https://en.wikipedia.org/wiki/Luna_26.

Sometime in 2028: Launch of Habitat One to the Axiom space station.

Sometime in 2028: India launches its second crewed orbital flight *Gaganyaan 5*.

Sometime in 2028: India launches *Mars Lander Mission* (MLM 2 or *Mangalyaan 2*). This seems to be the same as MOM2. For more information, https://en.wikipedia.org/wiki/Mars_Lander_Mission

Sometime in 2028: Launch of the first module of India's *Bharatiya Antariksha* space station. For more information, see https://en.wikipedia.org/wiki/Bharatiya_Antariksha_Station.

Sometime in 2028: Launch and landing of Japan/India *LUPEX* (Lunar Polar Exploration) lander. India knows this as Chandrayaan-5. For more information, see https://en.wikipedia.org/wiki/Lunar_Polar_Exploration_Mission.

Sometime in 2028: Launch of *Chang'e 8*, which will include a lander, rover and a 3D printing experiment using lunar resources. This will be the last Chang'e mission before China sends a human crew to the Moon.

First half of 2028: Launch of *Artemis IV*, which, with the revised launch schedule will be the first manned landing on the Moon since 1972. This was to use *Lunar Gateway,* it looks like this will be cut, and with the administration also wanting to cut the SLS, timing of this and further Artemis missions will probably change.] For more information, https://en.wikipedia.org/wiki/Artemis_IV.

First quarter of 2028: Launch of the *Emirates Asteroid Mission* to the asteroid belt, where it will make at least seven flybys of asteroids, the largest of which are Chimaera and Justitia. [See May 2035.]

March 29, 2028: Launch of India's *Shukrayaan-1* Venus orbiter. This is also called VOM (Venus Orbiter Mission). For more information, see https://en.wikipedia.org/wiki/Shukrayaan-1.

April 2028: Launch of JAXA's *DESTINY+*, an asteroid flyby mission to Near Earth Asteroid Apophis and later Phaethon, the parent of the Geminid meteor shower. It will arrive there in 2029. For information, see en.wikipedia.org/wiki/DESTINY%2B. On same launch is the ESA's *Ramses* spacecraft, which will also fly by Apophis. For more information, https://en.wikipedia.org/wiki/Ramses_(spacecraft)

Between July 5 – 25, 2028: Launch of *Dragonfly*, the Titan helicopter mission. For information, see en.wikipedia.org/wiki/Dragonfly_(spacecraft).

Fourth quarter of 2028: Probable launch of *Artemis V* to land on the Moon.

October 2028: ESA launches the *ExoMars Mars Rover*, which has been christened *Rosalind Franklin*. For more information, visit https://en.wikipedia.org/wiki/ExoMars.

November 2028: JAXA, the Japanese space agency, launches *OPENS-0*, which will fly by the rings of Saturn in 2039.

Sometime in 2028: First crewed flight to the Russian Orbital Space Station (ROS).

Sometime in 2029: Launch of *Luna 27*, the Luna-Resurs Lander which will land in the South Pole-Aitkin Basin on the far side of the Moon. This mission is in tandem with 2028's Luna 26 orbiter. For more information, see https://en.wikipedia.org/wiki/Luna_27#Science_payload.

Sometime in 2029: Launch of the *Solar Power Orbit Observatory*, assuming it can find a ride.

Sometime in 2029 [moved from 2028, which was moved from July 2026]: *ClearSpace-1* will capture and deorbit *PROBA-1*.

Sometime in 2029: Probable launch of *Artemis VI* to land on the Moon.

Sometime in 2029: Launch of the *ARIEL Space Telescope* and *ESA/JAXA Comet Interceptor* via Ariane 62 to the Sun-Earth L_2 point, where the Interceptor will wait for a long-period comet or interstellar object to come by.

March 5, 2029: 50th Anniversary of *Voyager 1* flyby of Jupiter.

April 21, 2029: *OSIRIS-APEX* rendezvous with the asteroid Apophis. Note: *OSIRIS-APEX* is the same spacecraft as *OSIRIS-REx*; it is renamed "Apophis Explorer" for this part of its mission.

August 2029: The *Psyche* asteroid probe arrives at asteroid 16 Psyche. For more information, visit https://en.wikipedia.org/wiki/Psyche_(spacecraft).

September 2029: Launch of *Tianwen 4* which will carry Jupiter and Callisto orbiters and a mission to Uranus. The Uranus spacecraft will eventually leave the solar system, something that only the US has achieved.

Sometime in 2030: *DESTINY+* flies by asteroid 3200 Phaethon, the parent body of the Geminid meteor shower.

Sometime in 2030: Launch of China's *Tianwen-3* Mars sample return mission and orbiter.

Sometime in 2030: China will land a crewed mission on the Moon.

Sometime in 2030: Launch of Russia's *Luna 28* sample return mission.
Sometime in 2030: Launch of *UVEX*, NASA's Ultraviolet Explorer wide-field ultraviolet telescope.
Sometime in 2030: Maiden flight of Siraya, Taiwan's first orbital flight vehicle.
April 11, 2030: *Europa Clipper* arrives at Jupiter.
November 12, 2030: 50th anniversary of *Voyager 1* flyby of Saturn.
Sometime in 2031 or 2032: Launch of DAVINCI, a NASA Discovery Program mission to Venus.
Spring 2031: *Europa Clipper*'s first flyby of Europa.
June 2031: Launch of *VERITAS* Venus orbiter. For more information, see https://en.wikipedia.org/wiki/VERITAS_(spacecraft).
July 2031: *Hayabusa 2* arrives at asteroid 1998 KY26.
July 2031: *JUICE* flies by Ganymede, inserts into Jupiter orbit.
November2031: Launch of the ESA's *EnVision* Venus orbiter.
Sometime in 2032: Launch of the first South Korean lunar lander and rover, *KLLR*.
Sometime in 2032: Launch of the pressurized *Lunar Cruiser*, a crewed lunar rover.
Sometime in 2033: Launch of the Foundational Surface Habitat, the first component of the Artemis Base Camp.
March 2, 2033: *Lucy* flies by the double Trojan asteroid 617 Patroclus-Menotius. I believe these are the largest asteroids it will encounter.
December 2034: JUICE achieves Ganymede orbit.
Sometime in 2035: Launch of *LISA* gravitational wave observatory.
21 January 2035: *Tianwen-2* rendezvous with comet 311P/PanSTARRS.
May 2035: The *Emirates Asteroid Mission* touches down on Justitia.
Sometime in 2036 {moved from 2031(!)]: Launch of Russia's Venera-17 Venus orbiter and lander.
January 24, 2036: 50th anniversary of *Voyager 2* flyby of Uranus.
2038 or 2039: Launch of *Chandrayaan-H1*, India's first crewed mission to the Moon (a flyby, not a landing).
Sometime in 2036: *Dragonfly* arrives at Titan.
August 25, 2039: 50th anniversary of *Voyager 2* flyby of Neptune.
August 12, 2045: The next total solar eclipse visible in Oklahoma City. This one is also visible in Salt Lake City, Denver, Little Rock (again), Tampa Bay and New Orleans.

Oklahoma Space Alliance Officers, 2026

Clifford McMurray, President and *Update* Editor
405-329-4326 (H) 405-863-6173 (C)
Dave Sheely, Vice-President, 405-821-9077 (C)
Syd Henderson, Secretary & *Outreach* Editor,
405-321-4027 (H) 405-365-8983 (C)
Tim Scott, Treasurer, 405-740-7549 (H)

OSA E-mail Addresses and Web Site:

cliffmcmurray at hotmail.com (Clifford McMurray)
sheely at sbcglobal.net or david.sheely.1 at us.af.mil (David Sheely)
ahemphil at gmail.com (Adam Hemphill)
sydh at ou.edu (Syd Henderson)
sswift42 at aol.com (Steve Swift)
ctscott at mac.com (Tim Scott)
t_koszoru01 at cox.net (Heidi and Tom Koszoru)
john.d.northcutt1 at tds.net (John Northcutt)
lensman13 at aol.com (Steve Galpin)

E-mail for OSA should be sent to sydh at ou.edu. Members who wish their e-mail addresses printed in Outreach, and people wishing for space-related materials e-mailed to them should contact Syd. Oklahoma Space Alliance website is http://osa.nss.org . Webmaster is Syd Henderson.

Other Information

Oklahoma Space Industrial Development Authority (OSIDA), 401 Sooner Drive/PO Box 689, Burns Flat, OK 73624, 580-562-3500. Website is http://airspaceportok.com/#home,

Science Museum Oklahoma (former Omniplex) website is www.sciencemuseumok.org. Main number is 602-6664.

Tulsa Air and Space Museum, 7130 E. Apache, Tulsa, OK 74115.
Web Site is www.tulsaairandspacemuseum.com. Phone (918) 834-9900.

The Mars Society address is The Mars Society, 11111 West 8th Avenue, Unit A, Lakewood, CO 80215. Phone: (303) 980-0890Their web address is www.marsociety.org.

The National Space Society's Headquarters Executive Director e-mail nsshq@nss.org. The Chapters Coordinator is Bennett Rutledge 720-641-7987, rutledges@chapters.nss.org. The address is: National Space Society, 1300 I Street NW, Suite 400E, Washington, DC 20005. Phone (321)452-2448. The web page is space.nss.org.

The Planetary Society phone 626-793-5100. The address is 60 South Los Robles Avenue, Pasadena, California, 91101, and the website is www.planetary.org. E-mail is tps@planetary.org.

NASA Spacelink BBS 205-895-0028. Or try www.nasa.gov. .

Congressional Switchboard 202/224-3121.

Write to any U. S. Senator or Representative at [name]/ Washington DC, 20510 (Senate) or 20515 [House]

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