OUTREACH November 2014

Note: Last September, the Postal Service decided to start enforcing rules about self-mailing newsletters to OUTREACH. This means either using a heavy stock for the cover and attaching three tabs to each newsletter, or mailing OUTREACH in envelopes. I did tabs last time and envelopes this time. I think I like the envelopes better, especially since I can print the cover in one go, and have the addresses and logo appear just where I want them.

November Meeting:

Oklahoma Space Alliance will meet from 3:15 to 6:00 p.m. on Saturday, November 8, 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.

This is the meeting at which we nominate officers. If you wish to serve as an officer of Oklahoma Space Alliance, please let us know at the meeting or contact Syd by e-mail at sydh@ou.edu. Syd will be sending out election ballots around the beginning of December by both e-mail and snail mail. If you wish to be an officer, please contact him by December 1. Elections will be held at the Christmas Party.

Saturday November 8, 2014

Program

Place: Harry Bears in Moore, OK

3:15 pm

1) Discuss Activities
    a. Summary of August Meeting
    b. Student Projects
    c. Nomination of Officers
    d. OSIDA Meeting (none)
    e. Treasurers Report
    f. Christmas Party
2) What's Happening (Steve Swift)
    Space News, Pictures, Videos & Links
3) Discussion Topic: What do you say when someone says commercial space is too expensive or too dangerous?
4) Chat

Minutes of October Meeting

Oklahoma Space Alliance met at Harry Bears All-American Grill on Sunday, October 12. Attending were Steve, Karen and Brian Swift, Vickey Richartz, Greg Rasnake, Dave Sheely, Greg, Caitlyn (?) and Stephanie Thibodeaux, Don Robinson, Russ Davoren, Penny McBride, Craig Crawford and Syd Henderson.

This was our Space Week celebration, a couple of days late to accommodate our speaker. Mr. Rasnake is Deputy Director of Strategic Planning for FAA Office of Commercial Space Transportation, and our guest speaker. The purpose of the office is ensuring public property and national security and foreign policy of the United States during commercial launch and re-entry.

The FAA has 40,000 employees, most of them being air traffic controllers followed by security. The Office of Commercial Space Transportation had eighty people.

Insurance for commercial space flights can go up to a billion dollars. The CST can issue fines but has never had to issue one to the space industry. The commercial space industry effectively regulates itself.

The number of commercial space launches per year was 4 in 2010, 5 in 2011, 3 in 2012 and 18 in 2013. The number is expected to rise rapidly, and projections for 2023 are a baseline of 120, with 50 being conservative and 230-330 being expansive. There could be 50 next year. [That seems doubtful now with the twin accidents to the Cygnus cargo craft and SpaceShipTwo.--Syd]

The CAMI medical institute is in OKC. Mr. Rasnake will be staying in the area for several months and hopes to attend OSA meetings.

Other news: The "vomit comet" can use the Oklahoma Spaceport's air corridor.

Sierra Nevada is developing a 3-astronaut suborbital spacecraft, a scaled-down version of the Dream Chaser vehicle being developed as part of the Commercial Crew project.

National Space Society Encourages Virgin Galactic To Press On

Washington DC - October 31, 2014 - The National Space Society (NSS) extends its support to Virgin Galactic and Scaled Composites over the tragic loss of SpaceShipTwo and offers its heartfelt sympathy to the families involved and to everyone who worked on that program.

"We are extremely honored that Virgin Galactic President George Whitesides served on the NSS team as our Executive Director and we all stand by him in this time of difficulty," said Mark Hopkins, Chairman of the NSS Executive Committee. "We expect that the cause of the accident will be found and fixed so that the Virgin Galactic dream of 'opening space to tens of thousands of people' can become a reality."

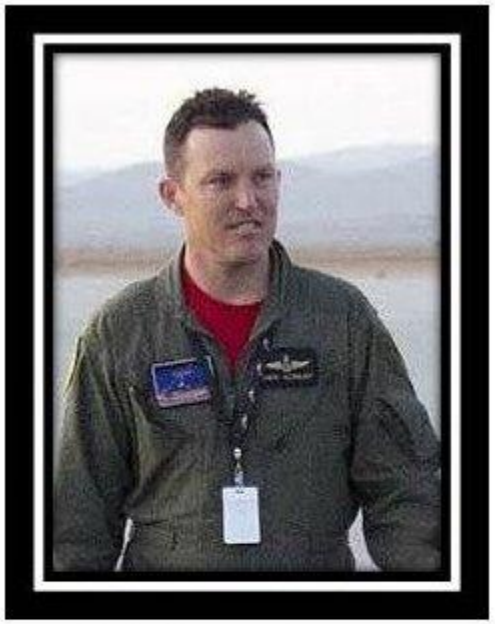
NSS encourages Virgin Galactic to continue moving forward. NSS has been a consistent supporter of private efforts to develop space commercially, including both orbital and sub-orbital tourism. Economic returns from spaceflight are necessary for humanity's long-term future in space.

NSS notes that fatal accidents during both the testing of aircraft and their operation were relatively common during the early days of commercial aviation, and now it has happened in commercial space flight. America was always built on the courage of those who dared to explore new frontiers. From Lewis and Clark to the Apollo astronauts, great men and women have tested themselves against the frontiers of their age.

The frontier of space is far from tamed. The men and women of Virgin Galactic and Scaled Composites are engaged in one of the great efforts of our time: opening space for all humanity. That is a noble pursuit and we are all thankful for their work and for their sacrifice.

NSS Executive Vice President Paul Werbos sums up: "This is a sad moment for the space tourism industry and the families of the pilots. The Scaled Composites pilots are true heroes who risked their lives to blaze a trail to a better future for everyone"

-From the NSS Website



Michael Alsbury
1975-2014
Test Pilot Scaled Composites
Copilot SpaceShip Two
He died opening the way to space. May his memory be taken to the stars.

Space News:

On Friday, October 31, Virgin Galactic's SpaceShipTwo broke apart during a test flight, killing pilot Michael Alsbury and seriously injuring pilot Peter Siebold. (SpaceShipTwo carries two pilots.) The breakup occurred two seconds after the tail rudders deployed prematurely, the "feathering" maneuver meant to slow the spacecraft down when it's at a high altitude. Pieces of the spacecraft were found over a distance of five miles, consistent with the spacecraft breaking up. There was no sign of an in-flight explosion; the fuel tanks are intact. The engines ignited nine seconds before the breakup and were recovered.

In order to deploy the feathering mechanism, a lever must be unlocked and a handle moved to the "feather" position. The lever was indeed unlocked, but the handle wasn't moved, suggesting the feathering message deployed unintentionally.

Siebold was able to get out of the plane before it broke up and parachuted back to Earth. It is not known at what point Alsbury died.

The disaster will certain set back further test flights by Virgin Galactic by months if not more than a year.

This disaster coincidentally came three days after the explosion of an Antares rocket as it was clearing the tower at its launch pad on Wallops Island on the east coast of Virginia. There was severe damage to some buildings near the launch pad, although the launch pad itself was not destroyed. No injuries were reported, although windows were blown out in nearby buildings. NASA officials are warning people to stay away from any rocket debris since some of it may contain caustic substances.

Orbital Services has a $1.9 billion contract for eight cargo flights to resupply the Space Station and this would have been the third such flight.

Antares relies partly on 40-year old Soviet rocket engines, fueling speculation that one of these may have malfunctioned. The engines date back to the Soviets' N-1 Moon Rocket which was cancelled in the 1970s, leaving behind lots of NK-33 engines which have been modified for the Antares program. The engines are generally very reliable but one exploded last May during a test.

Paul Marks at *New Scientist* warns that the CubeSat craze is a recipe for disaster. About a hundred CubeSats were launched last year, and this could pick up to 200 to 700 hundred per year, presenting a sizable collision hazard. At two hundred CubeSats launched per year, there will be 16 million passes within 10 miles of other spacecraft during the next 30 years. This, however, depends on the rate of deorbiting. CubeSats are supposed to deorbit with 25 years, but some are in orbits that will last a lot longer.

On October 19, the nucleus of Comet Siding Spring passed within 87,000 miles of Mars. All five spacecraft orbiting Mars survived undamaged, and we are still awaiting pictures. This rather nondescript one is from the *Mars Reconnaissance Orbiter*.

MAVEN, which was designed to analyze the Martian atmosphere, turned its instruments onto the comet, detecting a huge cloud of hydrogen atoms released by solar radiation from water on the comet's surface.

Isotope analysis and models by Alice Stephant and François Robert and colleagues at the National Museum of Natural History in Paris, France, indicates that most of the Moon's water may not have come from comets at all, but from the solar wind. Hydrogen in the solar wind contains less deuterium (I presume because it gets burned up in the Sun) and analysis of the lunar soil brought back from Apollo 16 and 17 indicates the soil to deficient in deuterium. [It seems likely to me that ice in craters near Mercury's poles comes from the same source.]

Sky Viewing

Lots of meteor showers from here to the end of the year, but the Geminids are by far the best.

The **Leonid** meteor shower will peak on the mornings of November 17 and 18. However, this isn't a huge shower this year, with there being maybe a dozen meteors per hour. The Moon will rise about 3:00 a.m., and will be a thin crescent when it does.

The **Taurid** meteor shower actually occurs through October and November. Even at its peak in early November, there are maybe a dozen meteors per hour, but they can be bright fireballs. Unlike most showers, the Taurids are visible all night.

The **Geminid** meteor shower peaks on the nights of December 13 and 14. These seem to radiate from the vicinity of the star Castor, which is fairly high in the sky in mid-evening so there are quite a few meteors even before midnight. This shower can produce over a hundred meteors per hour at its peak. The Moon will rise around midnight, and will be in the last quarter.

Finally, the **Ursid** meteor shower peaks on the morning of December 22. This shower will produce maybe 15 meteors per hour, but have the advantage of appearing during the New Moon, and their radiant is always above the horizon.

Mercury is currently going through its best morning apparition of the year, and is magnitude -0.8. Look for it low in the east-southeastern sky about 45 minutes before sunrise, a little below and to the left of Spica. Mercury is close to perihelion, which means its angular separation from the Sun is 20 degrees. On the other hand, it's rising directly above the Sun, which makes it easier to see. Mercury will become hard to see later in the month as it approaches superior conjunction with the Sun on December 8. It will become visible in the western sky at sunset around the end of December, and on New Year's Eve will be three degrees below Venus. (Mercury is approaching a conjunction with Venus in early January in which they will be separated by less than a degree.)

Venus was in superior conjunction with the Sun on October 25 and still is too close in the sky to the Sun to be visible, a situation that will persist through the rest of November. By late December, Venus will be just visible in the west right after sunset.

Mars is magnitude 0.9 in the southwestern sky at sunset. It's going to be about 20 degrees above the horizon at sunset through December as it moves through the constellations Sagittarius and Capricornus. What's happening is the Sun and Mars are both setting the same amount earlier each night. This will end in December but Mars won't be in conjunction with the Sun until June.

Jupiter is rising about midnight and is magnitude -2.0. It is moving into the constellation Leo. By the end of November it will be rising around 10:00 p.m., and by the end of December, it will be rising at 8:00 p.m. It will also be growing brighter, reaching magnitude -2.2 on December 1, and -2.4 on January 1. Jupiter is approaching opposition, which it will reach in February, and will be the brightest non-lunar object in the night sky for the next couple of months,

Saturn is approaching its November 18 conjunction with the Sun and isn't visible all month. It will return to the morning sky in December, and will rise three hours before the Sun by New Year's Eve. Saturn is currently in Libra, but will move into Scorpius in December.

Uranus is high in the southeastern sky in the constellation Pisces at sunset, but is only magnitude 5.7. **Neptune** is more to the south in the constellation Aquarius, and is magnitude 7.9. 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 is a finder chart for Pluto on page 36 of the November 2014 issue of *Astronomy*. On November 10, Pluto will be 3.7 degrees south of Mars. Pluto is nearing conjunction with the Sun, so won't be visible in December even through a large telescope.
[Data for this section from *Astronomy*, *Sky & Telescope*, Wikipedia and NASA.]

Viewing Opportunities for Satellites (November 8 – December 13)

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. Expedition 41 is returning on November 9, Expedition 42/43 launches on November 23, and SpaceX is launching a Dragon Cargo Ship on December 9.

ISS November 9, 2014

Time	Position	Elevation
6:04 a.m.	223°	22°
6:05	220	43
6:06	126	83
6:07	53	41
6:08	50	22

ISS November 11, 2014

Time	Position	Elevation
Appears out of Earth's shadow		
6:02:16 a.m.	271°	23°
6:02:38	288	26
6:04	324	32
6:05	0	26
6:06	14	20

Tiangong 1 November 14, 2014

Time	Position	Elevation
5:05 a.m.	236°	10°
5:08	315	53
5:11	33	10

ISS November 28, 2014

Time	Position	Elevation
6:32 a.m.	287°	18°
6:33	270	29
6:34	227	38
6:35	186	30
6:36	167	18

Tiangong 1 December 5, 2014

Time	Position	Elevation
5:28 p.m.	212°	10°
5:29	135	51
5:30	60	15
Vanishes into Earth's shadow		

Vanishes into Earth's Shadow

Tiangong 1 December 9, 2014

Time	Position	Elevation
5:21 a.m.	300°	10°
5:23	225	42
5:29	152	10

ISS December 7, 2014

Time	Position	Elevation
6:54 p.m.	234°	22°
6:55	240	41
6:56	319	77
6:56:47	24	60

ISS December 10, 2014

Time	Position	Elevation
6:00 p.m.	252°	20°
6:01	268	35
6:02	320	50
6:03	13	35
6:04	30	20

Key: Position is measured in degrees clockwise from north. That is, 0° is due north, 90° is due east, 180° is due south, and 270° is due west. Your fist held at arm's length is about ten degrees wide. "Elevation" is elevation above the horizon in degrees. Thus, to see the International Space Station on at 6:02 p.m. on December 10, measure five fist-widths north from due west (or four west from due north), 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:

November 9, 2:45 p.m. ISS Expedition 41farewell and hatch closure. 6:15 p.m.: undocking coverage. 8:45 p.m.: deorbit and landing coverage. (Landing is at 9:58 p.m.)

November 23, 2:00 p.m.: ISS Expedition 42/43 launch coverage. [Launch is at 3:01 p.m.] 8:15 p.m.: Docking Coverage. (Docking is at 8:50 p.m.) 10:00 p.m.: Hatch opening coverage. (Hatch opening is at 10:30 p.m.)

December 4, 9:00 a.m.: Lecture by *Dawn* project director Mary Rayman on *Dawn*'s arrival at Ceres.

December 9, 3:00 p.m.: Coverage of Launch of SpaceX's Dragon Cargo Ship to the ISS.

December 11: time to be determined: Rendezvous and Grapple of Dragon Cargo Ship with the ISS.

Calendar of Events

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 23: Expedition 42 launched to the space station.

No earlier than December 4: 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 3, 2015: Peak of Quadrantid meteor shower.

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.

January 14, 2015: Mercury is at greatest elongation, 19 degrees east of the Sun (so can be seen after sunset).

January 30, 2015: Mercury is in inferior conjunction with the Sun.

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.

February 6, 2015: Jupiter is at opposition.

February 25, 2015: Neptune is in conjunction with the Sun.

February 27, 2015: Mercury is at greatest western elongation, 26.7 degrees from the Sun (so can be seen before sunrise).

March 20, 2015: Total eclipse of the Sun visible in the North Atlantic between Iceland on the one hand and Scotland and Norway on the other. The total eclipse will pass over the Faroe islands and Svalbard in the Arctic Ocean.

April 4, 2015: Total eclipse of the Moon visible over the Pacific Ocean, west coast of United States, the east coast of Asia, Australia and New Zealand.

April 6, 2015: Uranus is in conjunction with the Sun.

April 9, 2015: Mercury is in superior conjunction with the Sun.

April 22, 2015: Peak of Lyrid meteor shower.

May 5, 2015: Peak of Eta Aquarid Meteor shower.

May 6, 2015: Mercury is at greatest elongation, 21 degrees east of the Sun (so can be seen after sunset).

May 22, 2015: Saturn is at opposition.

May 30, 2015: Mercury is in inferior conjunction with the Sun.

June 6, 2015: Venus is at greatest eastern elongation, 45.4 degrees from the Sun (so can be seen after sunset).

June 14, 2015: Mars is in conjunction with the Sun.

June 14, 2015: The Moon occults Mercury.

June 24, 2015: Mercury is at greatest western elongation, 22 degrees from the Sun (so can be seen before sunrise).

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/.

July 18, 2015: The Moon occults Venus.

July 23, 2015: Mercury is in superior conjunction with the Sun.

July 28, 2015: Peak of Delta Aquarid meteor shower.

August 12, 2015: Peak of Perseid meteor shower.

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

August 26, 2015: Jupiter is in conjunction with the Sun.

August 31, 2015: Neptune is in opposition.

September 4, 2015: Mercury is at greatest elongation, 27 degrees east of the Sun (so can be seen after sunset).

September 28, 2015: Total lunar eclipse visible from most of North America (including Oklahoma), all of South America, all but the eastern part of Africa, western Europe and the entire Atlantic Ocean.

September 30, 2015: Mercury is in inferior conjunction with the Sun.

October 11, 2015: Uranus is at opposition.

October 15, 2015: Mercury is at greatest western elongation, 18 degrees from the Sun (so can be seen before sunrise).

October 21, 2015: Peak of Orionid meteor shower.

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

November 17, 2015: Mercury is in superior conjunction with the Sun.

November 17, 2015: Peak of Leonid meteor shower.

November 29, 2015: Saturn is in conjunction with the Sun.

December 14, 2015: Peak of Geminid meteor shower.

December 22, 2015: Peak of Ursid meteor shower.

December 28. 2015: Mercury is at greatest elongation, 20 degrees east of the Sun (so can be seen after sunset).

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)
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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. 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, 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.

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?
_____ 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.**