

# **OKLAHOMA SPACE ALLIANCE**

## **OUTREACH – September 2018**

**102 W. Linn #1, Norman, OK 73069**

Oklahoma Space Alliance will meet  
2:00 p.m. on September 8, 2018 at  
Earl's Rib Palace, 920 SW 25th St,  
Moore, OK.

Directions are inside.

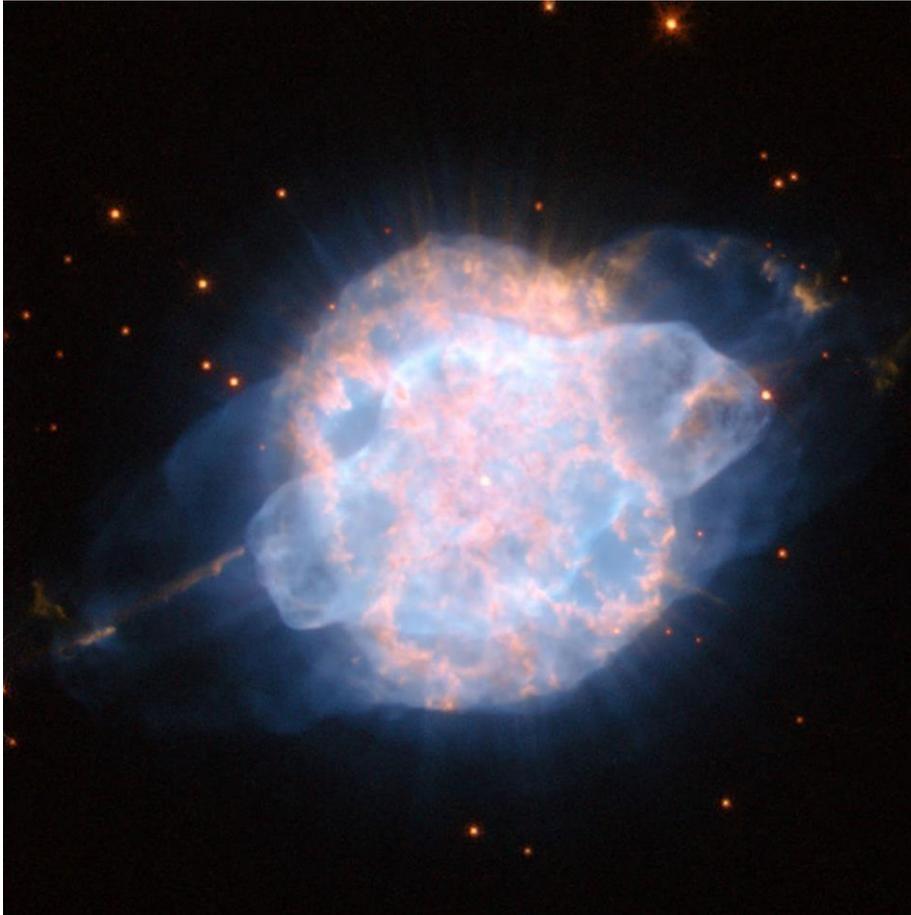


Figure 1 Planetary Nebula NGC 3918 Photographed by Hubble Telescope (NASA)

**OKLAHOMA SPACE ALLIANCE  
OUTREACH  
September 2018**

## September Meeting:

Oklahoma Space Alliance will meet at 2:00 p.m. on September 8, 2018 at Earl's Rib Palace, 920 SW 25th St, Moore, OK. This is between the 1-35 West Frontage Road and Telegraph Road. Telephone number is 793-7427.

### Saturday September 8, 2018 Program

Place: Earl's Rib Palace

Moore Oklahoma

2:00-5:00 PM

- 1) Introductions
  - a. What's Happening in Space, News, Pictures, and Videos approximately one hour.
  - b. Short presentation of the National Space Society's Space Settlement Roadmap General Milestones 1-6
- 2) Break
- 3) Oklahoma Space Alliance Chapter Business Discussion
  - a. Review OSA treasurer's report
  - b. Summary of August meeting minutes
  - c. Discussion of topics for future meetings
  - d. Discussion of better ways to involve non-NSS member type people.
  - e. Other issues
    - i. Oklahoma Space Alliance Website
- 4) Video: Speech by Jeff Bezos. The speech was given at the International Space Development Conference last May, in Los Angeles, CA. 45 minutes
- 5) Chat

## Minutes of August Meeting

National Space Society's Oklahoma Space Alliance chapter held its regular monthly meeting on August 11, 2018 at Earl's Rib Palace in Moore, Oklahoma. In attendance were David Sheely, Mike Hopkins, Tom Koszoru, Claire and Clifford McMurray, Tim Scott, Michael Smith-Antonides, Brian Swift, Steve Swift, Dennis Wigley, and Syd Henderson. Dave presided over the meeting.

Most of the "What's Happening in Space" segment was in last month's *Update*, so I'll just cover the highlights.

We looked at a NASA article on how the Parker Solar Probe will approach the Sun. This will involve several flybys of the Earth and Sun to modify the orbit so that it can fly within four million miles of the surface of the Sun.

We watched a video of meteors colliding with the Moon. The meteors were about the size of a walnut.

We watched videos of This Week at NASA.

We watched a video of a test of Orion, trying out the abort system.

The 50<sup>th</sup> anniversary of Apollo begins this fall with the anniversary of Apollo 7 [See "Space News."] This Christmas is the anniversary of Apollo 8, the astronauts on which were named *Time* magazine's Men of the Year.

NASA Administrator Bridenstine testified to Congress on the James Webb Space Telescope. Water was found underneath a Martian icecap.

*Apollo 11* tapes have been digitized, including conversations that haven't previously been released. Dave presented a compilation of rocket launches over July 2018, including SpaceX launch of a multitude of satellites for Iridium.

We have \$955.79 in our checking account and \$267 in cash, for a total of \$1222.79. What level of budget for the *Apollo 11* anniversary do we feel comfortable spending? Tim thinks \$200.00.

Do we have bylaws on webspace? [Yes, as part of the March *Outreach*, since our bylaws specify that the bylaws must be printed in our print newsletter. Not as a standalone.

We watched a video by Frank Drake, author of the Drake equation. The most interesting thing to me was the Kepler Orrery showing the comparative orbital movements of the exoplanet systems. It's strangely mesmerizing.

Minutes by OSA Secretary Syd Henderson

## Space News

Astronauts aboard the ISS sealed a leak August 30 in the Soyuz capsule attached. The leak was causing air pressure to go down in the entire station. NASA is still investigating the cause, which could be a seal or valve leaking, or possible a hole from a micrometeorite. The leak was about two millimeters in diameter, which seems consistent with a micrometeorite.

NASA is trying to reestablish contact with Mars Rover *Opportunity*, which they've not heard from since June 10. Mars has been covered by a planetary dust storm for months, and, since *Opportunity* is solar-powered, it's been shut down for the duration. The dust storm is finally dissipating, so *Opportunity*'s batteries should start charging up when the sky is clear enough. It's also Martian summer where *Opportunity* is located, and dust storms tend to keep the surface warm, so cold shouldn't be affecting the space craft.

The rover presumably went into hibernation when its power got too low, and hopefully will come out of it when it gets enough sunlight. The rover has a function that causes it to try to communicate with Earth when it hasn't heard from Earth in a long time. This is an automatic function to make sure that its communication equipment is operating. Even if NASA does hear from *Opportunity*, it may be weeks before they are in regular communication.

*Opportunity* landed on Mars in 2003 and was planned to last for 90 Martian days (about 92 Earth days), so it has been operating for sixty times as long as its original mission, during which it has travelled a total of twenty-eight miles. Still, it's natural to hope it can continue its mission for years to come.

The dust storm doesn't cause problems for NASA's other currently operating Mars Rover, *Curiosity*, because that is nuclear-powered.

## Apollo Anniversaries

We are fast approaching a series of fiftieth anniversaries of the *Apollo* space program. Actually the first one, a grim one, was the anniversary of the Apollo 1 fire, which killed Gus Grissom, Ed White and Roger Chaffee on January 27, 1967. After that, there was a twenty-one-month hiatus until American manned spaceflight resumed in October 1968.

Here is a timeline of the *Apollo* missions, including some (but not all) unmanned ones (the first four listed):

Apollo 1-A (AS-201), February 26, 1966: First flight of Command Module; suborbital.

Apollo 4, November 9, 1967: First flight of Saturn V

Apollo 5, January 22, 1968: First flight of Lunar Module

Apollo 6, April 4, 1968: Second flight of Saturn V.

### **Manned Apollo Missions**

Apollo 1: Supposed to be launched on February 21, 1967, but fire killed the astronauts during a test on January 27, 1967. This would have used a Saturn IB rather than a Saturn V.

Apollo 7, October 11 – 22, 1968: Tested command module in Earth orbit.

Apollo 8, December 21 – 27, 1968: First manned spacecraft to orbit the Moon. This was the first manned mission to use the Saturn V.

Apollo 9, Mar 3 – 13, 1969: Tested Lunar Module in Earth orbit.

Apollo 10, May 18 – 26, 1969: Test of Lunar Module in Moon orbit. Dress rehearsal for Moon landing.

Apollo 11, July 16 – 24, 1969: First landing of men on the moon.

Apollo 12, November 14 – 24, 1969: Second landing.

Apollo 13, April 11 – 17, 1970. Oxygen tank exploded. Moon landing aborted, and frantic and successful emergency operations brought crew back to Earth.

Apollo 14, January 31 – February 9, 1971: Third landing.

Apollo 15, July 26 – August 7, 1971: Fourth landing.

Apollo 16, April 16 – 27, 1972: Fifth landing.

Apollo 17, December 7 – 19, 1972, Sixth and last landing.

Next to *Apollo 9*, *Apollo 7* is probably the least remembered of the manned missions because it didn't go to the Moon. It was a test of the Command Service module, and the astronauts were Wally Schirra, Donn Eisele and Walter Cunningham. It was the only flight for the last two, and Schirra's last of three flights due to a "mutiny" by the crew (although Schirra had already announced his retirement). Cunningham was the Lunar Module Pilot despite there not being a Lunar Module on the spacecraft. Instead they used a docking adapter on the S-IV B stage to simulate rendezvous with the Lunar Module. One of the panels on the S-IV B stage failed to open completely at first. (This stage would hold the Lunar Module on future flights; after the experience on *Apollo 7*, NASA jettisoned these panels on future flights.) *Apollo 7* was also the first American manned spacecraft to transmit live television broadcasts from space. (Gordon Cooper had transmitted live pictures from his Mercury flight in 1963, but they weren't broadcast.)

*Apollo 7* is also noted for the tension between Mission Control and the astronauts. Part of this was that Mission Commander Schirra developed a head cold near the beginning of the mission and was irritable with Mission Control, which was adding things to the manifest while the crew was in flight. (It's sometimes reported that all the crew had colds, but it was just Schirra. They did, however, suffer from motion sickness.) Eisele and Cunningham also began arguing with Mission Control, which led to them being grounded from future missions.

The last straw was that Schirra wanted the crew to land with their helmets off because of his head cold. (Ostensibly they all had the cold.) He was worried that his eardrums might burst since he would be unable to blow his nose with the helmet on. This would not have been an issue on earlier flights, but the Apollo helmet didn't have a moveable visor.

Despite these episodes, *Apollo 7* was considered a highly successful mission. They tested the Service Propulsion System, which was the engine that on future missions would put the spacecraft into and out of lunar orbit and deorbit the spacecraft when it came back to Earth orbit.

## Sky Viewing

After a summer of bright planets, we are beginning to lose them over the next couple of months. **Mercury** is very low on the eastern horizon about 45 minutes after sunrise. It's magnitude -1.0, which makes it brighter than Procyon to its upper right, but not as bright as Sirius, which is to Procyon's lower right. Mercury will disappear into twilight by September 11 as it approaches superior conjunction on September 20. It will return in the west in late October but will be very low because of the shallow angle of the ecliptic.

**Venus** is low in the western sky at sunset, about twenty degrees below Jupiter, but at magnitude 4.6, is still easy to see. The shallow angle of the ecliptic at sunset that makes Mercury hard to spot, also affects Venus, so that by the end of September, Venus will only be seven degrees above the horizon at sunset. This gets worse in October, so you'll probably be unable to see Venus at all. Venus is in inferior conjunction with the Sun on October 26, so it will become a spectacular morning star around Thanksgiving, helped by the angle of the ecliptic at dawn being steep instead of shallow.

**Mars** at magnitude -1.9 is still as bright as Jupiter, but that is about to change as it moves away from us. It is also noticeably orange, and easily visible in the south all evening. The dust storm that covered Mars at opposition is finally dissipating, but probably too late for *Opportunity*, which is solar powered. [See "Space News."] Mars will fade rapidly to magnitude -1.3 by the beginning of October, and magnitude -0.6 by the end of October. That is still plenty bright, and it will be visible all evening long. **Jupiter** is in the southwest at sunset and shines at magnitude -1.9, which is brighter than any star. It's currently setting about 10:30 p.m., but by the end of September, that will be 8:30 p.m., and by the end of October, Jupiter will be moving into twilight at sunset. It is in conjunction with the Sun on November 26.

**Saturn** is magnitude 0.4 and near the tip of the spout of the Teapot asterism in Sagittarius. Currently it is about halfway between Antares and Mars (although since Saturn is brighter at the moment than Antares, this is more of a guide to find the star than the planet.) Saturn is due south an hour after sunset, and bright all evening. Saturn's rings are near maximal tilt, making this a good time to find a telescope. Saturn will be visible all evening though most of September but will only be visible in the early evening in late October.

With the Venus and Jupiter about to disappear, *Astronomy* magazine's headlines for "Sky this Month" are "**Uranus** Reaches its Peak" (October) and "**Neptune** at its Best." To tell the truth, unless they're near conjunction, both planets are so far away that their brightness doesn't change more than a tenth of a magnitude anyway, Uranus is always about magnitude 5.7 and Neptune is always magnitude 7.8. One change is that Uranus is no longer in Pisces: it is now in southwestern Aries. (It will be back in Pisces for a couple of months around January 1 due to retrograde motion against the stars.) Neptune will be in Aquarius for years to come. Uranus is at opposition on October 23 and Neptune was on September 7, hence the headlines. Finder charts for Uranus and Neptune are online at [http://wwwcdn.skyandtelescope.com/wp-content/uploads/WEB\\_UrNep18.pdf](http://wwwcdn.skyandtelescope.com/wp-content/uploads/WEB_UrNep18.pdf)

There don't seem to be any notable meteor showers in September, but there are a couple in October. The better-known are the **Orionids**, which peak around October 21 and peak at around 20 meteors per hour. The Moon is out during the early part of the shower and will be in a gibbous phase but will set around 4:00 a.m. so if you get up early, you'll get to see them at their best.

*Astronomy* speculates that this year the usually minor shower the **Draconids** may be much more prominent than usual. This is because their parent, Comet Giacobini-Zinner, flew by the Sun last month. Based on previous passes, there should be ten meteors per hour, and possible more than the Orionids. In addition, they peak on the night of October 8 – 9 and the new moon is October 9.

Information for this section comes from the September and October issues of *Sky & Telescope* and *Astronomy*, and from their websites.

## Viewing Opportunities for Satellites (September 8 – October 13)

You can get sighting information at [www.heavens-above.com](http://www.heavens-above.com), which allows you to get satelliteviewing data for 10-day periods and gives you a constellation map showing the trajectory of the satellite.

<https://spaceflight.nasa.gov/realdata/sightings/SSApplications/Post/JavaSSOP/JavaSSOP.html> gives coordinates at 20-second intervals from when the satellite rises, not from when it peaks. (This program requires Java. I'm currently using Internet Explorer to run it and making an exception for the site in the Java Control Panel.) I'm using its information for the International Space Station and Hubble Space Telescope, interpolating when necessary. It doesn't give you information for Tiangong 2, so I'm using Heavens Above for those. The *Sky & Telescope* web site carries ISS observation times for the next few nights at [skyandtelescope.com/observing/almanac](http://skyandtelescope.com/observing/almanac).

With the addition of the solar panels, the International Space Station can be as bright as magnitude 3.8, which it will on March 18, making it brighter than all the stars other than the Sun and all the planets other than Venus, although magnitude -2 to -3 is more likely. The Hubble Space Telescope can get up to magnitude 1.5, which is brighter than the stars in the Big Dipper, although, since it is lower in the sky, it is more difficult to see. I'm including data for Tiangong 2, which can get up to magnitude 1.0 at least. Missions to and from the International Space Station or Tiangong-2 may change its orbit. Japan is launching a cargo spacecraft to the Station on September 10. Expedition 56 returns on October 4, and Expedition 57 launches on October 11. China was doing some maneuvering of Tiangong-2 in June, possibly as a test for its future reentry, but it has returned to its former orbit.

Assuming its orbit is not changed, The ISS will go nearly overhead on September 16, and **will** go directly overhead on October 12.

Tiangong-2, 15 September 2018		
Time	Position	Elevation
8:55 p.m.	300°	10°
8:58:16	25	73
8:58:48	88	56

ISS 16 September 2018		
Time	Position	Elevation
6:30 a.m.	309°	22°
6:31	305	42
6:32	41	81
6:33	141	41
6:34	136	21

Tiangong-2, 16 September 2018		
Time	Position	Elevation
7:57 p.m.	306°	10°
8:00	20	43*
8:03	95	10

\*Passes through bowl of Big Dipper

Tiangong-2, 17 September 2018		
2018 Time	Position	Elevation
8:36 p.m.	289°	10°
8:39	211	55
8:41	142	24
Vanishes into Earth's shadow		

ISS 17 September 2018		
Time	Position	Elevation
Appears from Earth's shadow		
5:39 a.m.	350°	33°
5:40	39	46
5:41	88	33
5:42	106	19

HST 19 September 2018		
Time	Position	Elevation
9:02 p.m.	224°	20°
9:03	205	27
9:03:36	177	31
9:03:47	172	31
Vanishes into Earth's shadow		

## HST 20 September 2018

Time	Position	Elevation
8:51 p.m.	227°	20°
8:52	208	28
8:53	180	32
8:54	151	28
8:25	188	36
8:26	132	52
8:27	79	35
8:28	64	20

Vanishes into Earth's shadow

## ISS 21 September 2018

Time	Position	Elevation
8:24 p.m.	204°	20°

## HST 21 September 2018

Time	Position	Elevation
8:40 p.m.	229°	20°
8:41	210	27
8:42	182	31
8:42:43	154	27
8:43:13	142	24

Vanishes into Earth's shadow

## HST 22 September 2018

Time	Position	Elevation
8:30 p.m.	131°	20°
8:31	212	27
8:32	184	30
8:33	158	27
8:34	139	20

## ISS 23 September 2018

Time	Position	Elevation
8:16 p.m.	250°	21°
8:17	266	36
8:18	322	52

8:19            15            36  
 Vanishes into Earth's shadow

## Tiangong-2, 7 October 2018

Time	Position	Elevation
Appears from Earth's shadow		
6:05:48 a.m.	278°	65°
6:06:09	334	73
6:09	61	10

## ISS 10 October 2018

Time	Position	Elevation
8:00 p.m.	340°	17°

8:01	359	27
8:02	37	34
8:03:29	74	27
8:03:34	76	26

Vanishes into Earth's Shadow

## ISS 12 October 2018

Time	Position	Elevation
7:52 a.m.	312°	22°
7:53	312	42
7:54	52	90
7:55	133	43
7:56	133	22

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 is about ten degrees wide. "Elevation" is elevation above the horizon in degrees. Thus, to see the International Space Station at 8:16 p.m. on September 23, measure two fist-widths south from due west, then just over two fist-widths above the horizon.

All times are rounded off to the nearest minute except for times when the satellite enters or leaves the shadow of the Earth. The highest elevation shown for each viewing opportunity is the actual maximum elevation for that appearance.

### Programming Notice: NASA TV on the Web

Watch NASA TV (Public, Media and Education Channels) on your computer using Flash, Windows or QuickTime at <http://www.nasa.gov/multimedia/nasatv/index.html>.

NASA TV Schedules are available at <http://www.nasa.gov/multimedia/nasatv/schedule.html>

Highlights (all times are Central Daylight Time):

September 10, 5:00 a.m.: Coverage of launch of JAXA rocket carrying the Kounotori cargo craft from Tanegashima Japan. Launch is scheduled for 5:32 a.m.

September 14: 5:00 a.m.: Coverage of the arrival of the Kounotori Cargo Craft at the ISS. Capture is scheduled for 6:40 a.m. with installation at 10:40 a.m.

September 20, time to be determined: Coverage of spacewalk to install new batteries in ISS P4 Truss 4A Power Channel. The spacewalk will last six and a half hours.

September 26, time to be determined: Coverage of spacewalk to install new batteries in ISS P4 Truss 2A Power Channel. The spacewalk will last six and a half hours.

October 4, 3:00 a.m.: Undocking coverage of Expedition 56 aboard Soyuz MS-08. Undocking is at 3:19 a.m. 5:30 a.m.: coverage of reentry and landing. Landing is at 5:50 a.m. near Dzhezkazgan, Kazakhstan.

October 11, 2:30 a.m.: Space Station 57-8 launch coverage. Launch is scheduled for 3:39 a.m. from Baikonur Cosmodrome in Kazakhstan. 9:00 a.m.: Docking coverage begins. Actual docking is scheduled for 9:43 a.m., with hatch opening at approximately 11:35 a.m.

## Calendar of Events

September 8: Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.  
September 10, 5:32 a.m.: Launch of Kounotori Cargo Craft from Tanegashima, Japan to ISS, via a JAXA H-II rocket.

September 12: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify. The craft will arrive at the ISS on September 14 at 6:40 a.m.

September 14: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). 7:00 p.m., followed by a talk at about 7:45 p.m. See <http://www.okcastroclub.com/> for details.

September 20: Mercury is in superior conjunction with the Sun.

October: Boeing's CST-Starliner makes its first automated test flight. See [https://en.wikipedia.org/wiki/CST-100\\_Starliner](https://en.wikipedia.org/wiki/CST-100_Starliner) for details.

October 4: Mission 56 returns from the Space Station.

October 4: 61<sup>st</sup> Anniversary of launch of *Sputnik 1*.

October 6 – 13: Okie-Tex Star Party, Camp Billy Joe, Kenton OK 73946. Hosted by the Oklahoma City Astronomy Club. For more information, visit <http://www.okie-tex.com>.

October 10: [tentative] Oklahoma Space Industry Development Authority [OSIDA] meets at 1:30 p.m. the Oklahoma Department of Transportation Building in Oklahoma. Call 580-562-3500 to verify.

October 11: Mission 57 launches to the Space Station from the Baikonur Cosmodrome, carrying American astronaut Nick Hague and Russian cosmonauts Alexey Ovchinin and Nikolay Tikhonov.

October 12: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). 7:00 p.m., followed by a talk at about 7:45 p.m. See <http://www.okcastroclub.com/> for details.

October 13: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

October 19: The European Space Agency/JAXA *BepiColombo* Mercury Orbiter is launched. On its way to Mercury, *BepiColombo* will make two flybys of Venus and one of Earth, and six flybys of Mercury before settling into orbit. Home page is <http://sci.esa.int/bepicolombo>.

October 24: Uranus is at opposition.

October 26: Venus is in inferior conjunction with the Sun.

November: [Postponed from September] SpaceX Commercial Crew Demonstration mission 1. This mission will be uncrewed and launched by a Falcon 9.

November: SpaceX will launch 70 small satellites in one launch.

November 6: Mercury is at greatest eastern elongation, 23 degrees east of the Sun, and is visible after sunset in Scorpius.

November 10: [Tentative] Oklahoma Space Alliance meeting, 2:00 p.m., Earl's Rib Palace in Moore, Oklahoma.

November 26: Jupiter in in conjunction with the Sun.

November 26: *InSight* Lander lands on Mars. For more information, visit [mars.nasa.gov/insight/mission/timeline/landing/entry-descent-landing/](https://mars.nasa.gov/insight/mission/timeline/landing/entry-descent-landing/)

November 27: Mercury is in inferior conjunction with the sun.

November 30: [Moved from November 16] Second launch of Falcon Heavy, this on the Space Test Program Flight 2 for the Air Force. This will carry 25 small satellites and a 5000 kg ballast mast which presumably will not be a Tesla Roadster.

December: China launches the *Chang'e 4* lunar lander and rover, which will be the first to land on the far side of the Moon. The Queqiao relay satellite was launched on May 20. Landing site is the Von Karman crater, which is thought to be the oldest impact crater on the Moon.

December: SpaceX launches the *Sparrow* Moon lander, which was one of the Google Lunar XPrize contestants. For information, see [https://en.wikipedia.org/wiki/SpaceIL#Sparrow\\_lander](https://en.wikipedia.org/wiki/SpaceIL#Sparrow_lander) or [www.spaceil.com](http://www.spaceil.com).

December 7. Mars is only two seconds of arc south of Neptune at 8:55 p.m. CST. In other words, this is the best possible time to find Neptune.

December 13: Expedition 57 returns for the ISS.

December 15: Mercury is at greatest western elongation, 21 degrees west of the Sun (hence is visible before sunrise), in the constellation Libra.

December 20: Expedition 58 launches for the ISS, carrying NASA astronaut, Anne McClain, Canadian astronaut David-Saint-James, and Russian cosmonaut Oleg Kononenko.

Early 2019: Launch of the European Space Agency's CHEOPS space telescope, which will study exoplanets, which transit their star's disc. Project website is <http://sci.esa.int/cheops>.

Early 2019: [Moved from December 2018] Boeing's CST-Starliner makes its first crewed flight. This will be the first American spacecraft to carry astronauts to orbit since 2011. See [https://en.wikipedia.org/wiki/CST-100\\_Starliner](https://en.wikipedia.org/wiki/CST-100_Starliner) for details.

Sometime in 2019: China launches the *Chang'e 5* lunar sample return mission. This will be the first spacecraft to return material from the Moon since 1976 (the Soviet Union's *Luna 24*.)

January 1, 2019: *New Horizons* flies by Kuiper Belt object 2014 MU<sub>69</sub>. January 2, 2019: Saturn is in conjunction with the Sun.

January 3, 2019: [Postponed from October] Earliest date that India's *Chandrayaan-2* may be launched to the Moon. The mission includes a lander, rover and orbiter, the first two landing near the south pole of the Moon.

January 17, 2019: SpaceX will launch its first manned Dragon-2 capsule to the International Space Station. [Postponed from December.]

February 2019: Launch from Cape Canaveral of the European Space Agency/NASA Solar Orbiter (SolO), which will orbit the Sun at a distance closer than Mercury. Web site is [sci.esa.int/solarorbiter](http://sci.esa.int/solarorbiter)

February 13, 2019: *Sparrow* moon lander lands on the Moon. For more information, see [https://en.wikipedia.org/wiki/SpaceIL#Sparrow\\_lander](https://en.wikipedia.org/wiki/SpaceIL#Sparrow_lander) or <http://www.spaceil.com/>. March

2019: SpaceX launches a Crew Dragon in-flight abort test.

April 2019: If all goes well with the March launch, SpaceX's Dragon 2 capsule will carry its first crew to the ISS.

April 12, 2019: Yuri's Night: 58<sup>th</sup> anniversary of orbital manned space flight.

July 20, 2019: 50<sup>th</sup> Anniversary of *Apollo 11* landing on the Moon.

Fall of 2019: ALINA, the *Autonomous Landing and Navigation Module* will be launched aboard a Falcon Block 5, and land near the *Apollo 17* landing site in the Taurus-Littrow valley. It will carry two Audi lunar rovers which will try to locate *Apollo 17*'s Lunar Rover.

September 2019: Arrival of *OSIRIS-REx* at the near-earth asteroid 101955 Benu to return samples. For more information, visit <http://en.wikipedia.org/wiki/OSIRIS-REx> or <http://science.nasa.gov/missions/osiris-rex/>.

November 11, 2019: Mercury transits the Sun.

Sometime in 2020 Launch of the European Space Agency's Euclid space telescope. This will map the distribution of dark matter and search for evidence of dark energy. The Euclid website is <http://sci.esa.int/euclid>.

June 2020: [Moved from 2019] Maiden flight of the Space Launch System.

July 2020: United Arab Emirates launch the Mars probe *Hope*.

July 2020: ESA launches the *ExoMars Mars Rover* For more information, visit [en.wikipedia.org/wiki/Exomars](http://en.wikipedia.org/wiki/Exomars).

July 2020: Launch of the *Mars 2020* space rover, which will arrive on Mars at the beginning of 2021.

October 13, 2020: Mars is at opposition, 39 million miles from Earth.

Sometime in 2021: India hopes to launch its first manned spaceflight, but 2024 is more likely.

March 2021: [Moved yet again]: Launch of the James Webb Space Telescope.

Sometime in 2022: SpaceX plans to launch a human crew around the Moon. [This is speculative, reflected by this mission being postponed from 2018.]

Sometime in 2022: Proposed launch date of JUICE, the Jupiter Icy Moon Explorer, by the European Space Agency. The JUICE web site is <http://sci.esa.int/juice>.

June 2022: First crewed launch of an *Orion* space capsule.

Sometime in 2023: *OSIRIS-REx* returns with samples from the Asteroid Benu.

April 8, 2024: Next total eclipse of the Sun visible in the United States. This one will be visible on a path through northern Mexico (making landfall opposite the tip of Baja California), passes through Texas (including Dallas, Arlington and Waco), touches the southeastern corner of Oklahoma, then crosses Arkansas, eastern Missouri, Illinois, western Kentucky, Indiana, Ohio (including Cleveland), Erie in Pennsylvania, upper New York (including Buffalo and Niagara Falls), Burlington in Vermont, New Hampshire, and Maine, then into Canada.

December 19, 2024: *Parker Solar Probe* (formerly *Solar Probe Plus*) makes its first pass through the outer corona of the Sun. For more information, see <http://parkersolarprobe.jhuapl.edu>.

December 2025: *BepiColombo* arrives at Mercury orbit.

Sometime in 2030: JUICE achieves Jupiter orbit. [See 2022.]

Sometime in 2033: JUICE achieves Ganymede orbit. [See 2022.]

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, 2018 (Area Code 405)**

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E-mail for OSA should be sent to [sydh@ou.edu](mailto:sydh@ou.edu). Members who wish their e-mail addresses printed in *Outreach*, and people wishing space-related materials e-mailed to them should contact Syd. Oklahoma Space Alliance website is [osa.nss.org](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](http://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](http://www.tulsaairandspacemuseum.com). Phone (918) 834-9900.  
The Mars Society address is Mars Society, Box 273, Indian Hills CO 80454. Their web address is [www.marsociety.org](http://www.marsociety.org).

The National Space Society's Headquarters phone is 202-429-1600. Executive Director email [nsshq@nss.org](mailto:nsshq@nss.org). The Chapters Coordinator is Bennett Rutledge 720-641-7987, [rutledges@chapters.nss.org](mailto:rutledges@chapters.nss.org). The address is: National Space Society, PO Box 98106, Washington DC 20090-1600 Web page is [www.nss.org](http://www.nss.org).

The Planetary Society phone 626-793-5100. The address is 65 North Catalina, Avenue, Pasadena, California, 91106-2301 and the website is [www.planetary.org](http://www.planetary.org). E-mail is [tps@planetary.org](mailto:tps@planetary.org).

NASA Spacelink BBS 205-895-0028. Or try [www.nasa.gov](http://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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A Chapter of the National Space Society  
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OSA Memberships are for 1 year, and include a subscription to our monthly newsletters, *Outreach* and *Update*. Send check & form to **Oklahoma Space Alliance, 102 W. Linn, #1, Norman, OK 73071.**