

OUTREACH July 2013

July Meeting:

Oklahoma Space Alliance will meet on July 13, 2013 at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City. Our feature presentations will start at 2:30 p.m. with the business meeting following at 4:15 p.m. The street address is 1617 SW 74th Street and the phone number is 685-5414.

If you take the exit at Pennsylvania coming from the east, you pass right by the entrance. If you're coming on Pennsylvania itself, there's an entrance from the street to the north of Denny's.

Agenda:

- 1) What's Happening:
Recent events related to space technology and achievements. Videos and pictures show what's happening.
- 2) Launch Vehicles:
Horizontal takeoff space launch vehicles as presented to OSIDA board on July 10, 2013.
- 3) Howard Bloom's presentation:
'Greening the Galaxy' as given at the 2013 International Space Development Conference.
- 4) Business Meeting
 - a. Review Minutes and Agenda
 - b. New mail
 - c. Treasurers Report
 - d. Report on OSIDA
 - e. Old Business
 - i. Moon Day
 - f. New Business
- 5) Adjourn

Minutes of June Meeting

Oklahoma Space Alliance met June 8, 2013 at the Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City. Attending were Steve, Karen and Brian Swift, Claire McMurray, Don Robinson, Linda Shannon, Dave Sheely, Walter Hutchinson, Tim Scott and Syd Henderson. Chris Carson was up from Texas.

Quote of the month, from Gerard O'Neill to a congressional committee in 1978: "This tiny Earth is not humanity's prison, is not a closed and dwindling resource, but is in fact only part of a vast system rich in opportunities."

What's Happening in Space?

Flight engineers Chris Cassidy and Tom Marshburn work on exterior of ISS to replace a pump controller box that was leaking ammonia.

ISS Commander Chris Hadfield sang "Somebody's Singing" with the Barenaked Ladies, marking a rare space/Earth music collaboration.

Sierra Nevada Corporation announced shipment of a Dream Chaser flight vehicle to NASA's Dryden Space Center at Edwards Air Force Base. [I don't know if this is the Dryden Flight Research Center, which is going to be renamed for Neil Armstrong, or the test range, which is going to be renamed for Hugh Dryden.] Canadian astronaut Chris Hadfield returned from space.

We watched a video of a launch of Boeing's Atlas V. Chris Carson pointed out that the Atlas V is actually developed from the Titan IV rather than previous Atlas rockets.

Planetary Resources announced first crowd-funded space telescope campaign. They raised \$500,000 in three days. [They've now raised \$1.5 million.] Info is at <http://www.planetaryresources.com/news-info/>.

ATV-4 Albert Einstein module was launched into space by an Ariane rocket, which carried 44,000 lb. of cargo. Information on this is at <http://blogs.esa.int/atv/category/atv-4/>. One of the astronauts, Luca Parmitano, dubbed it the "Automated Tiramisu Vehicle" because it brought him Italian food. [In another first, it brought lasagna to space.] SpaceX's Merlin 1D engine has achieved flight qualification. This engine is for use in the second stage of the Falcon Heavy launch vehicle.

A crew was launched to the space station in only six hours. We watched a video of the launch.

Karen Nyburg gave a video Q&A from the space station and also honored the 50th anniversary of Valentina Tereshkova's space flight.

We saw an announcement of opportunities to submit input to study of human spaceflight.

The cheap rate for attending the 2014 International Space Development Conference expires at the end of June. The 2014 ISDC is in Los Angeles.

Chris Carson warned us about a new bill in Congress that will seemingly expand the category of munitions to include not just rockets, but things like space hotels that are merely associated with rockets. They would fall under the scope of International Traffic in Arms. This seems to be an unintentional consequence of a badly worded amendment. Chris is trying to get the NSS Board to make a statement.

David Sheely talked briefly about his involvement in the NASA Space APP Challenge. The challenge was to design a cubesat 10 cm (about 4 inches) to a side and with a mass less than or equal to 1300 grams. [See the June *Update* posted on our web site.]

We watched a presentation from the ISDC by Zero G Solutions. Their aim to produce new varieties of patentable plant stem cells in zero-G so that desired traits can be used on Earth. No actual genetic modification is used, just artificial selection and different expression of the genes that are already there. Of particular interest is *Jatropha curcas*, the seeds of which contain 27 – 40 % oil [as well as the highly toxic curcun]. *Jatropha curcas* produces more oil than switchgrass, which is a prominent potential biofuel source.

The stem cells don't seem to revert when returned to Earth. This is also true for stem cells derived from bananas and rice.

They are also investigating human regenerative medicine, including the growth of connective tissue, which has never been done on the ground. One hope is that a human pancreas can be grown in space. Although some other tissues have been grown on Earth, this has never been done for a pancreas.

There is also a potential for 3-D printing of organs. This has been done for bladders, and it is hoped it can be done with kidneys.

Soonercon is in Midwest City in late June. They don't have a con-operated hospitality suite this time. We haven't heard anything about panels, but will have a table. [Note: we were eventually asked to participate on a panel.] Moon Day: Have been invited to participate. It is at the Frontiers of Flight Museum at Love Field in Dallas. Chris is trying to organize a big NSS presence at the World Science Fiction Convention in San Antonio, August 29 – September 2.

[Minutes by OSA Secretary Syd Henderson.]

Between-Meetings Activities

Oklahoma Space Alliance had a table at the Soonercon science fiction convention in Midwest City the last weekend in June. Oklahoma Space Alliance President Steve Swift participated on a panel about the solar system. We also had a one hour opportunity on Saturday for people to meet us in the hospitality area. At previous conventions we ran the convention's hospitality suite for a couple of hours, but this year the convention center handled the refreshments, so we had a social hour with literature strewn over two tables.

Notes on June 11 OSIDA Meeting

The Oklahoma Space Industry Development Authority met at the Department of Transportation building in Oklahoma City. Board members present were Jack Bonny, R. Allen Goodbary, Jay Edwards and James Cunningham. Steve Swift, Claire McMurray and Syd Henderson attended for Oklahoma Space Alliance. Executive Director Bill Khourie was unable to attend, so Jack Bonny presented his information.

The storms that assaulted Oklahoma in May also hit the Oklahoma Spaceport. 93 mph winds twisted metal, throwing some a distance of two miles. Windows were blown out and the roof was torn off one building. 50,000 square feet of warehousing was damaged as well as Hangar 17.

The airport is fully functional. The control tower was damaged but is completely operational. Aeromax LTD is operating at the Oklahoma Spaceport out of the ground level of the control tower. The company is based in Australia.

The spaceport still can't get the Feds to remove the derelict warehouses. They are full of two-by-fours. The State is willing to help. [Note: the warehouse that was damaged by the storm is not a derelict.]

A good foundation has been set for future operation of Raytheon/XCOR out of Oklahoma.

The OSIDA budget is \$394,589, same as last year.

OSIDA holds its officer nominations in June. Jack Bonny has completed two years as Chairman of the OSIDA board so was term-limited. Mr. Goodbary was nominated for Chairman, James Cunningham for Vice-Chairman and Robert Conner for Secretary-Treasure (per his acceptance).

The State sent people out to see the new Operations Center. The Fire Marshall has to go there and approve the building. There was some hail damage and some carpet damage that need to be repaired.

The July meeting is in Oklahoma City. The August meeting is proposed to be in Burns Flat.

--Notes by OSA Secretary Syd Henderson

Space News

Here are some picture from Mars's giant volcano Olympus Mons, showing lava flows that may date to a few tens of millions of years ago:

http://www.esa.int/Our_Activities/Space_Science/Mars_Express/At_the_foot_of_the_Red_Planet_s_giant_volcano. It's quite likely that our first Martian colonies may be in lava tubes around one of the Martian volcanoes. Caves have been discovered in the Tharsis Ridge volcanoes, and what look like lava tubes. It wouldn't be surprising that some of these existed around Olympus Mons as well.

It may soon be possible in the near future to send spacecraft to the outer solar system at a cost of a million dollars. The catch is that the satellites would only weigh about eleven pounds.

The satellites are cubesats, similar to the kind David Sheely talked about at the June meeting. The engine, dubbed CAT for CubeSat Antipolar Thruster, which is an ion thruster powered by solar panels. The total weight of propellant would be half the weight of the spacecraft. Possible propellants are water or iodine. In essence the CAT engine is a miniature version of the ion engine that allows Dawn to visit Vesta and Ceres.

There is now a Kickstarter campaign to space-test the new engine. \$200,000 would allow for a test, but it could happen fairly quickly if they net \$500,000. Planetary Resources is one of their partners, because CAT-propelled CubeSats would be perfect for asteroid reconnaissance.

Mars rover *Curiosity* finally resumed its trip to Mount Sharp, which it should reach sometime next year. The rover is zooming at a top speed of .09 mph. It's about five miles to the foothills of Mt. Sharp, but the rover will occasionally be stopped if it passes something interesting. On August 5, *Curiosity* will have been on Mars for one year.

The Space Shuttle *Atlantis* is finally available for public viewing at Kennedy Space Center. *Atlantis* is mounted at a 43.21-degree angle and the cargo bay doors are open so the robot arm can be displayed. *Atlantis* is the last of the four surviving shuttles to become available to public viewing.

The current solar sunspot cycle, which started in 2008, has been unusually quiet. However, on July 2, a huge group of sunspots began to form, and now span nearly a hundred thousand miles in an archipelago whose shape looks like a huge Hawaiian Islands. The largest grouping is about the diameter of Neptune.

Counterintuitively, the Sun shines hotter when it has lots of sunspots. This is because it also has more flares and hot spots. Although there haven't been any huge flares from this group yet, there is a very good chance one may erupt before they disappear.

A team using the Parkes radio telescope in Australia has detected four radio bursts from between 5.5 and 10 billion light-years away. The bursts last for a few milliseconds, and contain between 3,000 and 30,000 times the energy that the Sun gives off in an entire year. Nobody knows what is causing these, although aliens have been ruled out. A guess is that they may be flares from magnetars, neutron stars with extremely dense magnetic fields. Magnetars in our galaxy are thought to be one of the sources of short-lived gamma-ray flares.

The two newly discovered moons of Pluto have been officially named Styx and Kerberos after a river in Hades and the mythological three-headed dog that guards the gate of the underworld. The discoverers threw open the naming of the moons to the public. The actual winner was Vulcan, the name of the home planet of Mr. Spock and also the name of the Roman god of volcanoes. However, Vulcan was the name given to a hypothetical planet that orbited inside the orbit of Mercury and made its orbit precess. (The precession was later explained by Einstein's theory of general relativity.) The International Astronomical Union decided that this meant the name Vulcan cannot be reused (I think the *Star Trek* link was also a factor), so two appropriate Hadean names were selected.

The reason the Greek spelling Kerberos was used is because there is already an asteroid named Cerberus.

It's possible that the naming controversy over Alpha Centauri Bb may have been premature; there's some controversy over whether the exoplanet actually exists. At least three teams are investigating, including one that is planning to use the Hubble space telescope on the off chance the planet transits its star's disc. The chance of this happening, assuming there is a planet, is between ten and thirty percent.

Astronomers will have to hurry, because Alpha Centauri A and B are approaching each other as seen from Earth and it will get difficult to detect anything until they separate.

In any case, Alpha Centauri Bb would orbit very close to its star and is extremely hot. Any planets in the habitable zone would be difficult to detect, especially since the existence of planets larger than Neptune has been ruled out for the Alpha Centauri system (including Proxima Centauri).

Two rival teams investigating the red dwarf star Gliese 667C have found evidence of at least two planets and perhaps as many as seven. What's more, if the higher estimate is correct, Gliese 667C has three planets in its habitable zone. That is the maximum possible for this star: adding more planets to the habitable zone would make the orbits unstable.

All these possible planets lie within 55,000,000 miles of Gliese 667C, which is 60% of the distance from the Earth to the Sun. Since Gliese 667C is so much cooler than the Sun, the habitable zone is closer to the star. In fact, it is closer to the star than Mercury is to the Sun.

Meanwhile, the Kepler spacecraft has found three more planets that are in the habitable zones of their stars. Kepler-62f is 40% larger than Earth, Kepler-62e is 60% larger than Earth and Kepler-69c is 70% larger than Earth. (I assume in diameter.) The first two orbit the same star, Kepler-62, which is smaller than the Sun. Kepler-69 is similar to the Sun.

Kepler-62f is the smallest exoplanet detected in its star's habitable zone.

None of these three planets is close to Earth. Kepler-62 is 1200 light-years away and Kepler-69 is 2700 light-years away. In contrast, Gliese 667C is only 22 light-years away.

The winds of Venus are getting stronger. In 2006, winds at the top of Venus's clouds were clocked at 186 mph, but a Russian and a Japanese team both have found that the winds have increased to 250 mph. So far, there is no explanation at all for the speed up, or even why Venus's upper atmosphere moves at the wind speed of an F5 tornado.

But that is nothing compared with Uranus, whose winds can blow at 560 mph, or Neptune, where they can blow at 1500 mph. Scientists aren't sure how that's possible either. It's known that the winds occur in thin layers, and that's about it.

Sky Viewing

The **Perseid Meteor Shower** is one of the highlights of the year. This year it will peak on the morning of August 12, and, amazingly, there will be no Moon in the sky. Expect 80 to 100 meteors per hour in a dark sky, but I've seen a bunch in a park in the center of Norman. The shower should be nearly as good on August 13.

Comet ISON was stuck at magnitude 16 in May, which is a couple of magnitudes less than hoped for. Currently, it is lost in twilight until August. Since it's a first-timer, it's really unpredictable. John Bortle at *Sky & Telescope* is now guessing that Comet ISON will reach naked-eye visibility around November 10 but will brighten to 2nd magnitude before it disappears into twilight. At perihelion on November 28, it will be only 1.1 million miles from the surface of the Sun, at which point the head of the comet will peak at magnitude -6 for several hours. It will, however, be difficult to see because it will be so close to a sun. (Viewing it via solar telescope should be great.) When ISON re-emerges, the head should be 2nd magnitude again, but growing an enormous tail while the head disintegrates.

This is all guesswork, and Comet ISON may well be a couple of magnitudes brighter. It's also possible the comet may be disrupted completely by its close encounter with the Sun.

Mercury was in inferior conjunction with the Sun on July 9, hence is not currently visible. Mercury will be visible in the morning starting the last week in July, and on July 28 it will be seven degrees below Mars and about ten degrees below and to the left of Jupiter. On July 30, Mercury will be at greatest elongation with respect to the Sun, and will continue to brighten until August 9, when it will be magnitude -1.0. This is one of the best times to look for Mercury if you don't mind getting up. It will be about ten degrees above the horizon a half hour before sunrise. Mercury will fade into twilight after that, and be in superior conjunction with the Sun on August 24.

Venus is shining at magnitude -3.9 low in the western sky after sunset. It's only ten degrees above the horizon an hour after sunset, and it will be that height through all of July and August. On July 22, Venus will be one degree above the first magnitude star Regulus in Leo,

Mars is currently hidden in the dawn following its April 17 conjunction with the Sun, and, since it is magnitude 1.5, would be hard to spot anyway. However, by July 22, it will be visible about 45 minutes before sunrise, and will be easy to find despite its relative dimness because it will be less than a degree to the left of Jupiter. By the end of August, Mars will be rising three hours before sunrise but still will be around magnitude 1.5.

Jupiter was in conjunction with the Sun on June 19 and is still lost in the glare of the Sun. However, by July 22 (the day of the conjunction) with Mars, it will be magnitude -1.9 and easily visible. By the end of August, Jupiter will be rising about two o'clock in the morning and will dominate the early morning sky.

Saturn is magnitude 0.5 and still visible halfway up the southwestern sky at sunset. It's at the border of Virgo and Libra and will stay there through mid-August, after which it gradually moves toward Libra. Saturn will be continue to be visible through most of August, but by the end of the month it will be fading into twilight.

Uranus is magnitude 5.8 in Pisces, and is visible (probably through binoculars) most of the night. Uranus and Neptune are one constellation apart (as they will be for years), and Uranus is approaching opposition at the beginning of October.

Neptune is magnitude 7.8 and in the constellation Aquarius, where it will be for quite a few years yet. It is approaching opposition at the end of August, and is in the sky all night long, although you need binoculars or a telescope to see it.

Pluto was at opposition on July 2, which means this is the best time to try to find it if you have access to a sizeable telescope.

Sky & Telescope has a finder chart online for Uranus and Neptune, <http://media.skyandtelescope.com/documents/Uranus-Neptune-2013.pdf>, and there are finder charts on page 81 of the August issue of *Astronomy*. But if you're really feeling ambitious and have access to a powerful telescope, there is a large finder map for **Pluto** on pages 52-53 of the June issue of *Sky & Telescope*.

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

Viewing Opportunities for Satellites (July 11 – August 11, 2013)

You can get sighting information at www.heavens-above.com/. Heavens Above 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 very 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. It doesn't give you information for Tiangong 1, so I'm using Heavens Above for that. Sky Online (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. The next manned mission to the Space Station launches in September, but several Progress missions and a Japanese cargo mission will dock with the Space Station during the next month. Be sure to check Heavens Above or www.jsc.nasa.gov/sightings before going out to watch just in case.

Tiangong 1 July 15, 2013

Time	Position	Elevation
9:13 p.m.	234°	10°
9:16	151	67
9:19	68	10

ISS July 16, 2013

Time	Position	Elevation
5:41 a.m.	228°	24°
5:42	229	46
5:43	135	89
5:44	47	40
5:45	47	21

ISS July 19, 2013

Time	Position	Elevation
Appears from Earth's shadow		
4:54 a.m.	272°	37°
4:55	330	50
4:56	15	40
4:57	31	20

Tiangong 1 July 24, 2013

Time	Position	Elevation
10:06 p.m.	304°	10°
10:08:32	23	54
10:09:19	77	38

Tiangong 1 July 26, 2013

Time	Position	Elevation
9:23 p.m.	301°	10°
9:26	25	68
9:28	108	14

ISS August 3, 2013

Time Position Elevation

5:45 a.m.	324°	22°
5:46	340	39
5:47	42	62
5:48	103	38
5:49	116	21

ISS August 3, 2013

Time	Position	Elevation
10:25 p.m.	238°	23°
10:26	248	44
10:27	334	71
10:28	32	39

ISS August 4, 2013

Time	Position	Elevation
9:37 p.m.	209°	20°
9:38	196	36
9:39	142	58
9:40	78	40
9:41	62	22

ISS August 6, 2013

Time	Position	Elevation
9:36 p.m.	259°	19°
9:37	278	31
9:38	322	41
9:39	6	31
9:40	25	19

HST August 7, 2013

Time	Position	Elevation
Appears from Earth's Shadow		
5:24:26 a.m.	205°	25°
5:24:46	198	27
5:26	172	29
5:27	146	26
5:28	129	19

The Hubble Space Telescope is also visible on August 8 – 11 along similar trajectories to August 7. It appears from Earth's shadow at 5:20 of August 8, 5:15 on August 9, 5:10 on August 10, and 5:06 on August 11.

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 find the Hubble Space Telescope at 5:23 a.m. on August 8, measure four fist-widths south of due east, then 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:

July 16: 6:00 a.m.: ISS Expedition 36 U.S. Spacewalk Coverage (Spacewalk scheduled to begin at 7:10 a.m. CDT) July 27: 3:30 p.m. Progress Launch Coverage (launch is at 3:45 p.m.). 8:45 p.m.: Docking Coverage (docking is 9:26 p.m.)
August 3: Time to be determined: Launch of the HTV-4 from Japan to the ISS.

Calendar of Events

July 13: [Tentative] Oklahoma Space Alliance meeting at 2:30 p.m. at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City.

July 30: Mercury is at greatest western elongation, 20° from the Sun (hence can be seen before sunrise).

August 4: The asteroid Juno is at opposition, reaching a peak magnitude of 6.6.

August 10: [Tentative] Oklahoma Space Alliance meeting at 2:30 p.m. at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City.

August 12: Peak of the Perseid meteor shower.

August 14: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

August 24: Mercury is in superior conjunction with the Sun.

August 26: Neptune is at opposition.

September 6, 10:27 p.m.: Launch of LADEE (Lunar Atmosphere and Dust Environment Explorer). For more information, visit http://www.nasa.gov/mission_pages/LADEE/main/index.html.

September 11: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

September 14: [Tentative] Oklahoma Space Alliance meeting at 2:30 p.m. at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City.

September 25: Launch of three Expedition 37/38 members via Soyuz from the Baikonur Cosmodrome in Kazakhstan to the Space Station.

October: [Moved from August.] Launch of *Gaia* (Global Astrometric Interferometer for Astrophysics), the European Space Agency successor to *Hipparcos*. *Gaia* will provide data on one billion stars in the Milky Way, including distances, proper and radial motion, and spectroscopic info burying astronomers in data. *Gaia* will also observe asteroids closer than the Earth to the Sun. For more information, visit the project webpage at <http://sci.esa.int/gaia> or [http://en.wikipedia.org/wiki/Gaia_\(spacecraft\)](http://en.wikipedia.org/wiki/Gaia_(spacecraft)).

October 3: Uranus is at opposition.

October 8: Mercury is at greatest eastern elongation, 25° from the Sun (hence can be seen after sunset)

October 9: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

October 12: [Tentative] Oklahoma Space Alliance meeting at 2:30 p.m. at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City.

October 31: Venus is at greatest eastern elongation, 47° from the Sun (hence can be seen after sunset)

November: Comet C/2012 S1 (Comet ISON) will approach within 1.1 million miles of the Sun and be visible to the naked eye. It may well be visible during the daytime.

November 3: Hybrid solar eclipse. This will begin as an annular eclipse east of Florida, and will be total on a path from the mid-Atlantic through central Africa.

November 6: Saturn is in conjunction with the Sun.

November 9: [Tentative] Oklahoma Space Alliance meeting at 2:30 p.m. at Denny's on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City.

November 11: [Moved from September.] Space-X's third resupply flight to the ISS.

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

November 18: Launch of the Mars Atmosphere and Volatile Evolution orbiter (*MAVEN*). (Launch windows extend through December 7.) The project web site is <http://lasp.colorado.edu/home/maven/>.

November 18: Mercury is at greatest western elongation, 19° from the Sun (hence can be seen before sunrise).

November 25: Launch of three Expedition 38/39 members via Soyuz from the Baikonur Cosmodrome in Kazakhstan to the Space Station.

December 9: Launch of SpaceX's third commercial supply mission to the ISS.

December 11: [Tentative.] Oklahoma Space Industry Development Authority Meeting at 1:30 p.m., Oklahoma Department of Transportation Building in Oklahoma City.

December 13: Peak of the Geminid meteor shower.

December 29: Mercury is in superior conjunction with the Sun.

Sometime in 2014: First test flight of the Orion Multi-Purpose Crew Vehicle.

January 2014: Comet C/2012 S1 (Comet ISON) approaches with 37.2 million miles of Earth. It should be much brighter than Venus at this point. On January 8, it will be within two degrees of the North Star. January 5, 2014: Jupiter is at opposition.

February 14, 2014: Launch of Japan's *Astro-H* X-ray astronomy spacecraft. For details, visit <http://astroh.isas.jaxa.jp/index.html.en>.

April 6, 2014: Space-X's fourth resupply flight to the ISS.

April 14-15, 2014. Total eclipse of the Moon visible from North America.

April 15, 2014: The asteroids Vesta and Ceres are both at opposition.

July 2014: Launch date of *Hayabusa 2* sample return mission to asteroid 1999 JU₃. Web site is www.jspec.jaxa.jp/e/activity/hayabusa2.html.

August 2014 - December 2015: The European Space Agency's *Rosetta* space probe orbits comet ChuryumovGerasimenko. 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.

October 8, 2014: Total eclipse of the Moon visible from almost all of the Pacific Ocean, eastern Australia and western North and South America.

October 19, 2014: Comet Siding Spring will pass within 65,000 miles of Mars. There is a 0.01% probability of an actual collision.

Sometime in 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>.

Sometime in 2015: 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.]

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

Sometime in 2015: 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>. [Moved from 2014.]

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.

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: The European Space Agency/JAXA BepiColombo Mercury Orbiter is launched. Home page is <http://sci.esa.int/bepicolombo>.

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.

Sometime in 2016: Russia launches the orbiter of the "Luna-Glob" mission. [See 2015 for the lander launch.]

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

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

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. (This is the same asteroid

as before. It now has a proper name.) 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>.

January 2017: Proposed launch date for 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: Earliest date for the launch of the James Webb Space Telescope.

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.)

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

Oklahoma Space Alliance Officers, 2013 (Area Code 405)

Steve Swift, President	496-3616 (H)
Claire McMurray, Vice President	329-4326 (H) 863-6173 (C)
Syd Henderson, Secretary & <i>Outreach</i> Editor	321-4027 (H) 365-8983 (C)
Tim Scott, Treasurer	740-7549 (H)

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_Koszoru at cox.net (Heidi and Tom Koszoru)

john.d.northcutt1 at tds.net (John Northcutt) lensman13

at aol.com (Steve Galpin)

E-mail for OSA should be sent to sydh@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, 580562-3500. 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 is LtCol Paul E. Damphousse nsshq@nss.org. The Chapters Coordinator is Bennett Rutledge 720-529-8024. 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 \$30 introductory rate for new members (\$35 for new international members). Regular membership rates are \$55, international \$65. Student memberships are \$25. 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.marsociety.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?

_____ Yes _____ No. [See brochure for information.]

Name _____

Address

City _____ State _____ ZIP _____

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 2013

102 W. Linn #1, Norman, OK 73069



NOTE TIME AND LOCATION

Oklahoma Space Alliance will meet at 2:30 p.m. on Saturday, July 13 at Denny's Restaurant on the I-240 access road on the north side just east of Pennsylvania Avenue in southern Oklahoma City. Directions and an agenda are inside.