

## OUTREACH September 2014

### September Meeting:

Oklahoma Space Alliance will meet from 3:15 to 6:00 p.m. on Saturday, September 13, 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.

*Saturday September 13, 2014*

*Program*

*Place: Harry Bears in Moore, OK*

*3:15 pm*

- 1) Discuss Activities
  - a. Summary of August Meeting
  - b. OSA Accounts
  - c. Art Contest
  - d. Hometown Blitz
  - e. Student Suborbital Payloads
  - f. OSIDA Meeting
- 2) XCOR and Virgin Galactic Spacecraft
- 3) What's Happening (Steve Swift)  
Space News, Pictures, Videos & Links
- 4) Chat

### Space Blitz Report:

“Craig Crawford and I had a great meeting with Austin Manger, a staff member for Congressman and Senate candidate James Lankford. We asked for 10 minutes and got an hour and 15 minutes.

“I presented the attached Blitz talking points page, and we discussed space issues and opportunities. I also gave him an ad Astra, our last UPDATE, the paper I presented to OSIDA in July and some of our brochures.

“He wants us to send him 1 page position papers on space topics as the need arises. He asked to be added to our online mail list. He said he would take our 1-page talking points to Lankford. He agreed that he would use OSA as a resource for space issues and questions.

“Overall it was an excellent meeting.

“Claire, Please add our success with this meeting to the NSS Home District Blitz status.”

Steve

### Minutes of August Meeting

Oklahoma Space Alliance met at Harry Bears All-American Grill on August 9. In attendance were Steve, Karen and Brian Swift, Tim Scott, Don Robinson, Dave Sheely and Syd Henderson.

We currently have \$813 in the bank and \$267 in cash.

Art Contest: A necessary missing piece is the software to put the artwork on line. We may have to go outside our group. Do it all digital and have a sheet so they can give us permission to post artwork and whether to use a child's name online.

Hometown Blitz: Claire has agreed to meet with Inhofe and Steve asked meet with the Lankford campaign. In whose district is the Oklahoma Spaceport? [Answer: Frank Lucas, 3<sup>rd</sup> District.]

Steve, David, Claire and Syd have signed up for Meetup.

XCor is doing a program for Student Suborbital Payloads. Steve has received a description of a payload.

Dave Sheely did an overview of US Export Control law and how they apply to commercial space. This includes the International Traffic and Arms Regulation (ITAR), Export Administration Regulation (EAR), and the Missile Technology Control Regime (MTRC).

ITAR is administrated by the Department of State and includes the United States Munitions List. Space vehicles appear on the USML since they are also potential weapons or can bear potential weapons. This includes launch vehicles, explosives and propellants.

NASA's exemptions do not apply EAR under all circumstances and never when dealing with foreign persons of proscribed countries. Included among these are rival powers such as China and Iran, and unstable countries such as Iraq, Somalia and Burundi. The EAR is administered by the Department of Commerce.

Section 9 of the EAR is Propulsion Systems, Space Vehicles and Related Equipment, and you can find it here:

[www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear](http://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear) (This is the most recent version, and may not be exactly what Dave presented.)

The MTCR consists of the following 34 countries:

Argentina (1993)	Greece (1992)	Republic of Korea (2001)
Australia (1990)	Hungary (1993)	Russian Federation (1995)
Austria (1991)	Iceland (1993)	South Africa (1995)
Belgium (1990)	Ireland (1992)	Spain (1990)
Bulgaria (2004)	Italy (1987)	Sweden (1991)
Brazil (1995)	Japan (1987)	Switzerland (1992)
Canada (1987)	Luxembourg (1990)	Turkey (1997)
Czech Republic (1998)	Netherlands (1990)	Ukraine (1998)
Denmark (1990)	New Zealand (1991)	United Kingdom (1987)
Finland (1991)	Norway (1990)	United States of America (1987)
France (1987)	Poland (1998)	
Germany (1987)	Portugal (1992)	

[China, Israel, Romania and the Slovak Republic voluntarily abide by the MTCR's export laws despite not being members of the MTCR. China has applied but hasn't been accepted due to concerns about its export standards.--SFH]

What's Happening is online as part of <http://chapters.nss.org/ok/Update1408.pdf>.

### Notes on August 13 OSIDA Meeting

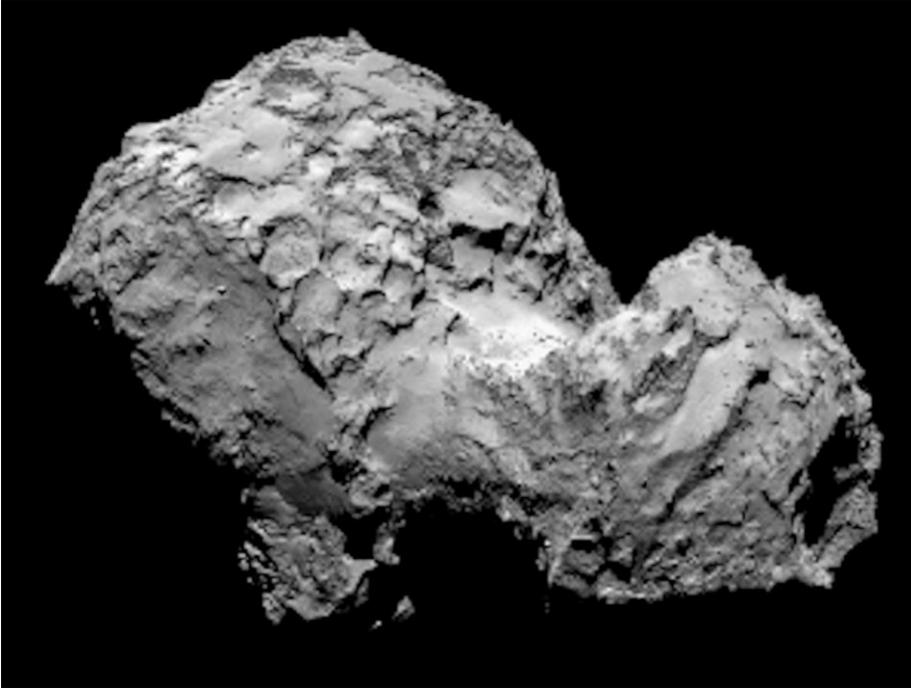
The Oklahoma Space Industry Development Authority met at 1:30 August 13, 2014 in the Department of Transportation Commission Room. Topics of discussion include the following:

1. Bill Khourie introduced Greg Rasnake, Deputy Director of Strategic Operations of the FAA. He recently moved his office to the OKC FAA Center.
2. Forms for annual performance evaluation of the Executive Director were distributed to board members.
3. Bill Khourie reported that the security system installation in the Oklahoma Air and Space Port Control Center was complete,
4. An asbestos survey of the Control Tower was completed. The report shows the building is asbestos free.
5. The next COMSTAC (Commercial Space Transportation Advisory Committee) meeting is in Washington D. C. on September 16 & 17.
6. Bill Khourie reported that DARPA (Defense Advanced Research Projects Agency) selected three companies to prepare their vision of DARPA's next generation spaceplane (known as the XS1). Contracts were issued to Boeing, Northrop and Masten Systems.
7. OSIDA's Business Development Committee reported that the feasibility study proposed by Oklahoma Secretary of Science and Technology, Dr. Stephen McKeever, is not required. A three-inch binder with past studies and recommendations was delivered to Chairman Goodbary. Bill Khourie stated that contents of the binder will be distributed to board members via the internet. *{This OSA member is concerned that Dr. McKeever's proposal emphasized the need for investment sources, industry participation and funding all in context of recent space industry developments. OSIDA's previous studies and reports probably indicate site capability to support spaceport activity, and may not address the broader issues and recent developments emphasized by Dr. McKeever. This writer understands that the OSIDA Board and Dr. McKeever are pursuing these issues.}*
8. The board approved purchase of a front-end loader—cost not to exceed \$56,786.82. *{This writer does not understand how an already busy staff does not outsource (contract) the backhoe work instead of purchasing the equipment. The backhoe work is either minimal or requires staffing to support. In either case, contracting makes sense.}*
9. The board convened Executive Session to review a company's possible operations on the Oklahoma Spaceport.

Reported by OSA President, Stephen Swift

### **Space News: Rosetta Arrives at Destination**

On August 6, the Rosetta spacecraft finally ended its ten-year voyage to Comet 67P/Churyumov-Gerasimenko (henceforth referred to as Comet 67P) and began movements to go into orbit around it. The actual orbit began on September 10 marking the first time a spacecraft has orbited a comet. Along the way, Rosetta flew by Mars, by Earth three times, and flew by asteroids 2867 Šteins and 21 Lutetia.



Comet 67P turns out to be about 2.2 by 2.5 miles, and consists of two irregularly spherical lobes joined at a neck. There's a large round crater or vent at one end, and a small third lobe attached to the side of the larger lobe. It is roughly the shape of a rubber duck. [Other angles look like an elephant's head and a mushroom.] There's speculation that it may consist of two comets stuck together. If so, it might resemble Comet 103P/Hartley 2, which has two lobes of different composition.

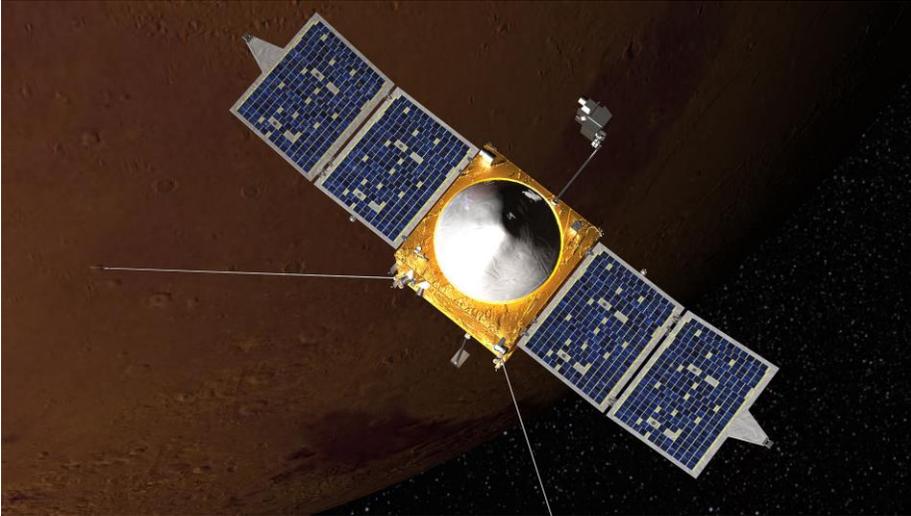
The mission plan is to accompany Comet 67P around the Sun, which is not quite the hell-ride it seems, since perihelion for Comet 67P is 115 million miles from the Sun; in other words, its entire orbit is outside Earth's. Aphelion is about 25 million miles outside Jupiter's orbit. At present, Comet 67P is about 300 million miles from the Sun, about double the distance of Mars. This means it's still not active, so *Rosetta* will get to see it come to life.

A highlight of the mission comes on November 11, when the Philae lander makes a soft landing on Comet 67P. Well, if you consider harpooning a comet to be a soft landing. One of Philae's missions is to dig into the comet to a depth of about 10 inches and take samples of the interior. Of particular interest is whether the water is similar in isotope composition to that on Earth. The landing site for Philae will be announced on September 15.

## Space News

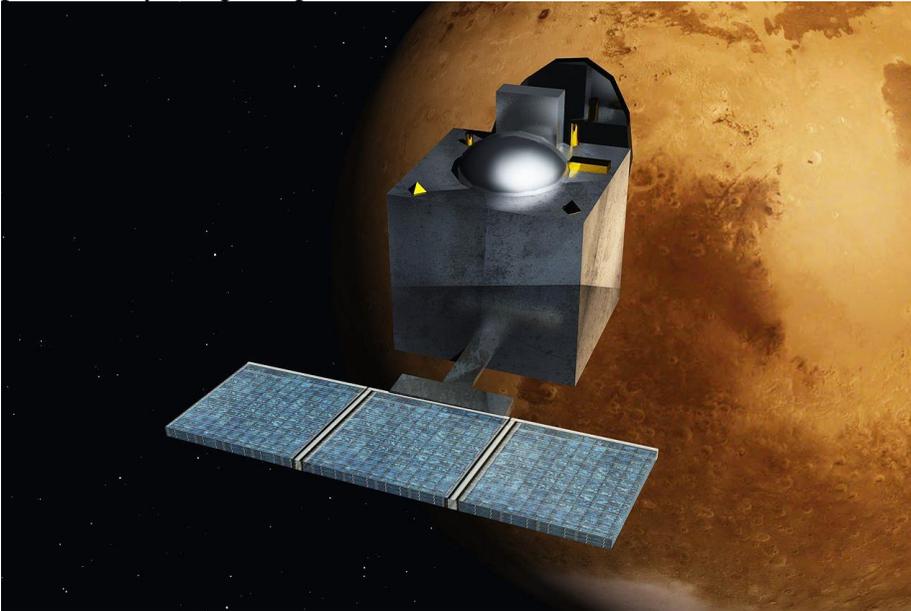
On September 21, NASA's *MAVEN* (Mars Atmosphere and Volatile EvolutionN) spacecraft will enter orbit around Mars, followed on September 24 by India's *MOM* (Mars Orbiter Mission, or *Mangalyaan*, Sanskrit for "Mars Craft"). The latter, if successful, will make India's the fourth space program to have a successful Mars mission, after the United States, USSR and European Space Agency. Japan has had an unsuccessful mission fly by Mars.

*MAVEN* and *MOM* will have a ringside seat when Comet Siding Spring passes by on October 19, although *MAVEN* will be discreetly on the far side of Mars for the 20 minutes of closest approach.



*MAVEN* is the first spacecraft specifically designed to study the Martian atmosphere, particularly its history. One way to do this is by measuring the ratio of isotopes in the Martian atmosphere, in particular the ratio of hydrogen to deuterium. Since deuterium is heavier than regular hydrogen, it tends to be lost less rapidly from the Martian atmosphere. The hydrogen/deuterium ratio in today's atmosphere can be compared with that in rocks on the surface, which reflect the ratio billions of years ago when they were formed.

*MOM*'s main mission is to search for methane in the Martian atmosphere. Methane can be produced by inorganic processes such as volcanism, but can also be a sign of life.



Both missions have lifetimes of about a year, although *MAVEN* may conceivably last as long as a decade.

On October 19, Comet C/2013 A1, aka Comet Siding Spring, will pass within 82,000 of Mars. The space probes orbiting Mars and Mars rovers will naturally be taking advantage of their location to observe it (although my understanding is that the orbiting spacecraft will be on the other side of the Mars at closest approach). By comparison, the closest observed approach of a

comet to Earth is that of Lexell's Comet, which came within 1.4 million miles of Earth in 1770 and hasn't been seen since.

Comet Siding Spring won't be spectacular from Earth, but, at magnitude 9, will be visible through a telescope. The apparent distance between Mars and the comet will be two minutes of arc, or one-fifteenth the diameter of the Moon.

Add another line to your address book. The Milky Way is a member of a supercluster of galaxies named Laniakea, which is also a beach in Hawaii. The group of astronomers who dubbed the supercluster is led by R. Brent Tully, who unsurprisingly is from the University of Hawaii. The previously defined local supercluster, the Virgo Supercluster, is a mere concentration of galaxies within the larger Laniakea.

The Virgo Supercluster contained some 100 galaxy groups and clusters, and had a diameter around 100 million light-years. The Laniakea Supercluster has a diameter of 500 million light-years. If these numbers scale in each dimension, the Virgo Supercluster has 1/125 the volume of Laniakea, which is a Superdupercluster.

It has long been known that many galaxies, including the Milky Way, seem to be moving toward a dense region near the Centaurus, Norma and Hydra called the Great Attractor. This region, about 160 million years away, is now the center of Laniakea.

We may not be done adding lines to our addresses: Laniakea is moving toward a distant concentration of galaxies named Shapley, which is 650 million light-years away. Could we be a member of a super-super-supercluster 1.3 billion light-years across or even larger?

By the way, in addition to being a beach, Laniakea is Hawaiian for "spacious heaven."

Full articles on this is on the *Sky & Telescope* website at <http://tinyurl.com/pz4le9f> and the *Astronomy* website at <http://tinyurl.com/nhe69hk>.

Using a particularly sensitive neutrino detector, a team of scientists including Andrea Pocar, Laura Cadonati and Keith Otis at the University of Massachusetts at Amherst have become the first scientists to directly detect neutrinos from the proton-proton reaction from the Sun's core. This reaction is the first step in a series of nuclear reactions that converts hydrogen into helium and powers the Sun.

Jupiter's moon Europa appears to have a surface of huge mobile ice slabs. In other words, it may be the only body in the solar system other than Earth to have plate tectonics. This might explain why plumes of water vapor were seen spouting from the south polar region. Since new ice is being formed on the surface of Europa, it must be getting subducted somewhere else.

The plates are not thought to extend all the way through the icy crust of Europa. Instead, they are expected to float on top of a shelf of warmer, more fluid ice, much as the Earth's crust floats and moves around atop the mantle.

In recent years, we've discovered two classes of planets that orbit close to stars, "Hot Jupiters" and "Hot Super-Earths" and the speculation is that they might be related. A Northwestern University team led by Francesca Valsecchi have a theory of just how: When a star and planet get close together, the Roche lobes of the two can meet, and the heated atmosphere of the planet can overflow into the star's atmosphere. When this happens, the planet also moves outward a bit (conservation of angular momentum), but eventually tidal forces will pull it in again, until it falls into its star.

The paper will be published in *Astrophysical Journal Letters*, but you can find a summary at [skyandtelescope.com](http://skyandtelescope.com).

The Pleiades have moved away again. Data from the *Hipparcos* space probe had indicated they were 392 light-years away with an error of less than one percent. This caused a problem because it also meant the Pleiades were ten percent closer than expected, which meant they were substantially dimmer than expected, by about a quarter of a magnitude.

New measures using radio interferometry place the Pleiades at 435 light-years, and restore them to their proper brightness. But this raises the problem of what went wrong with the *Hipparcos* measurement, which is serious because its database is essential to astronomy. However, it could also be something odd about the Pleiades, such as we're looking down the long axis of the cluster and *Hipparcos* measured the nearest members.

On August 25, the *New Horizons* spacecraft crossed the orbit of Neptune on its way to visit Pluto. By coincidence, it was the 25<sup>th</sup> anniversary of *Voyager 2*'s flyby of Neptune, the only one yet to occur. Although *New Horizons* snapped a picture of Neptune and Triton, they were 2.5 billion miles away, or maybe 300 million miles closer than they are to Earth. (This illustrates why Pluto and Neptune never collide: when Pluto crosses Neptune's orbit, it is 50 degrees ahead or behind Neptune, and never approaches within 17 AU, or 1.5 billion miles. Another way of putting it: Pluto comes closer to Uranus—11 AU or 1 billion miles—than to Neptune. Pluto and Neptune are in a 3:2 orbital resonance, so don't expect these numbers to change any time in the next billion years.)

## Sky Viewing

October 2014 will be a great month for sky viewing, with a total lunar eclipse followed two weeks later by a partial solar eclipse, both visible from Oklahoma.

Unfortunately, the total lunar eclipse once again occurs in the early morning, this time on October 8. Partial eclipse begins at 4:18 a.m., with totality beginning at 5:27 a.m. and ending at 6:22 a.m. The partial eclipse will end at 7:32 a.m. These times are the same throughout the Central Time Zone, but an hour earlier for our Wyoming correspondent.

On October 23, there will a partial eclipse sun visible from Oklahoma, with the partial phase beginning at 2:38 p.m., peaking at 4:45 p.m., and ending at 6:52 p.m. (which is, unfortunately, after sunset). I wouldn't expect to see much except from 3:45 to 5:45. At the peak of the eclipse, the Moon will be covering about half the Sun's disk.

**Mercury** is currently low in the sunset and visible with binoculars about 20 minutes after sunset. It is having its worst evening apparition of the year due to the shallow angle the ecliptic forms with the western horizon this time of year, and even at greatest elongation on September 21 will not be very high. (This is only true in the Northern Hemisphere. In the Southern Hemisphere, it's the best apparition of the year.) Mercury will be going through inferior conjunction with the Sun on October 16, and be at a much better greatest elongation before sunrise on November 1, when it will be visible 45 minutes before sunrise.

The bright rival for Mercury to its upper left is Spica.

**Venus** rises only an hour before the Sun but is conspicuous at magnitude -3.9. By the end of the month, it will be rising only half an hour before the Sun and be a bit less bright, and it

will be lost in the glare of the Sun for most of October. Superior conjunction is on October 25, and by mid-November, Venus will be an evening star.

**Mars** is in the southwest before sunset. On September 12, Antares, Mars and Saturn will form a horizontal straight line, left to right in the southwestern sky after sunset. Their respective magnitudes are 1.0, 0.7, and 0.6. The third-magnitude star between Antares and Mars is Delta Scorpis aka Dschubba. Mars will be setting about three hours after sunset for the rest of September and all of October as it keeps pace with the Sun going into Autumn.

On October 19, Comet Siding Spring will pass within 100,000 miles from Mars, and care is being taken that all spacecraft orbiting Mars are on the other side of the planet during closest approach.

**Jupiter** is another morning star, but much higher than Venus. It's currently rising about three hours before the Sun and is magnitude -1.8. By the end of September, Jupiter will be rising at 3:00 a.m., and at the end October, will be rising at 1:00 a.m. In the meantime, it moves away from the Beehive in Cancer toward the bright star Regulus in Leo.

**Saturn**, as mentioned above, is about as high and to the north of Mars at sunset. Unlike Mars, Saturn is approaching the Sun in the sky, and will be setting two hours after sunset on September 30, and by the end of October will be lost in the sunset.

**Uranus** is high in the southeast at midnight in the constellation Pisces, and will be at opposition on October 7. This means it has a conjunction with the Moon on October 8, just as the lunar eclipse is near its peak. (This is actually an occultation for people north of the Arctic Circle.) Since Uranus is near opposition, it is visible all night, but at magnitude 5.7, not too visible.

**Neptune** is high in the south at midnight, in the constellation Aquarius. It was at opposition in late August, and is above the horizon most of the night, but, as always, is invisible to the naked eye.

Finder charts for Uranus and Neptune are on page 50 of the September *Sky & Telescope*, or online at <http://www.skyandtelescope.com/astronomy-news/observing-news/uranus-and-neptune-in-2014/>.

**Pluto** is low in the southern sky in the constellation Sagittarius at sunset, and is above the horizon all evening. There was a finder chart for Pluto in the June *Sky & Telescope*.

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

### Viewing Opportunities for Satellites (September 12 – October 12)

You can get sighting information at [www.heavens-above.com](http://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](http://www.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. SpaceX will be launching its next resupply mission on September 19. The next manned mission to the Space Station will be launched September 25.

## ISS September 12, 2014

Time	Position	Elevation
5:28 a.m.	185°	17°
5:29	166	25
5:30	132	31
5:31	98	25
5:32	78	17

## ISS October 6, 2014

Time	Position	Elevation
8:18 p.m.	222°	22°
8:19	217	42
8:20	137	80
8:21	56	42
8:22	52	24

## ISS September 13, 2014

Time	Position	Elevation
6:16 a.m.	261°	19°
6:17	281	30
6:18	322	39
6:19	4	30
6:20	24	19

## ISS October 7, 2014

Time	Position	Elevation
9:28 p.m.	193°	18°
9:29	174	30
9:30	132	38
9:31	92	29
9:32	73	18

## ISS September 28, 2014

Time	Position	Elevation
7:00 a.m.	323°	21°
7:01	334	39
7:02	39	64
7:03	106	40
7:04	118	22

## HST October 8, 2014

Time	Position	Elevation
6:26 a.m.	219°	19°
6:27	201	26
6:28	175	29
6:29	148	26
Vanishes into Earth's shadow		

## ISS October 1, 2014

Time	Position	Elevation
Appears from Earth's Shadow		
6:09:38 a.m.	302°	35°
6:09:51	300	41
6:11	222	76
6:12	147	42
6:13	140	23

## HST October 9, 2014

Time	Position	Elevation
6:19 a.m.	223°	20°
6:20	204	27
6:21	177	31
6:22	138	27
Vanishes into Earth's shadow		

## Tiangong 1 October 1, 2014

Time	Position	Elevation
Appears from Earth's Shadow		
6:39 a.m.	200°	16°
6:41	337	56
6:44	57	10

## ISS October 9, 2014

Time	Position	Elevation
Appears from Earth's shadow		
7:26 p.m.	255°	39°
7:27	320	63
7:28	24	39
7:29	36	22

## HST October 10, 2014

Time	Position	Elevation
6:12 a.m.	226°	20°
6:13	208	27
6:14	180	31
6:15	153	27

Vanishes into Earth's shadow

## HST October 11, 2014

Time	Position	Elevation
6:05 a.m.	227°	20°
6:06	210	27
6:07	183	30
6:08	156	27

Vanishes into Earth's shadow

## Tiangong 1 October 11, 2014

Time	Position	Elevation
Appears from Earth's Shadow		
6:53 a.m.	297°	11°
6:55	210	89
6:58	118	10

## Tiangong 1 October 12, 2014

Time	Position	Elevation
Appears from Earth's Shadow		
6:18:16 a.m.	255°	51°
6:18:45	210	60
6:22	125	10

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 6:18:45 a.m. on October 11, measure three fist-widths west from due south, then five 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:

September 10: Expedition 40 Soyuz undocking from Space Station, 5:45 p.m. (Undocking is 6:02 p.m.) Deorbit and landing coverage, 8:15 p.m. Landing and post-landing activities, 11:00 p.m.

September 19: Coverage of SpaceX-4/Dragon Launch, 12:30 a.m.

September 20: Coverage of Berthing (time to be announced) and Grapple of SpaceX-4/Dragon, 4:30 a.m. [Shouldn't these be in the opposite order?]

September 25: Coverage of ISS Expedition 41/42 Launch, 2:30 p.m. (Launch is 3:25 p.m.) Docking coverage, 8:45 p.m. Hatch opening and other activities, 10:30 p.m.

### Calendar of Events

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 19: SpaceX launches a resupply mission to the ISS at 1:38 a.m. CDT.

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](http://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 14: Next Antares mission to the ISS.

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 23: Partial eclipse of the sun, visible from central and western North America.

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/](http://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](http://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](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 Benu 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](http://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](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 Benu 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 Oklahoma. 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 & <i>Update</i> Editor	496-3616 (H)
David Sheely, Vice President	821-9077 (C)
Syd Henderson, Secretary & <i>Outreach</i> Editor	321-4027 (H) 365-8983 (C)
Tim Scott, Treasurer	740-7549 (H)
Claire McMurray, Communications	329-4326 (H) 863-6173 (C)

### **OSA E-mail Addresses and Web Site:**

sswift42 at aol.com (Steve Swift)

cliffclaire at hotmail.com (Claire McMurray)

sydh at ou.edu (Syd Henderson)

ctscott at mac.com (Tim Scott)

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](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 [chapters.nss.org/ok/osanss.html](http://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](http://www.state.ok.us/~okspaceport).

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 e-mail [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, 1155 15th Street NW, Suite 500, Washington DC 20005 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].

**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.)

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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](http://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](http://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.

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