# OUTREACH July 2014

**July Meeting:**

Oklahoma Space Alliance will meet from 5:00 to 7:00 p.m. on Saturday, July 19, 2014, at Harry Bears All-American Grill, 2113 Riverwalk Dr., Moore, Oklahoma, (2 tenths of Mile South of S. 19th And West of I35 Frontage Road). The number is 405-799-2327.

**Oklahoma Space Alliance Meeting**
**July 19, 2014**
**5:00-7:00**
**AGENDA**

1) 5:00 p.m. Business Meeting
    a. Minutes of June Meeting
    b. Review Agenda
    c. Treasurers Report
    d. Old Business
        i. NSS Election
        ii. Art Contest
    e. New Business
        i. NSS Home Town Blitz
        ii. (Central) Oklahoma Space Exploration and Settlement Meetup
    f. OSIDA Meeting
        i. Agenda Topics
        ii. S.Swift OSA Presentation
    g. OSA / Spaceport Discussion
2) What's Happening
    a. Space News Slides, Videos & Links
3) Adjourn

**Minutes of June Meeting**

Oklahoma Space Alliance met June 14 at Harry Bear's All-American Grill in Moore, Oklahoma. In attendance were Steve, Karen and Brian Swift, Claire and Clifford McMurray, Dave Sheely, Don Robinson, Linda Shannon, Peggy and James McBride, Ross Davoren, Craig Crawford, Dennis Wigley and Syd Henderson, This was the first meeting for the McBrides and for Mr. Crawford, and both families joined Oklahoma Space Alliance.

We need to have a work session in Norman to discuss what can do for the new emphasis of OSIDA on Oklahoma space development.

Soonercon is the last week in June. We will have a meet-up where we will have a table, and possibly a room party. [This didn't happen as we hoped. See below.]

Moon Day this year is July 19 since the anniversary of the *Apollo 11* Moon Landing falls on Sunday, July 20. Texas has their event on the 19th.

World Space Week is October 4 – 10. It is a function of the United Nations. The first object to launch into space (not Sputnik?) was apparently during this week [but the framing dates

are the launch of Sputnik and the signing of the Outer Space Treaty, in 1957 and 1967, respectively].

A kickstart effort to reboot the ISEE-3 has been allowed by NASA. [But see "Space News."]

ISDC 2016 will probably be in Puerto Rico with a tour of the ARECIDBO telescope facility.

What's Happening in Space?

Steve had missed the May meeting, so had two months' worth of material to make up for, which he has put on line in last month's Update, online at http://chapters.nss.org/ok/Update1406.pdf. One item that is good news is that most space commerce has been taken off the munitions list. (However, human-rated spacecraft are still on the list, which makes it difficult to make deals with other nations.)

--Minutes by OSA Secretary Syd Henderson

**Minutes of June 18 Special Meeting**

Oklahoma Space Alliance members had a special meeting at the McMurray residence on June 18. In attendance were Claire and Clifford McMurray, Steve and Brian Swift, Peggy McBride, Dave Sheely, Vicky Richartz and Syd Henderson. This was a brainstorming session for what OSA can contribute to OSIDA.

Texas gave XCOR 10 million so XCOR went to Texas.

According to Ross Robinson, a number of people are enthusiastic over Dr. McKeever's proposal to take advantage of the possibilities of opportunities for developing the Oklahoma Spaceport for commercial use. This will be driven less by Oklahoma taxpayers and more by commercial development. Some of this has already been done, such as testing by both Boeing and Armadillo. (Although Aerospace is in hibernation mode since the crash of a STIG-B rocket last year.)

Can Stratolaunch use the Spaceport? The spaceport has a permit for a winged piloted spacecraft (and the Spaceport is limited to horizontal launches). These include Stratolaunch, Virgin Galactic's SpaceShipTwo, and XCOR's future LEO spacecraft. Perhaps by the time the last is ready for launch, the Spaceport will be allowed to launch orbital craft.

What kind of commercial space activities can be successful? Suborbital payloads such as medical research.

Kip: If we could get a large number of flights with high school kids flying payloads, it would go a long way toward making OK space look real.

Claire: Fed Ex wants suborbital point-to-point delivery.

At the same time promote the space settlement contest.

--Minutes by OSA Secretary Syd Henderson

**Meetups:**

One on-going discussion which I don't see in my notes but which I know we've discussed is using Meetup to attract more members. We can go along with several other groups to break up the fee (which is not extravagant anyway). The Meetup site is www.meetup.com, and

the particular one we're sponsoring is (Central) Oklahoma Space Exploration & Settlement Meetup, located at www.meetup.com/Central-Oklahoma-Space-Exploration-Settlement-Meetup.

**Soonercon**

Several Oklahoma Space Alliance members went to Soonercon, but for various reasons, we didn't have as much of a presence as we hoped. Since none of us had a room on the party floor, and a rule restricted parties to that floor, we had no party. We also didn't have a table this time since they went rapidly.

Larry Nemecek, best known for his Star Trek connections, was present and let us know about a kickstarter project to build a reusable spacecraft to carry student projects on a suborbital flight. The spacecraft will be known, inevitably, as Enterprise. (It's worth noting that first commercial version of SpaceShipTwo will be the VSS Enterprise.)

A science fiction project Larry is involved with may be of interest. *Star Trek Continues* is an online effort to complete the five-year mission of the Starship Enterprise, which was abruptly cut off in its third year by cancellation. So far, there are three episodes, the third of which, a continuation of "Mirror, Mirror" in the mirror universe (the one in which the Federation is replaced by an Empire, Spock has a goatee, and Kirk is a genocidal lunatic), I saw an enjoyed. I calculate that at the current rate of production, they'll complete their mission sometime around 2028, but I expect production will speed up since they don't have to keep recreating sets from scratch. (They also have to be anal-retentive about details because Trekkies are watching.)

**Notes on July 9 OSIDA Meeting**

The Oklahoma Space Industry Development Authority met at the Oklahoma Department of Transportation building in Oklahoma City. Board members present were Jack Bonny, Jay Edwards, R. Alan Goodbary, James Cunningham and Robert Cox. Steve Swift, Claire McMurray, Dave Sheely and Syd Henderson attended on behalf of Oklahoma Space Alliance.

OSIDA is not as financially well-off as they might seem, since they have expenses that must be met, and there are restrictions to the use of some areas. OSIDA has a large number of contacts which they are restricted from divulging, sometimes by statute.

OSA President Steve Swift presented a paper, Oklahoma Space Industry: Opportunities and approaches, giving his ideas on how OSIDA might proceed toward becoming a successful spaceport. To quote Steve:

> "What is the main business of suborbital space flight? It is not rocket engines, winged launchers and spacecraft. The real business of suborbital flight is passenger and payload spaceflight. As winged horizontal launch spacecraft become successful, the business of passenger and payload spaceflight will thrive and will offer important business opportunity.
>
> "Suborbital spaceflight using the existing spaceport and launch corridor is a significant opportunity for Oklahoma. Oklahoma does not have to sell spaceflight and doesn't have to pay for it. Airports do not sell passenger and freight services, they collect fees and rents from others who do provide those services. The main spaceport business is to provide needed infrastructure and to define require rules, guidelines and fees. Other entities that that pay rent and fees provide the actual spaceflight."

Steve pointed out that:

> "Of special interest of Oklahoma, another technology gap exists in the use of natural gas fueled suborbital spacecraft. Although several companies developed and tested natural gas rocket engines, none of the pending horizontal launch suborbital spacecraft use these engines. Natural gas is an important fuel for future spaceflight. It burns cleaner than many other rocket fuels; it minimizes corrosion and coking of engine nozzles, it's energy content is competitive, and companies such as SpaceX, ATK and XCOR all pursue future use of natural gas fueled rocket engines.

Steve presented some of the ideas we came up with at our special meetings to stimulate interest in space industry, such as "Both orbital and suborbital science payloads created by school and college students for launch into space" Student science projects get reduced suborbital pricing (less than $1,000), and, when publicized, get a great deal of public interest.

This was the meeting at which OSIDA elects officers for the coming year. Mr. Goodbary's can serve for another year, and the board simply reappointed all its officers.

--Notes by OSA Secretary Syd Henderson

**Space News**

The FAA has approved a Space X Texas Launch Site in Cameron County, Texas. Cameron County is at the southern tip of Texas, where the Rio Grande flows into the Gulf of Mexico, and its largest city is Brownsville, Texas.

The kickstart effort to reboot the ISEE-3 was successful financially, raising $159,502, which was $34,502 more than their goal. The plan was to communicate with the satellite sometime between late May and early July, and change its orbit so it can use the Moon's gravity to get it back into a halo orbit. The original communication hardware was no more, but the project members managed to procure their own hardware and on May 19, install it on the Arecibo dish antenna in Puerto Rico.

The project started to communicate with ISEE-3 on May 29, and on July 2, fired the thrusters for the first time in 27 years. However, on July 8, a longer sequence of firings failed, and there's a good chance the project won't succeed in their goal. There's even a chance that ISEE-3 will crash into the Moon in August. The reboot project, which is still in contact with the spacecraft, is going to keep trying.

On the other hand, the Planetary Society has launch plans for its light sail project. LightSail-1 consists of two spacecraft, LightSail-A will be launched around May 2015 into low Earth orbit and is mostly to test the concept. LightSail-B will be launched about SpaceX's Falcon Heavy Rocket, which hasn't been flown yet, carried to medium Earth Orbit, the operate using only its sails for propulsion. The two spacecraft will each have an area of 344 square feet (a square 18.5 per side) and will be visible to the naked eye from the Earth.

The cost of the missions is $4.5 million, of which the Planetary Society has already raised $4 million with two years to go.

This is the second time the Planetary Society has tried a solar sail project, the first being Cosmos 1 in 2005, which failed when the rocket carrying it fell into the Barents Sea north of Russia.

This would not be the first solar sail to be launched (although it's the first privately funded). The first true solar sail spacecraft, Japanese IKAROS probe flew by Venus on December 8, 2010.

The European Space Agency's *Venus Express* spacecraft recently completed a month of experimental aerobraking that took it as low as 79 miles above the surface of Venus. Although this put considerable stress on the spacecraft, it has survived intact. At its lowest altitude, the aerobraking slowed the spacecraft's orbital period by more than an hour. The density of Venus's atmosphere increases a thousandfold from one hundred to eighty miles.

*Venus Express* was launched in November 2005, and entered Venus orbit on April 11, 2006, so it's been in orbit for just over 3000 days. It was inspired by *Mars Express*, which has been orbiting Mars for 4000 days; the Venus probe is considerably modified because it's in a much hotter region of the Solar System.

*Venus Express* has been boosted back to a more sensible orbit 275 miles up. I've seen some mention that the spacecraft will make a fatal plunge into Venus's atmosphere late this year, but the extension of the mission into 2015 would seem to contradict that.

*Venus Express* is the only spacecraft currently orbiting Venus, and no other spacecraft has even visited Venus since the twin flybys of *Akatsuki* and *IKAROS* in early December 2010. *Akatsuki* was supposed to orbit Venus but missed orbital insertion, and another attempt will be made in 2015. Except for *Akatsuki*, no Venus probes are expected for the rest of the decade, unless India launches its ISRO probe next year.

One of the great mysteries of the solar system is the composition of Mercury, which has a huge iron core topped by a relatively thin core. As a result, the density of Mercury is 98% that of Earth despite having a much smaller mass squeezing its core. There have been three competing theories as to how this could be: (1) Mercury got so hot in the past that it simply lost most of its crust to evaporation, (2) The part of the Solar System where it formed was simply mostly iron, or (3) A giant impact stripped away the crust and left the core and a thin crust behind. Option 1 seems to have eliminated when volatile elements were discovered in Mercury's crust. Option 2 also seems unlikely since the composition of the solar nebula seems different than that. However Option 3 has new life with a twist, thanks to a simulation by Arizona State University theorist Eric Asphaug and University of Bern (Switzerland) theorist Andreas Reufer. Their suggestion is that Mercury wasn't the impact victim but the projectile. Essentially it endured one or several glancing impacts with larger objects that stripped its crust but left the core behind. The impactee, being larger, would have captured much of the expelled crustal material.

Asphaug and Reufer also think that similar hit-and-runs could account for asteroids with iron cores, which larger asteroids being the impactees.

**Sky Viewing**

The night of August 12 and 13 is the peak of the **Perseid Meteor Shower**, one of the best of the year. Unfortunately, this year's occurs only two days after the Full Moon, which will interfere with viewing dimmer meteors. *Sky & Telescope* suggests standing with your back to the moon on the evening of August 13.

More spectacular will be the conjunction of **Venus** and **Jupiter** on the morning of August 18. Venus will pass only 0.2 degrees north of Jupiter. By way of comparison, the Full Moon is

0.5 degrees across. At that time Venus will be magnitude -3.8 and Jupiter magnitude -1.8. They will also be within half a degree of the Beehive Cluster in Cancer. Unfortunately, these will all be pretty low in the eastern sky when twilight begins.

**Jupiter** actually began July low in the western sky after sunset, and is currently nearing conjunction with the Sun on July 24. Consequently, Jupiter will not be visible again until early August.

**Venus**, on the other hand, will be visible through July and August, low in the eastern sky before sunrise. It is, however, moving away from us and is almost a full magnitude less than its usual brightness. Venus is slowly approaching superior conjunction with the Sun on October 25.

**Mercury** is also low in the eastern sky before sunrise, shining at magnitude -0.4, and the 19th and 20th are probably the best time to see it before it reaches superior conjunction with the Sun on August 8. (Unlike Venus, Mercury is brightest after it passes greatest elongation.) On the other side of the conjunction, Mercury will become visible in the western sky in late August. However it will be very low in the sky a half hour after sunset, and the situation won't improve much as it nears its greatest elongation.

**Mars** and Spica were only 1.3 degrees apart on July 13, and are still pretty close together. Mars is magnitude 0.2, almost a magnitude brighter than Spica, and the two are easily the brightest objects currently in the constellation Virgo. They can be found high in the southwest at sunset, and will be easily visible throughout July. Mars will move into the constellation Libra around August 10 and converge toward the constellation Saturn. During the last week of August, the two planets will be within four degrees of each other, with Mars passing 3.6 degrees south of Saturn on the night of August 27. At that point, the two planets will be fraternal twins at magnitude 0.6.

**Saturn** awaits Mars in the constellation Libra and is only slightly dimmer than Mars (and brighter than Spica). Look to the upper left of Mars and Spica and Saturn is the brightest object in that part of the sky. Saturn is high south by southwest at sunset and by the end of August will be in the southwest at sunset.

**Uranus** is up in the southeast before morning twilight. It is still located in the constellation Pisces and shines at magnitude 5.8 a couple of degrees south of the fourth-magnitude star Epsilon Piscium.

**Neptune** is in the constellation Aquarius, as it will be for decades, and is in the southern sky at sunset. It lies about halfway between the fourth magnitude stars Theta and Tau Aquarii, and in mid-August will be close to the fifth magnitude star Sigma Aquarii. Neptune itself is magnitude 7.8. The planet will appear as a tiny disk with a moderately good telescope, which will distinguish it from the stars.

See http://tinyurl.com/nakhk6a for a finder chart for Uranus and Neptune. There's also a link to a more detailed pdf file,

**Pluto** reached opposition on July 4, but is still only magnitude 14.1. The July issue of *Astronomy* has a finder chart. We'll get a far better view when *New Horizons* cruised through the Pluto-Charon system almost exactly a year from now.

The asteroids **Ceres** and **Vesta** are very close all month, and were only ten minutes of arc apart on July 5. (The Moon appears thirty minutes of arc across.) However, Vesta is magnitude 7.2 and Ceres is magnitude 8.5, so you'll need binoculars to see them. They're located three or four degrees below Theta Virginis. There are finder charts in both the July and August *Astronomy* and the July *Sky & Telescope*. I particularly like the last because it also shows the

path of Mars, which is also cruising through Virgo. The same map appears online at http://tinyurl.com/pc75ntd.

(Sorry about the tinyurls but I draw the line at 93 character web addresses. They both link to *Sky & Telescope* webpages.)

[Data for this section from *Astronomy*, *Sky & Telescope*, Wikipedia and NASA.]

**Viewing Opportunities for Satellites (July 18 – August 18, 2014)**

You can get sighting information at www.heavens-above.com, which allows you to get satellite-viewing data for 10-day periods, and gives you a constellation map showing the trajectory of the satellite. Heavens Above has changed its detail view so that you can no longer get location coordinates. On the other hand, it does give useful maps.

http://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. I'm using its information for the International Space Station and Hubble Space Telescope, interpolating when necessary. (Note: I'm having problems accessing this from my home PC, but not from the Mac at work.) It doesn't give you information for Tiangong 1, so I'm using Heavens Above for that. The *Sky & Telescope* web site carries International Space Station observation times for the next few nights at skyandtelescope.com/observing/almanac.

With the addition of the solar panels, the International Space Station can be as bright as magnitude -3.5, 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. China's Tiangong 1 space station can get up to magnitude -0.6, which is brighter than all the night stars except Sirius and Canopus.

Missions to and from the Space Station may change its orbit. At this writing, a Cygnus cargo craft is on its way to the Space Station. A Progress module will be launched from Baikonur Cosmodrome on July 23, and an ESA Automated Transfer Mission from Kourou, French Guiana no earlier than July 25. The next manned mission to the Space Station will be launched on September 25.

Tiangong 1 July 19, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:46 p.m. | 298° | 10° |
| 9:49 | 27 | 86 |
| 9:51 | 116 | 22 |

Vanishes into Earth's Shadow

HST July 20, 2014

| Time | Position | Elevation |
|---|---|---|
| 10:10 p.m. | 215° | 19° |
| 10:11 | 197 | 25 |
| 10:12 | 172 | 28 |
| 10:13 | 147 | 25 |

Vanishes into Earth's Shadow

HST July 21, 2014

| Time | Position | Elevation |
|---|---|---|

| | | |
|---|---|---|
| 10:03 p.m. | 221° | 20° |
| 10:04 | 202 | 27 |
| 10:05 | 175 | 30 |
| 10:06 | 149 | 27 |

Vanishes into Earth's Shadow

HST July 22, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:56 p.m. | 221° | 21° |
| 9:57 | 206 | 27 |
| 9:58 | 179 | 31 |
| 9:59 | 151 | 27 |

Vanishes into Earth's Shadow

HST July 23, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:49 p.m. | 227° | 21° |
| 9:50 | 208 | 27 |
| 9:51 | 181 | 31 |
| 9:52 | 154 | 27 |
| 9:53 | 135 | 21 |

HST July 24, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:49 p.m. | 227° | 21° |
| 9:50 | 208 | 27 |
| 9:51 | 181 | 31 |
| 9:52 | 154 | 27 |
| 9:53 | 135 | 21 |

HST July 25, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:35 p.m. | 230° | 19° |
| 9:36 | 212 | 25 |
| 9:37 | 187 | 28 |
| 9:38 | 162 | 25 |
| 9:39 | 144 | 19 |

Station August 2, 2014

| Time | Position | Elevation |
|---|---|---|
| 5:57 a.m. | 305° | 22° |
| 5:58 | 297 | 42 |
| 5:59 | 223 | 73 |
| 6:00 | 150 | 39 |
| 6:01 | 142 | 22 |

Station August 2, 2014

| Time | Position | Elevation |
|---|---|---|
| 10:37 p.m. | 260° | 19° |
| 10:38 | 279 | 31 |
| 10:39 | 322 | 40 |
| 10:40 | 5 | 31 |
| 10:41 | 24 | 19 |

Station August 3, 2014

| Time | Position | Elevation |
|---|---|---|
| 9:48 p.m. | 234° | 22° |
| 9:49 | 239 | 42 |
| 9:50 | 317 | 78 |
| 9:51 | 37 | 43 |
| 9:52 | 43 | 23 |

Station August 4, 2014

| Time | Position | Elevation |
|---|---|---|
| 8:59 p.m. | 205° | 20° |
| 9:00 | 187 | 36 |
| 9:01 | 133 | 51 |
| 9:02 | 81 | 35 |
| 9:03 | 65 | 20 |

Station August 6, 2014

| Time | Position | Elevation |
|---|---|---|
| 8:58 p.m. | 255° | 20° |
| 8:59 | 273 | 34 |
| 9:00 | 322 | 45 |
| 9:01 | 10 | 34 |
| 9:02 | 28 | 18 |

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 Tiangong 1 at 6:09 a.m. on August 11, measure six fist-widths east from due north, then one fist-width 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: July 21, 9:15 a.m.: Renaming ceremony of the KSC Operations and Checkout Building for Neil Armstrong.

July 23, 4:30 p.m.: launch of ISS Progress 56 module. 10:00 p.m.: Docking of Progress 56 with space station.

July 24: 8:15 p.m., launch of ATV-5 from Kourou, French Guiana to the Space Station. (Actual launch is 8:43 p.m.)

August 11, 7:15 a.m.: Docking of ATV-5 with the Space Station. (Actual docking is 8:34 a.m.)

**Calendar of Events**

July 19: Oklahoma Space Alliance meeting, 5:00 – 7:00 p.m., Harry Bear's All-American Grill in Oklahoma City.

July 20: 45th Anniversary of first moon walk.

July 24: Jupiter is in conjunction with the Sun.

No earlier than July 25: The European Space Agency's Automated Transfer Vehicle 5 is launched to the Space Station from Kourou, French Guiana

Sometime in August: SpaceX resupply mission from Cape Canaveral to the Space Station.

August 8: Mercury is in superior conjunction with the Sun.

August 8: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

August 9: [Tentative] Oklahoma Space Alliance meeting, location to be announced.

August 12: Peak of Perseid Meteor Shower,

August 13: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

August 2014 – December 2015: The European Space Agency's *Rosetta* space probe orbits comet Churyumov-Gerasimenko. In November 2014, it will release the Philae lander. Web page is www.esa.int/SPECIALS/Rosetta or visit en.wikipedia.org/wiki/Rosetta_%28spacecraft%29.

August 29: Neptune is at opposition.

September 10: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

September 12: SpaceX resupply mission to the ISS.

September 12: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

September 13: [Tentative] Oklahoma Space Alliance meeting, location to be announced.

September 20 - 28: Okie-Tex Star Party in Kenton, Oklahoma. Co-hosted by the Oklahoma City Astronomy Club. See http://www.okcastroclub.com/ for details.

September 21: Mercury is at greatest eastern elongation, 26 degrees from the Sun (so can be seen after sunset).

September 22: *MAVEN* arrives at Mars.

September 24: *Mangalyaan* arrives at Mars.

September 25: Expedition 41 launched to the ISS.

October 4 – 10: World Space Week, sponsored by the UN. For more information, visit www.worldspaceweek.org/wsw/index.php.

October 7: Uranus is at opposition.

October 8: Total eclipse of the Moon visible from almost all of the Pacific Ocean, eastern Australia and western North and South America.

October 10: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

October 11: [Tentative] Oklahoma Space Alliance meeting, location to be announced.

October 15: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

October 16: Mercury is in inferior conjunction with the Sun.

October 19: Comet Siding Spring will pass within 65,000 miles of Mars. There is a 0.01% probability of an actual collision.

October 25: Venus in superior conjunction with the Sun.

November 8: [Tentative] Oklahoma Space Alliance meeting, location to be announced.

November 12: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

November 14: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

November 18: Saturn is in conjunction with the Sun.

November 21: Mercury is at greatest western elongation, 19 degrees from the Sun (so can be seen before sunrise).

November 23: Expedition 42 launched to the space station.

No earlier than December 1: first test flight of Orion spacecraft.

December 5: SpaceX resupply mission to the ISS.

December 8: Mercury is in superior conjunction with the Sun.

December 12: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

December 13: [Tentative] Oklahoma Space Alliance Christmas Party, location to be announced.

Sometime in 2015: China launches the Tiangong-2 and 3 space stations. Tiangong-3 will eventually become the core of a large Chinese space station in the 2020s.

Sometime in 2015: Launch of Japan's *Astro-H* X-ray astronomy spacecraft. For details, visit http://astro-h.isas.jaxa.jp/index.html.en.

January 9, 2015: Oklahoma City Astronomy Club meets at Science Museum Oklahoma (formerly the Omniplex). There will be a novice session in the planetarium at 6:45 p.m., followed by a club meeting at 7:30 p.m. See http://www.okcastroclub.com/ for details.

February 2015: *Dawn* space probe arrives at Ceres. Operations are scheduled to continue through July. *Dawn* may continue on to other asteroids if it is still operational.

June 6, 2015: Venus is at greatest eastern elongation, 45 degrees from the Sun (so can be seen after sunset).

July 2015: The European Space Agency launches *LISA Pathfinder*. LISA=Laser Interferometer Space Antenna, a gravitational wave detector that is a joint ESA/NASA project. Web site is http://sci.esa.int/lisapf.

July 14, 2015: The *New Horizons* probe passes through the Pluto-Charon system. The New Horizons web site is pluto.jhuapl.edu/.

August 15, 2015: Venus is in inferior conjunction with the Sun.

October 26, 2015: Venus is at greatest western elongation, 46 degrees from the Sun (so can be seen before sunrise).

Sometime in 2016: Russia launches the lander of the "Luna-Glob" mission, which will deploy 13 mini-probes upon the lunar surface. For more information, see http://en.wikipedia.org/wiki/Luna-Glob.

Sometime in 2016: ESA launches the *ExoMars Mars Orbiter*. This mission will include a static lander, but the rover will be launched in 2018. For more information, visit en.wikipedia.org/wiki/Exomars.

March 8 – 17, 2016: Proposed launch date for *InSight*, a lander that will probe the interior of Mars. For information, see http://insight.jpl.nasa.gov/.

June 6, 2016: Venus in superior conjunction with the Sun.

July 4, 2016: *Juno* arrives at Jupiter. The NASA *Juno* page is http://www.nasa.gov/mission_pages/juno.

July 2016-2020: The *New Horizons* probe visits the Kuiper Belt.

July 9, 2016: [Moved from 2015.] The European Space Agency/JAXA BepiColombo Mercury Orbiter is launched. Home page is http://sci.esa.int/bepicolombo.

September 2016: Launch of *OSIRIS-REx*, the Origins Spectral Interpretation Resource Identification Security Regolith Explorer, which will orbit the near-earth asteroid 101955 Bennu and return samples. For more information, visit http://en.wikipedia.org/wiki/OSIRIS-REx or http://science.nasa.gov/missions/osiris-rex/.

Sometime in 2017: 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.

Sometime in 2017: India launches *Chandrayaan II*. This mission will include a lunar rover. For more information, visit http://en.wikipedia.org/wiki/Chandrayaan-2. [Moved from 2014.]

January 12, 2017: Venus is at greatest eastern elongation, 47 degrees from the Sun (so can be seen after sunset).

June 3, 2017: Venus is at greatest western elongation, 46 degrees from the Sun (so can be seen before sunrise).

July 2017: Launch of the European Space Agency/NASA Solar Orbiter (SolO), which will orbit the Sun at a distance closer than Mercury. Web site is http://sci.esa.int/solarorbiter.

August 21, 2017: The next total solar eclipse visible in the United States, on a pretty straight path from Portland, Oregon to Charleston, South Carolina. St. Louis is the biggest city in-between.

Sometime in 2018: ESA launches the *ExoMars Mars Rover*. For more information, visit en.wikipedia.org/wiki/Exomars.

Sometime in 2018: Russia launches the orbiter of the "Luna-Glob" mission. [See 2016 for the lander launch.]

July 30, 2018: Proposed launch date for *Solar Probe Plus*, which will study the corona of the Sun from within four million miles. For more information, visit http://en.wikipedia.org/wiki/Solar_Probe_Plus or http://solarprobe.jhuapl.edu/. (This spacecraft will fly by Venus seven times to refine its orbit.)

October 2018: Earliest date for the launch of the James Webb Space Telescope.

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.

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.

January 2022: *BepiColombo* arrives at Mercury orbit.

Sometime in 2023: Arrival of OSIRIS-Rex at the near-earth asteroid 101955 Bennu to return samples. [See September 2016.]

April 8, 2024: A total solar eclipse crosses the US from the middle of the Mexico-Texas border, crosses Arkansas, southern Missouri, Louisville, Cleveland, Buffalo and northern New England.

December 19, 2024: *Solar Probe Plus* makes its first pass through the outer corona of the Sun. [See July 30, 2018.]

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 Okla-homa. This one is also visible in Salt Lake City, Denver, Little Rock (again), Tampa Bay and New Orleans.

**Oklahoma Space Alliance Officers, 2014 (Area Code 405)**

Steve Swift, President & *Update* Editor 496-3616 (H)
David Sheely, Vice President 821-9077 (C)
Syd Henderson, Secretary & *Outreach* Editor 321-4027 (H) 365-8983 (C)
Tim Scott, Treasurer 740-7549 (H)
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t_koszoru01 at cox.net (Heidi and Tom Koszoru, new address)
sheely at sbcglobal.net or david.sheely.1 at us.af.mil (David Sheely)
john.d.northcutt1 at tds.net (John Northcutt)
lensman13 at aol.com (Steve Galpin)

E-mail for OSA should be sent to 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 chapters.nss.org/ok/osanss.html. 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. Web site www.state.ok.us/~okspaceport.

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 Mars Society, Box 273, Indian Hills CO 80454. Their web address is www.marsociety.org.

The National Space Society's Headquarters phone is 202-429-1600. Executive Director e-mailnsshq@nss.org. The Chapters Coordinator is Bennett Rutledge 720-641-7987, rutledg-es@chapters.nss.org. The address is: National Space Society, 1155 15th Street NW, Suite 500, Washington DC 20005 Web page is 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. 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].

**OKLAHOMA SPACE ALLIANCE**
A Chapter of the National Space Society

**MEMBERSHIP ORDER FORM**

Please enroll me as a member of Oklahoma Space Alliance. Enclosed is:
_____ $10.00 for Membership. (This allows full voting privileges, but covers only your own newsletter expense.)
_____ $15.00 for family membership

_____ TOTAL amount enclosed

National Space Society has a special $20 introductory rate for new members ($35 for new international members). Regular membership rates are $55, international $65. Student memberships are $18 new, $25 renew. Senior memberships are $20 new, renew $40. Part of the cost is for the magazine, *Ad Astra*. Mail to: National Space Society, 1155 15th Street NW, Suite 500, Washington, DC 20005, or join at www.nss.org/membership**.** (Brochures are at the bottom with the special rate.) Be sure to ask them to credit your membership to Oklahoma Space Alliance.

To join the Mars Society, visit www.marssociety.org. One-year memberships are $50.00; student and senior memberships are $25, and Family memberships are $100.00. Their address is Mars Society, Box 273, Indian Hills CO 80454.

Do you want to be on the Political Action Network?
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Phone (optional or if on phone tree)_____

E-mail address (optional)_____

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.**

**OKLAHOMA SPACE ALLIANCE**

**OUTREACH – July 2014**

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

**NOTE TIME AND LOCATION**
Oklahoma Space Alliance will meet
From 5:00 – 7:00 p.m. on Saturday, July 19
at Harry Bears Restaurant,
2113 Riverwalk Dr., Moore, Oklahoma,