

The Inner Solar System: What we've learned in the past three decades- and what we don't know "yet"

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"Earth-like" planets < No! Yes! >



About Moon Miners' Manifesto - "The Moon - it's not Earth, but it's <u>Earth's!</u>"

- MMM's VISION: "expanding the human economy through off-planet resources"; early heavy reliance on Lunar materials; early use of Mars system and asteroid resources; and permanent settlements supporting this economy.
- MMM's MISSION: to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
- Moon Miners' Manifesto CLASSICS: The non-time-sensitive articles and editorials of MMM's first twenty years
 plus have been re-edited, reillustrated, and republished in 23 PDF format volumes, for free downloading from
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- For additional space news and near-term developments, there is a daily RSS feed space news section on http://www.moonsociety.org. You can also read Ad Astra magazine mailed to National Space Society members. •

Milwaukee Lunar Reclamation Society is an independently incorporated nonprofit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. MLRS serves as the Milwaukee chapter of both The National Space Society and The Moon Society: - http://www.moonsociety.org/chapters/milwaukee/

• The National Space Society is a grassroots pro-space member-ship organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.

National Space Society 1155 15th Street NW, Suite 500 Washington, DC 20005 (202) 429–1600 - www.NSS.org

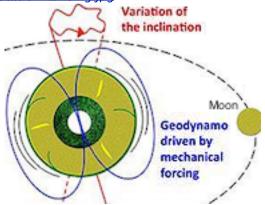
- The Moon Society seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." Contact info p. 9.
- NSS chapters and Other Societies with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.
- Publication Deadline: Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, Sooner is better! No compensation is paid.
- Submissions by email to KokhMMM@aol.com Email message body text or MS Word, Open Office Text files, and pdf file attachments or mailed CDs, DVDs, or typed hard copy [short pieces only, less than 1,000 words] to:

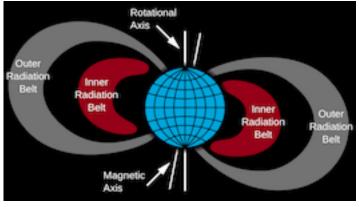
 Moon Miners' Manifesto, c/o Peter Kokh, 1630 N. 32nd Street, Milwaukee, WI 53208-2040

In Focus The Moon may play major role in maintaining Earth's magnetic field

www.space-travel.com/reports/**The_Moon_thought_to_play_a_major_role_in_maintaining_Earths_magnetic_fiel d_**999.html

 $www.spxdaily.com/images-lg/\textbf{gravitational-effects-lunar-sun-cyclical-deformation-earth-mantle-wobble-r} \\ \underline{otation-axis-lg.jpg}$





1 April, 2916 – The gravitational effects associated with the presence of the Moon and Sun cause cyclical deformation of the Earth's mantle and wobbles in its rotation axis. This mechanical forcing applied to the whole planet causes strong currents in the outer core, which is made up of a liquid iron alloy of very low viscosity. Such currents are enough to generate the Earth's magnetic field.

(Editor: Given the protection Earth's magnetic field gives us - the Van Allen Belts - this could mean that otherwise Earthlike planets - "Hydrotectonic" (with "active tectonic processes in the presence of water") i.e. with continents and oceans but without a sizable moon - might not support advanced life as Earth does.

That might make worlds like ours even more rare and special than previously thought.

Perhaps we should start thinking of our home world as "an integral pair", a "Earth-Moon", "Terra-Luna" [Latin], "Gaia-Selene" {Greek] - PK)

(The Moon is already a key anchor of a Greater Earth Econosphere)

("Mother Earth and Father Sky" homage)

Is the Earth-Moon system another type of "Binary Planet"?

By Peter Kokh

Time to divide "Binary Planet" into two classes

https://en.wikipedia.org/wiki/Double_planet

http://solarsystem.nasa.gov/news/2006/08/17/what-is-a-binary-planet

Our suggestion for a definition: Size and orbital location are not enough

• An Earthlike (continents & oceans) planet with an "interactive moon" that produces tides not only in the primary planet's ocean(s) but also in its sub-crustal magma



- Such a moon is likely to have 1/100th or more of primary's mass
- Common center of mass is in the primary's molten mantel

Relevant and supporting links:

http://news.discovery.com/space/alien-life-exoplanets/are-habitable-binary-planets-possible-141211.htm http://www.space.com/27832-binary-earth-size-alien-planets.html http://solarsystem.nasa.gov/news/2006/08/17/what-is-a-binary-planet

What Earth's history means for the search for other "Earth-like Planets"

By Peter Kokh

 $\sqrt{}$ we need to look for "Earth-like" planets with sizable "moons"

 $\sqrt{\text{Will}}$ we be able to determine the percentage of such pairs? 1 in a 10?, 1 in 100?, 1 in 1,000?

- indicators and clues?
- Orbital "waves" center of planet is alternately closer and farther from its sun-star "several" times per orbit. How hard will that be? Is our resolving telescope power too low for that?

What we've learned:

There are "Earthlike" planets in terms of size and proximity/distance from their suns.

What we don't yet know:

What spectral range of stars can host matured Earth-like planets? And with sizable moons?

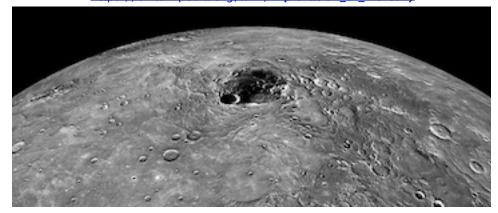
What we need to know if we are going to incorporate Mars into the human realm

Just as on the Moon, people will have to budget their time out on the surface, exposed to cosmic rays. Homes will be interconnected by shielded streets and walkways. Sunshine can be ducted inside settlements.

Mercury: what we have learned so far and Unanswered Questions

By Peter Kokh

asic Information: https://en.wikipedia.org/wiki/Exploration of Mercury



Mercury's North Polar Area: ice-filled craters and likely lavatubes with mild temperatures

Past Articles in MMM: (http://www.moonsociety.org/publications/mmm_themes/mmmt_solarsystem.pdf)

- MMM #78 Mercury: The Other Terrestrial Planet; Mercury Gateway: Grand Central to the Outer Solar System
- MMM #204 Three Myths of Planet Mercury; More on Mercury as a Human Frontier
- MMM #205 Mercury Frontier Speculations for the fun of it
- MMM #244 Mercury A Coming Attraction

What we've learned:

- $\sqrt{}$ The north polar area has craters into which the sun never shines, and which hold reservirs of water ice.
- √ There is a basaltic "sea" (mare) near the north pole that most certainly holds intact lavatubes with moderate temperatures and quite possibily suitable for a human outpost.
- √ Mercury could become a Grand Central Station for shorter flights between the planets at more frequent intervals (for example, offering faster and more frequent Earth–Mars and Mars–Earth travel opportunities)
- √ Thanks to its closeness to the Sun, Mercury is very energy rich. Lasers could be used to accelerate departing space craft, and decelerate incoming ones no fuel needed.
- √ Radiation levels on Mercury, due to its closeness to the Sun are highest in the solar system. Space suits, vehicles, habitats must be protected accordingly; times spent on the surface restricted, vehicles protected.
- √ Mercury is smaller than Mars, but denser its **gravity level is the same as that on Mars, 38**% that of Earth's. If pioneers can adapt to Martian gravity, they can adapt to Mercury's also.
- $\sqrt{}$ The hemisphere which faces the Sun when Mercury is furthest from the Sun (aphelion) will be more "temperate" than the hemisphere which faces the Sun when Mercury is closest to the Sun (perihelion).
- √ Why does Mercury rotate so slowly? (it takes 59 Earth days to spin once on its axis (the rotation period), and about 88 Earth days to complete one orbit about the Sun. However, the length of the day on Mercury (sunrise to sunrise) is 176 Earth days (48% c. half of an Earth year).

What we don't yet know but need to know if we are going to incorporate Mercury into the human realm

- $\sqrt{}$ Is there a network of intact lavatubes, and tube entrances? Most likely. Their diameter would be similar to those on Mars, smaller than those on the Moon, an inverse relationship with gravity.
- $\sqrt{\text{Volume/mass of water-ice reservoirs}}$ within polar craters and possibly within lavatubes

Missions Needed: (Messenger learned a lot, but not enough)

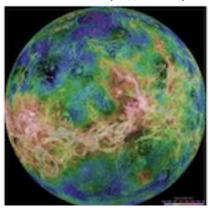
- Mercury GRAIL: "Ebb & Flo" type satellites like those orbiting the Moon, to map north polar subsurface tubes
- Landers to sample polar ice, and to explore lavatube pit entrances if any are found
- "Stations" around the globe to measure temperatures, radiation levels, and more.
- Unknown: It seems likely that there will be outposts on Mercury, but will personnel be on temporary tours of duty or will there be some "settlers?"
- Note: Sydney, Australia was settled with "prisoners" who fathered normal free settlers, the start of what is now a "world class city." https://en.wikipedia.org/wiki/Convicts_in_Australia

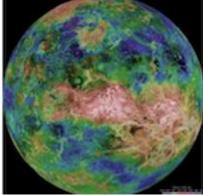
Venus: what we have learned so far and Unanswered Questions

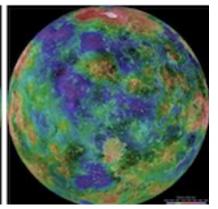
Bv Peter Kokh

Basic Information: https://en.wikipedia.org/wiki/Venus

https://en.wikipedia.org/wiki/Observations and explorations of Venus







Two "continents" – **Aphrodite Terra** along the equator, **Ishtar Terra** around Venus' north pole [Those of us old enough to remember the range of speculation about Venus before the first probe revealed its hellish state, believed that someday, Venus would be settled by humans]

http://www.moonsociety.org/publications/mmm_papers/venus_rehabpaper.htm [1992, 1998, 2000]

Aerostat "Xities" over Venus Venus: Balloons & Aerobots Touring Venus from Above Visits to Venus enroute to Mars "Subnubilar" Industries Over Venus Geomorphing Venus

High Sky Aircraft for Venus The "Friday File"

"89% of all the water we could want to fill Venus' dry "ocean basins" is already there!" - Peter Kokh [Hint: water = H_2O = 89% oxygen by weight - we just have to add the 11% hydrogen from the solar wind]

Possible Outposts: "Floating aero-outposts" at a level above the bulk of the too thick too hot atmosphere:
√ Read **Aerostat "Xities" over Venus** in paper referenced above.

What we don't yet know:

Venus Geomorphed

Why does Venus rotate so slowly and in the "opposite" direction (is there any way, if not to reverse that direction, to speed up the rotation? If not, we should be able to live with Venus' "seasons."

If the excess Oxygen (from CO2) in the atmosphere were combined with solar wind hydrogen to rain water into Venus' basins, where would the "sea-level" boundaries be? What percentage of Venus surface would be ocean, what percentage continents and islands?

What we need to know if we are going to incorporate Venus into the human realm

- Possible tourist flights to Venus in aero-floating platforms with instruments
- Instrument monitors at the two highest altitude points, and lowest points
- Atmospheric composition at various latitudes
- Areas of active volcanism
- Basalt areas possible lavatubes
- Earthquake sensor placement

What can we do to make Venus a friendlier place? - a task for millennia? Or just centuries?

- ("89% of all the water we might want to fill Venus' "ocean basins" is already on Venus") (see above)
- If we hydrogenated Venus' atmosphere, lowering the pressure and temperture, what would be sea-level?
- How hyper-tropical would the climate be
- How can we reduce the heat? (give it an escape route?)

Editor: We have "undereplored" Venus to date because it seems so hostile a world and it is difficult to imagine humans having outposts on/over this world. We should be trying to find out all the leverage points and conditions and boundaries – and test them

To Determine

- What could we do with the enormous carbon reservoir left over from hydrogenating the atmosphere? Answer: create a sunshield – at what altitude? In orbit at Venus Sun LX point?
- Is there any way to slow/accelerte Venus rotation rate (keeping its direction, vs. reversing it?) ##

Mars: what we have learned so far and Unanswered Questions

By Peter Kokh

https://en.wikipedia.org/wiki/Mars

https://en.wikipedia.org/wiki/Observations_and_explorations_of_Mars http://www.moonsociety.org/publications/mmm_themes/mmmt_Mars.pdf

http://www.moonsociety.org/mars/

What we've learned:

Mars was never "Earth-like." but it was once wetter with a thicker atmosphere. We mau not be agle to make it "another Earth": But there are surely ways to tap existing water and ice reserves. Mars has found ways to hold on to some of its initial water endowment. We are finding sub-surface ice pockets in many places.

There is also the reaasonable possibility of breeding plants that can fluroish in improved conditions still colder and dryer than plants face on Earth – our proposed "redhousing project."

[MMM #93 "Redhousing:" breeding Mars-hardy plants in compressed Mars Air; Sowing New Life on Mars – published in http://www.moonsociety.org/publications/mmm_themes/mmmt_Mars.pdf]

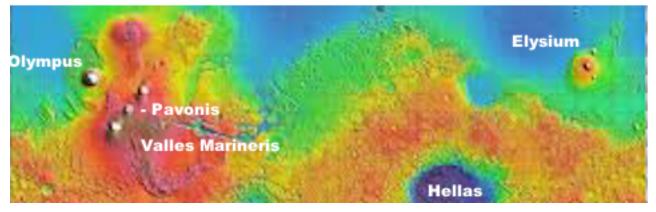
We need to develop faster means of transport Earth to Mars and Mars to Earth – The Vasimir project and nuclear propulsion development will allow settlers to get to Mars from Earth faster and arrive in better physical conditions, more ready to "hit the ground running." Current rocket technology is not up to the task.

What we don't yet know and need to explore:

- subsurface water reservoirs, aquifers, permafrost Earth's permafrost areas have been mapped from above by plane and by satellite: a permafrost mapper satellite over Mars is priority #1 It may put other locations on the "settlement map"
- Limits of past oceans and seas finind a way to detect ancient shorelines is high priority
- Composition of Mars' small moonlets **Phobos** and **Deimos:** if they are rich in elements scarce on the Moon, that would create export income for Mars at rates better than Earth sourcing

Known Gifted Locations:

- Areas with both towering ice-capped shield volcanoes and nearby "below sea level" depressions that provide lavatube networks for shielded settlements, enormous reserves of water, and areas where agriculture might take hold.
 - Examples: Olympus Mons and Elysium Mons border the great northern ocean-sized depression.
 - Pavonis Mons has the advantage of being on the equator ideal for a launch track up its western slope to reduce costs of lights to Earth and elsewhre and is closest to the upper reaches of the Valles Marineris depression. Lavatube "skylihgts" have been found on its flanks.
 - The Hellas Basin is deepest but not situated near any "known" ice reserves. (that is why we need a permafrost mapping satellite!)



Blue: lowest altitudes = **Red:** highest altitudes - **White:** ice caps on tall volcanoes

What we need to know, do, have if we are going to open Mars to settlement

- \$\$\$ Areo[Mars]-synchronous orbit satellites: continuous observation, communication, power
- Surveys of lavatubes in the flanks of Mars' massive shield volcanoes = (a GRAIL-type ebb & flo mission in orbits skimming over Mars surface: GRAIL has detected hidden lava tubes on the Moon.)
- Explore ways to Make Mars more "life-friendly" and at the same time, breed plants that can take root and grow to harvest as Mars' atmosphere is thickened and altered the "redhousing" project (see above) ##

For past articles, Visit http://www.moonsociety.org/publications/mmm classics/ or /mmm_themes/

Propellants for Lunar Spacecraft

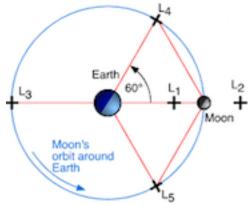
By Dave Dietzler

Nuclear Rockets

Barring the creation of high thrust fusion drives with incredible exhaust velocities that allow spaceflight with only tiny amounts of reaction mass, passenger flights from low Earth orbit to the Moon will use vast amounts of propellant. Nuclear fission rockets would use less propellant than chemical rockets, but the role of nuclear fission in space will probably be limited by publicly perceived and real dangers.

Propellant for chemical rockets that pass rapidly through the Van Allen radiation belts, unlike unmanned solar-electric cargo ships, could be obtained from the Moon and near Earth asteroids.

Lunar polar ice could supply liquid hydrogen and liquid oxygen for "Moon Shuttles" that travel between the lunar surface and a space station at **EML1**.



[Lagrange points are positions in an orbital configuration of two large bodies where a small object affected only by gravity can maintain a stable position relative to the two large bodies. EML! Is approximately 60,000 miles "Earthward" from the Moon.]

However, it is doubtful that ice will be easy to mine in super cold craters. Conditions there will make metals brittle and prone to breaking. Ice mining machines will need onboard nuclear power plants or receiving antennas to get power from microwave beams transmitted from stations on the crater rims. Although millions of tons of ice are believed to exist in perpetually dark craters the ability to mine that ice and produce propellant from it in the future may be limited.

It should be possible to extend hydrogen supplies by combining it with plentiful silicon to make silane—SiH4.°° Simple calculations show that by using silane and liquid oxygen it is possible to effectively double hydrogen supplies.

Isp 450 seconds for LH2/LOX Isp 340 seconds for SiH4/LOX

°° **Silane** is an inorganic compound with chemical formula, SiH₄. It is a colourless, flammable gas with a sharp, repulsive smell, somewhat similar to that of acetic acid. Silane is of practical interest as a precursor to elemental silicon. Wikipedia

Using online calculator at: http://quantumg.net/rocketeq.html it is found that for a 100 ton ship, payload and dry tank mass, and a delta velocity of 3200 m/s, enough to reach escape velocity from LEO, that 107 tons of LH2 and LOX would be required and 161 tons of SiH4 and LOX.

Running a hydrogen rich 1:6 fuel to oxidizer ratio like the Space Shuttle main engines, it is found that 107/7 = 15.3 tons of LH2 are needed.

Since SiH4 + 2O2 ==> SiH4 + 2H2O Si atomic mass is 28, H2 is 2 and O2 is 32

28 + 4 + 64 = 96 (4/96)X(161) = 6.7 tons of hydrogen with silane and LOX, less than half as much as is required with LH2 and LOX.

Other fuel options

It should also be possible to build rockets that burn **aluminum powder and liquid oxygen** in the form of a monopropellant slurry as demonstrated by Wickman (see: http://www.wickmanspacecraft.com/lsp.html) This propellant combination is not very powerful and a tank full of monopropellant is like a loaded bomb. It might be more effective if Moon Shuttles use bipropellant rockets burning a fuel consisting of a silane and metal powder (aluminum, magnesium or ferrosilicon) slurry. This could greatly extend hydrogen supplies.

Cost factors will come into play. Water can simply be split into hydrogen and oxygen by electrolysis and these gases can be liquefied in Sun shielded space radiators exposed only to the cold of outer space. Ferrosilicon and oxygen can be produced by magma electrolysis. Magnesium can be obtained by silicothermic reduction of magnesia. Aluminum production by electrolysis may require carbon, chlorine, a flux of lithium chloride, or other

elements not common on the Moon. Chlorine is also needed for silane* synthesis but it can be recycled. Making silane is complex but the whole process can be automated and without labor costs prices can remain low. If the greater complexity of producing silane and metal powders does not spell higher prices this could be a better way to fuel Moon Shuttles based on the assumption that ice mining and hydrogen production will be costly and limited.

Spaceships traveling from LEO to a spaceport at Earth Moon Lagrange point one (EML1) will probably be filled with propellant derived from near Earth objects. Industrial bases on the Moon will be "bootstrapped" from a minimal mass of machinery that makes maximal use of on-site materials to self replicate and build mines and mass drivers. Lunar materials would be used to build space shipyards perhaps at L5 where artificially intelligent robotic asteroid mining ships and tankers are built.

Fuel from asteroids

Carbonaceous chondrite asteroids can be over 20% water and a few percent organics in material resembling kerogen. The stony component of these asteroids consists mostly of oxygen, silicon, iron, magnesium, small amounts of aluminum and calcium, and numerous trace elements.

Once again, there is access to lots of silicon to make silane and extend hydrogen supplies. Asteroidal material would be mined, crushed up, and roasted with solar heat to drive off water and organic compounds. This dried out material could be treated with fluorine to displace oxygen in minerals and form tetrafluorosilane gas (SiF4, b.p. minus 86 C.). Oxygen and SiF4 could be separated with membranes. The SiF4 would be decomposed at 850 C. with solar heat to get silicon and recover fluorine. Alternatively, something like a giant mass spectrometer could separate all elements in the asteroid.

All that useless rock that was sought after for its water and organics now becomes valuable property. It becomes a source of oxygen for breathing and propellant and a source of silicon for silane and solar panels. Silica, SiO2, the main component of glass, obtained by re-oxidizing silicon or boiling it directly out of minerals in the vacuum with focused solar rays, can be used for construction in space.

Glass/glass composites*

Glass fibers have more tensile strength than steel. Fiberglass made with a polymer matrix from asteroidal organics could find many uses. Iron can be combined with carbon via the ancient crucible steel method. Rods of iron are packed in carbon powder and brought up to red heat for a few days with free solar energy.

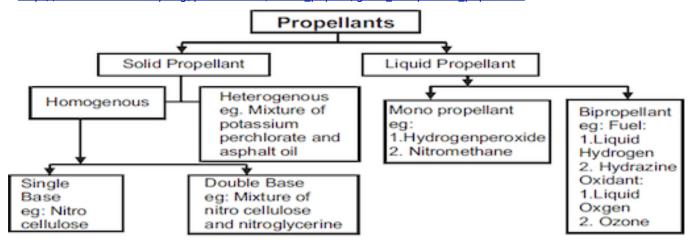
Carbon dissolves into the iron and forms steel. Space stations and space colonies could be built with steel. Magnesium is a respectable metal compared to unalloyed aluminum and it will not catch fire in the vacuum of outer space. It is a good reflector.

Sheets and foils of magnesium could concentrate solar energy onto silicon photovoltaics and increase their power output. It would also be wise to consider slurry fuels made of silane, iron and/or magnesium powders. Magnesium is shock sensitive in liquid oxygen and will detonate. Tanks of magnesium and liquid oxygen slurries might be ignited with electric sparks for blasting into asteroids.

Transporting all this material mined by unpaid robots that never sleep through space will be a challenge. Solar electric propulsion is very efficient and requires only meager amounts of reaction mass. Solar sails many kilometers in diameter or magnetic sails like those envisioned by Andrews and Zubrin might move mountains of raw material through space with no propellant at all.

Finally, one must wonder if it will be more profitable to mine small numbers of large asteroids over a kilometer wide and just take the materials wanted and leave the slag behind, or bag and capture large numbers of small asteroids just tens of meters wide and use every last bit of them for propellant and space construction materials in Earth-Moon space? ##

* http://www.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm



http://www.ustudy.in/node/9853

THE MOON SOCIETY - LUNAR FRONTIER SETTLEMENT - WWW.MOONSOCIETY.ORG

From Africa to the Moon, the Human Epic, told in footprints, Continues to the Stars!







Our Goal is Communities on the Moon involving large scale industrialization and private enterprise.

The Moon Society Journal Section (pages 9-12)

About the Moon Society

Objectives of the Moon Society include, but are not limited to:

- Creation of a spacefaring civilization, which will establish communities on the Moon involving large-scale industrialization and private enterprise.
- Promotion of interest in the exploration, research, development, and habitation of the Moon, through the media of conferences, the press, library and museum exhibits, and other literary and educational means
- Support by funding or otherwise, of scholarships, libraries, museums and other means of encouraging the study of the Moon and related technologies
- Stimulation of the advancement and development of applications of space and related technologies and encouragement their entrepreneurial development
- Bringing together persons from government, industry, educational institutions, the press, and other walks of life for the exchange of information about the Moon
- Promoting collaboration between various societies and groups interested in developing and utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to individuals and organizations that have contributed to the advancement of the exploration, research, development, and habitation of the Moon, as well as scientific and technological developments related thereto.

Our Vision says it all - "Who We Are and What We Do" - www.moonsociety.org/spreadtheword/whowhat.html We envision a future in which the free enterprise human economy has expanded to include settlements on

the Moon and elsewhere, contributing products and services that will foster a better life for all humanity on Earth and beyond, inspiring our youth, and fostering hope in an open-ended positive future for humankind.

Moon Society Mission: to inspire and involve people everywhere, from all walks of life, to create an expanded Earth-Moon economy that contributes solutions to the major problems that challenge our home world.

Moon Society Strategy: We seek to address these goals through education, outreach to young people and to people in general, competitions & contests, workshops, ground level research and technology experiments, private entrepreneurial ventures, moonbase simulation exercises, tourist centers, and other means.

Interested in having input? Any member may ask to join the Leadership Committee and attend our Management Committee meetings held twice monthly. You may even express opinions. Decisions are often made by consensus, so this input has value. Write president@moonsociety.org

From Moon Society President Ken Murphy



I had a couple of interesting discussions recently. One was with the Dallas Mars Society, who asked me to present to them on the Moon. So I talked about cislunar space instead. It was fairly free-ranging and covered a lot of topics (but still not all of them), and helped them to see things in a new perspective. They didn't find it compelling, a response we see often from those who don't want to accept better ideas because they've invested so much in their agendas. I have een challenged to a public debate by the chapter president, so we'll see how that goes.

At the meeting we also heard from a young gentleman who was helping to put together a Political Action Committee (PAC) for space matters. This comes on the heels of recent efforts to get legislation put in place to make space settlement a priority for NASA. While legislation is nice, it's really the funding that matters, and as we've seen Congress can barely put its money where its mouth is as it is. Coupled with an ossifying workforce at NASA, and we've got a recipe for the kind of aimless, directionless efforts we see now. What's needed more than legislation right now is a serious rejuvenation of the NASA workforce, passing the torch from the Shuttle generation to those who follow. Less emphasis on Earth wouldn't hurt, either. There's a whole lot of space out there to discover, and a whole lots of folks studying the Earth already. It only serves to confuse the public, as a rep from SpaceCenter Houston (representing NASA Johnson) noted to me at Earth Day recently here in Dallas.

The Moon Society – Lunar Frontier Settlement – www.moonsociety.org p.2

Still, the message of cislunar space is getting out there. One recent addition to the effort is by Dr. Paul Spudis, who recently published "The Value of the Moon". Whilst a little too heavy on background, and a little too focused on water, the book does nevertheless at least touch on many of the interesting things to do on the Moon if we're going to be living and working there. In the regard it's well worth a read.

Members that can make it are encouraged to attend the International Space Development Conference in Puerto Rico this year. We do need to try to represent as best we can, even at the space conferences. There's a lot of effort going into "#Journey2Mars", and we need to be sure our voice of reason is not lost in the chorus of Arean ambitions. Economics and business are something that most folks 'get', to a greater of lesser extent, and that's what cislunar space, development of the Moon, and The Moon Society are all about. There's an old political saying that "It's the economy, stupid", and that will hold true no less in space than here on Earth. Our Moon and cislunar space are the proving grounds for that – let's get to work! **KM**

For our Yuri's Night Party, MLRS produced a list of other Human "Space Firsts"

By Peter Kokh (additions and corrections welcome! - kokhmmm@aol.com)

- 1st to orbit more than once Gherman Titov first person to orbit the Earth multiple times (a total of 17), to spend more than a day in space, to sleep in orbit and to suffer from space sickness August 6, 1961
- 1st woman in space: Valentina Tereshkoca: on Vostok 6, June, 16 1963
- 1st spacewalk: Alexey Leonov: March 18, 1965, he became the first human to conduct extraehicular acitivity (EVA) the first space walk,, exiting the capsule during the Voskhod 2 mission for 12-minute spacewalk.
- Ist hookup in space Apollo-Soyuz July 17, 1965 Tom Stafford and Alex Leonov shake hands: also on this mission, Vance Brand and Deke Slayton (US) and Valeri Kubsov (USSR)
- Ist persons on a "space station" -
- 1st trip around the Moon, Apollo 8, December 24, 1968: First persons to $\sqrt{}$ pass through the Van Allen belts; $\sqrt{}$ to travel beyond low Earth orbit, $\sqrt{}$ to travel out of sight of Earth, and $\sqrt{}$ to see an "Earthrise"

Commander Frank Borman, Command Module Pilot James Lovell, and Lunar Module Pilot William Anders — became the first humans to travel beyond low Earth orbit, the first to see Earth as a whole planet, the first to directly see the far side of the Moon, and then the first to witness Earthrise. maximum distance from Earth of 203,752 nautical miles (234,474 statute miles; 377,349 kilometers)

- Ist man on the Moon: Apollo 11: Neil Armstorng and Buzz Aldrin landed on July 20, 1969
- The first space station, Salyyt 1, was launched by the Soviet Union on April 19, 1971 with cosmonauts Vladimir Shatalov, Aleksei Yeliseyev, and Nikolai Rukavishnikov on board. They were the first persons to die in space.
- 1st drive on the Moon: Jim Irwin with the Lunar Roving Vehicle, Apollo 15, July 31, 1971

What did we forget?

We welcome additions and corrections! As well as a list of human firsts yet to be realized.

Note: While I did list the first woman in space, in general, this is a list of first person achievements, which happens to "male heavy" If I were to make an addition, it would be (below):

Some suggestions

- The first person to sing "country" in space, Shannon Lucid, on the Mir EO-21 mission, March 22-Sept. 26, 1996 [Do purchase the DVD of her singing country music on board MIR (along with Russian "Country" by the cosmonauts) http://www.amazon.com/Mission-To-Mir-IMAX-VHS/dp/B00005MEPF
- First Crew to Repair a Satellite: the Hubble Space Telescope: Shuttle Endeavour Mission STS 61, December 2-3, 1983 Kathryn Thornton and Tom Akers six hours, 35 minutes

Feats to come

- $\sqrt{\text{First person to relocate to the Moon for the rest of his/her life and leave Earth behind}$
- $\sqrt{\text{First person to be born on the Moon}}$
- $\sqrt{\text{First person to set foot on Mars}}$
- $\sqrt{\text{First person to go to Mars to stay}}$
- $\sqrt{\text{First person to be born on Mars}}$
- $\sqrt{}$ First crew to visit one of Jupiter's moons, Etc. ##

Out of Africa to the 8th continent (the Moon) and beyond, to The Stars!

We humans recognize only temporary limits
and continue to explore new horizons beyond the next hill. PK

The Moon Society – Lunar Frontier Settlement – <u>www.moonsociety.org</u> p. 3

Keeping up with the Space News - How we do it

By Peter Kokh, editor MMM, issues #1-Current (almost 30 years)

A feature of MMM, for well over ten years, has been lists of "Space News Browsing Links." In putting this list together every month, I have been using a variety of sources, but I started with just one. The Moon Society had arranged for the current daily "space news" (guided by a number of key words which we had supplied) from a free web search service]. http://www.moonsociety.org/zebrafeeds/demo.php?zflist=Space-News&zftrim=20news

This service automatically put the latest new on our home page. While the web team that designed the current Moon Society website from scratch, chose not to incorporate this feature, the old site is still up, but not advertised, and the news service is still working, and I access it via **the address above**, checking it daily.

Hint to the current web team. Members/ visitors can access this site by the addition of one short link on the new home page: "today's space news."

I have also found a number of other sources, most of them updated weekly

- www.space.com --- http://www.moondaily.com --- http://www.marsdaily.com
- http://www.saturndaily.com --- http://www.terradaily.com ---http://www.spacedaily.com
- http://www.solardaily.com">http://www.solardaily.com --- http://www.solardaily.com

I have also found a number of other sources, most of them updated weekly

- www.space.com --- http://www.moondaily.com --- http://www.marsdaily.com
- http://www.saturndaily.com --- http://www.terradaily.com ---http://www.spacedaily.com
- http://www.skynightly.com --- http://www.gpsdaily.com --- http://www.solardaily.com

It is not uncommon for the same story to be listed on more than one of the above sites.

The latest addition to my source list, updated weekly, includes news these other sites may miss.

• http://phys.org/space-news/ - articles on this site, when they cover a story found on one or more of the sites above, tend to be a bit more complete and professional. More importantly, this site commonly lists one or more relevant space news items missed by the othr sites.

I cover all these news items (with an image if any and a paragraph or two, not just give the link) in **To The Stars International Quarterly** – published at the start of January, April, July, October.

TTSIQ issues are online: www.moonsociety.org/international/ttsiq/ & www.nss.org/tothestars/ ##

Participate at National Space Society International Space Development Conferences

By Peter Kokh

The Society has tried to have a noticeable presence at the annual ISDCs. Dave Dunlop and Ken Murphy have worked hard to see that each ISDC has a "Lunar Track" with interesting speakers.

They could use help (or relief) from other Society members.

The 2016 conference in San Juan, Puerto Rico will soon be over.

But we have a good crew - our joint MoonSociety / National Space Society crew - working on ISDC 2017 in St. Louis, MO. in the middle of the country. http://isdc.nss.org

The Milwauked chapter has donated its Moon Manor tabletop lunar homestead exhibit to St. Louis.

http://freemars.org/mnfan/ISDC/2010-Chicago/2010-05-28-101.jpg

We hope to be one of the speakers.

No chapter in your area? Organize a local contingent to attend the conference – this may be a way to attract new local members and launch a chapter, with ISDC attendance as its first project.

Existing chapters may want to reserve a display table, or help in other ways.

Perhaps, together, we can host one of the meal events.

If you are planning on attending, let us know. The more the merrier, and the more "constructive mischief" we can stir up.

https://www.facebook.com/permalink.php?story_fbid=1053839458029276&id=566953720051188

The Moon Society – Lunar Frontier Settlement – www.moonsociety.org p. 4



ORGANIZED CHAPTERS

Milwaukee Lunar Reclamation Society - http://www.moonsociety.org/chapters/milwaukee/ http://www.meetup.com/Milwaukee-Space-Exploration-Meetup/ - http://www.space-Mlwaukee.com Contact: Peter Kokh - kokhmmm@aol.com - MEETINGs, 2nd Sat 1-4 pm monthly except July, August,

At Mayfair Mall lower level Community room G150 for all meetings except December, in G110: Upcoming Meetings: MAY14, JUN 11, SEP 10, OCT 8, NOV 12

At the April 9th meeting, we put together a list of other human firsts in space, in observance of Yuri's Night - see above. We also discussed retaining our Meet-up site and measures to make our participation more fruitful. Earth Dav # 46

I applied for a table at the Washington Park Urban Ecology Center, for the Saturday April 23 9am-1pm Earth Day event - and at another observance in West Allis, Sunday, Both requests were turned down as "not appropriate." Our Theme: "Mother Earth & Father Sky: What would Earth be like without the Sun and the Moon?"

But I attended both events and I could see that my Mother Earth and Father Sky exhibit would not have fit in. Both events were designed for children with focus on gardens and local wildlife.

At the Sunday event I talked to the organizer who introduced me to someone else with whom she is working on a series of lectures for later this summer or fall. They both liked my exhibit materials and definitely wanted me to join in as a speaker. So all was not lost.

Moon Society St./NSS Louis Chapter - http://www.moonsociety.org/chapters/stlouis/

http://www.meetup.com/Saint-Louis-Space-Frontier-Meetup/

Contact: Robert Perry surfer bob@charter.net - Meetings 4th Saturday of the month in room 162 of McDonnell Hall of Washington Univ. (2016) MAY 28, JUN 25, JUL 23

Gateway to Space 2016 was a highly successful day and a half event iat Boeing St. Louis was highly successful. Participants gave the conf.

NSS/Moon Society Phoenix Chapter - http://nssphoenix.wordpress.com/ - c/o Mike Mackowski. http://www.meetup.com/NSSPhoenix/events/161939572/ - (blog) http://nssphoenix.wordpress.com Meeting 3rd Saturdays monthly at Humanist Community Center, Mesa, 627 W. Rio Salado Parkway. NEXT MEETINGS (2016) MAY 20, JUN 18, AUG 20, SEP 17. At the April meeting, our own Mike Clark presented some of the aerospace news videos he produces for the on-line TMRO webcasts (https://www.tmro.tv)

Tucson L5 Space Society - Now serving Moon Society Members www.tucsonspacesociety.org/ (not updated) www.meetup.com/NSSPhoenix/events/161939572/ (not updated)

Contact: Al Anzaldua - Meets monthly, every 2nd Saturday, 6:30 PM

Clear Lake NSS/Moon Society Chapter (Houston) -http://www.moonsociety.org/chapters/houston/

Contact: Eric Bowen eric@streamlinerschedules.com - Meeting 7 pm 3rd Mondays of even # months in the conference room of the Bay Area Community Center at Clear Lake Park: (2016) JUN 20

Our April chapter meeting was rescheduled for Monday evening, April 25, 2016. Dr. Larry Friesen presented highlights from the recent LPSC 2016 conference.

Local Contacts

No Chapter in your area? If you are willing to be listed as a local contact, let us know and we can list you and the proposed chapter area (Zip Codes) If there are other members in that area we will let you know.

Non-geographic chapters

An option not pursued to date is for activity groups organized around a project or special area of interest rather than physical meetings. These can be temporary, focused on a specific project (such as the creation of our **Solar** Power Beaming Desktop Demo Unit (2008) - http://www.moonsociety.org/projects/spb-demo/online_kit/ Or a re-energized crew to work on our Lunarpedia - http://www.lunarpedia.org/index.php?title=Main_Page Or a group focused on creation of more realistic artwork of lunar outposts and settlements. The options are as wide as our collective talents. ##

OCTOBER 2015 SPACE NEWS BROWSING LINKS

SPACE STATIONS + ROCKETS + COMMERCIAL SPACE

www.space-travel.com/reports/Russia_to_shift_all_Lunar_launches_to_Vostochny_Cosmodrome_999.

www.space.com/32453-blue-origin-launches-and-lands-rocket-third-time.html

www.space.com/32463-xcor-lynx-space-plane-2017.html

www.spaceflightinsider.com/organizations/isro/india-launch-reusable-spaceplane-may

 $\frac{https://blogs.nasa.gov/spacestation/2016/04/16/beam-successfully-installed-to-the-international-space-station/spacesta$

www.nasa.gov/press-release/nasa-works-to-improve-solar-electric-propulsion-for-deep-space-exploration

EARTH + NEAR SPACE

www.space-travel.com/reports/**The_Moon_thought_to_play_a_major_role_in_maintaining_Earths_magnetic_fiel d** 999.html

http://phys.org/news/2016-04-proof-ancient-supernovae-zapped-earth.html

www.spacedaily.com/reports/Six to 10 million years ago Ice free summers at the North Pole 999.html

MOOD

www.space_travel.com/reports/**The_Moon_thought_to_play_a_major_role_in_maintaining_Earths_magnetic_fiel d** 999.html

www.universetoday.com/128208/buried-lave-tubes/

www.space.com/32631-radioactive-iron-supernova-apollo-moon-rocks.html

www.space.com/32695-moon-colony-european-space-agency.html

MARS

www.marsdaily.com/reports/Mixed_Reality_Technology_Brings_Mars_to_Earth_999.html

http://phys.org/news/2016-03-mile-high-mars-mounds-built-climate.html

www.space.com/32440-mars-life-search-argyre-basin.html

http://phys.org/news/2016-04-scientists-gypsum-formsand-mars.html

www.space.com/32466-mysterious-mars-mounds-were-liquid-filled-craters.html

www.space.com/32715-china-mars-moon-exploration-plans.html

www.spacedaily.com/reports/NASA_rocket_fuel_pump_tests_pave_way_for_methane_fueled_Mars_lander_999.html

www.space.com/32563-how-buzz-aldrin-took-a-virtual-walk-on-mars.html

www.space.com/32719-spacex-red-dragon-mars-missions-2018.html

www.space.com/32716-nasa-augmented-reality-tech-mars-exploration.html

ASTEROIDS + COMETS

http://phys.org/news/2016-04-asteroid-hunting-spacecraft-year.html

http://phys.org/news/2016-04-team-clathrate-ices-comet-67p.html

OTHER PLANETS + MOONS

http://phys.org/news/2016-04-team-clathrate-ices-comet-67p.html

www.space.com/32742-juno-spacecraft.html

www.space.com/32597-europas-deforming-ice-is-a-surprising-heat-generator.html

www.spacedaily.com/reports/Cassini_Spies_Titans_Tallest_Peaks_999.html

www.space.com/32437-titan-hidden-surface-global-map.html

www.esa.int/Our_Activities/Space_Science/Cassini-Huygens/Profile_of_a_methane_sea_on_Titan

http://phys.org/news/2016-03-sustained-eruptions-icy-moon-saturn.html

www.spacedaily.com/reports/lcy_Spider_on_Pluto_999.html

www.space.com/32710-pluto-halo-craters-mystery-new-horizons.html

www.space.com/32508-what-planet-nine-looks-like-possibilities.html

http://www.spacedaily.com/reports/Planet X takes shape 999.html

www.space.com/32702-dwarf-planet-makemake-moon-hubble-discovery.html

ASTRONOMY + ASTROBIOTICS

www.space.com/32702-dwarf-planet-makemake-moon-hubble-discovery.html

http://phys.org/news/2016-04-physicists-rare-brown-dwarf-essential.html

 $\underline{http://phys.org/news/2016-04-\textbf{earthsthe-chemistry-star-planet-formation}.html}$

www.space.com/32499-nearby-rogue-alien-planet.html

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or /mmm_themes/

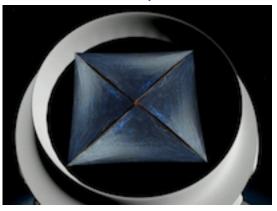
STAR TRAVEL AT LAST - UNBELIEVABLE !!!

Stephen Hawking & Russian Billionaire Want to Build Interstellar Starship

http://gizmodo.com/a-russian-billionaire-and-stephen-hawking-want-to-build-1770467186 http://gizmodo.com/watch-live-as-stephen-hawking-deliver-a-mysterious-anno-1770489990

www.space.com/32548-20-percent-light-speed-to-alpha-centauri-nanocraft-concept-unveiled-video.html





Left: Hawking speaking through apparatus

Right: rendering of proposed interstellar sail

"Breaktrough Starshot"

12 April, 2016 – Last year, the search for extraterrestrial intelligencegot a major boost when Russian billionaire Yuri Milner unveiled a \$100 million effort to scan the skies for radio and light signals emitted by aliens. Not content to simply sit tight and wait for ET to hail us, Milner now plans to build an interstellar spacecraft.

Light-propelled "nanocrafts" that can travel at relativistic speeds Reaching Alpha Centauri, just over 20 years after launch

www.space.com/32560-alpha-centauri-what-we-know.html https://en.wikipedia.org/wiki/Alpha Centauri

Three stars for the price of one

Not only is Alpha Centauri two stars which, each with its own planets, revolving around one another, but they have a third companion at some distance, Proxima Centauri. A super target!

In a joint announcement at the One World Observatory in New York City today, Milner and Stephen Hawking unveiled **Breakthrough Starshot**, a \$100 million research/engineering program to lay the foundations for an eventual interstellar voyage. The first step involves building **light-propelled "nanocrafts" that can travel at relativistic speeds—up to 20 % the speed of light.** At such high velocities, the robotic spacecraft would **pass Pluto in 3 days and reach our nearest neighbor star system, Alpha Centauri, just over 20 years after launch. Starchip," a gram scale wafer – "the size of a postage stamp"**

Included: cameras, photon thrusters, power supply, navigation, and communication equipment.

Propelling that miniature science laboratory is a "Lightsail," a meter-sized sail that's only a few hundred atoms thick and weighs a couple of grams. The light sail will be launched away from the Earth by a phased array of lasers, carrying a combined power over 100 Gigawatts, similar to that needed to lift the Space Shuttle off Earth.

One hundred million miles per hour

By directing that much energy at an object weighing just a few grams, we can theoretically accelerate said object up to 100,000,000 miles per hour—a thousand times faster than the fastest spacecraft today.

The idea is to launch a small fleet of craft toward Alpha Centauri, allowing us to perform many, many New Horizon-like flybys of our nearest neighbor's potentially habitable real-estate. ##

For Comparison

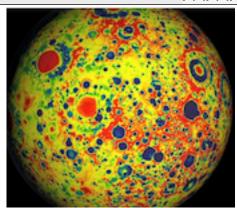
The **Voyager 1** probe, launched in 1977, 39 years ago, is currently about 20,070,139,746 KM from Earth, about 19 light <u>minutes</u> (a half light minute per year) – **Alpha Centauri** is **4.3 light <u>years</u> distant**.–

Comments

The aim better be accurte! Hopefully, some MMM readers will be alive, when 4.3 years after Starshot's arrival, confirmation signals and data about Alpha Centauri A and B and their planets gets back to us.

It's worth kicking any bad health habits to have a chance to see that day! PK

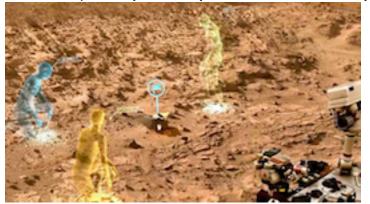
MMM PHOTO GALLERY





GRAILmission data points to possible lavatubes on the Moon: twin orbiters, Ebb and Flow (Right) Left: Map of variations in lunar gravity field, measured by Gravity Recovery and Interior Laboratory



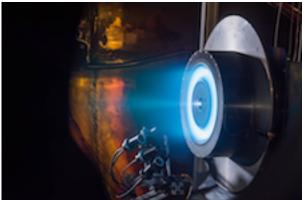


Left: Space-X "Red Dragon" crew capsule to be sent to Mars Right: Virtual presence on Mars





View of inflated BEAM module from outside (left) and inside (right) attached to the Space Station





NASA is working on "Solar Electric" propulsion systems

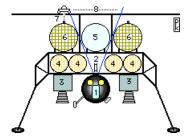
Selections from the

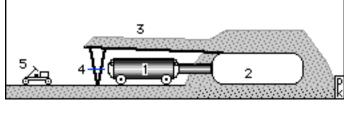


"MMM Speak"- New Words & Old Words with New Meanings http://www.moonsociety.org/publications/m3glossary.html

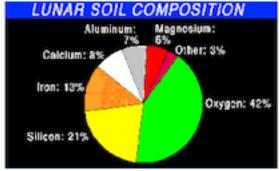
Amphibious Space/Surface Vehicles - In ordinary usage, an animal that is at home both in the sea and on the land. An Amphibious Vehicle on Earth means a craft that can ply the seas as well as land like the "Duck" of World War II familiarity. Here we apply it to a space craft that has an extendable chassis that allows it to drive on the lunar surface after landing.

The **Frog** version is one designed for repeated use both in space and on the lunar surface where its use would be confined to trips between the landing-launch site and a lunar surface habitat with which it would dock, sharing systems aboard the craft with which the waiting habitat had not been provided.





Building Materials from Moondust – Some of the materials we are used to using here on Earth are also abundant on the Moon, but others are not.



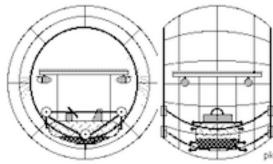




"Cupbar Znaunch"

Cagemobile – a vehicle inside a wheel, or unicycle capable of traversing uneven terrain while remaining erect. It could be solar powered or occupant-powered.

A driver pod rides the inside rails of a Lunar Squirrel; Cagemobile tire-frame. Suspended above the weighted driver pod is a solar power array that also supplies some shade, and which is equipped with lights for nightspan operation. This vehicle should be able to negotiate rolling terrain fairly well.



Copernica – We call our star "**The Sun"** because it provides us with sunshine and creates our days. But so will every intelligent species, using its own common word for "the sun." This is what is called a "role name" much like "father" (as opposed to mister so and so), "mother" and so on.

Should we give our sun a proper name? We name many other prominent stars in our nighttime skies, and surely if there is one star that is extra special, at least to us, it is our own star, "the sun." Most of us don't even bother to capitalize it.

"Copernica" is a suggestion. Nikolas Copernicus was the first person to demonstrate that the Sun, not Earth, was the center of our solar system. It would be appropriate to name our home star after him. There are other suggestions, of course. ##



NSS Chapters that share Moon Miners' Manifesto





WISCONSIN



MLRS - Milwaukee Lunar Reclamation Society

PO Box 2101, Milwaukee, WI 53201 - www.space-Milwaukee, WI 53201 - www.space-Milwaukee.com - http://www.meetup.com/Milwaukee-Space-Exploration-Meetup/

Ad Astra per Ardua Nostra = To the Stars through our own hard work!

PRESIDENT/MMM EDITOR • Peter Kokh NSS 414-342-0705 - kokhmmm@aol.com VICE-PRESIDENT Doug Armstrong NSS (414) 273-1126 - SECRETARY - Charlotte Dupree NSS (262) 675-0941 grdupree@charter.net

• <u>James Schroeter</u> (414) 333–3679 – <u>james_schroeter@yahoo.com</u> TREASURER/Database • <u>Robert Bialecki</u> (414) 372–9613 – <u>bobriverwest@yahoo.com</u> (• Current Members of the MLRS Board of Directors)

Saturday, April 9th we celebrated Yuri's Night in our regular meeting, with a list of human firsts in space Meetings 2016: MAY 14, JUN 11, (summer break), SEP 10, OCT 8, NOV 12, DEC 10

At the April 9th meeting, we put together a list of other human firsts in space, in observance of Yuri's Night – see above. We also discussed retaining our Meet-up site and measures to make our participation more fruitful. Earth Day: I applied for a table at the Washington Park Urban Ecology Center, for the Saturday April 23 9am-1pm – and another observance in West Allis, Sunday. Both requests were turned down as "not appropriate." Our Theme: "Mother Earth & Father Sky: What would Earth be like without the Sun and the Moon?"

But I attended both and I could see that my Mother Earth & Father Sky exhibit would not fit in. Both events were designed for children with focus on gardens and local wildlife. At the Sunday event I talked to the organizer who introduced me to someone else with whom she was working on a series of lectures for later this summer or fall. They liked my exhibit materials and definitely wanted me to join in as a speaker. So all was not lost. – PK

WISCONSIN



SSS - Sheboygan Space Society 728 Center St. Kiel, WI 54042-1034

www.sheboyganspacesociety.org c/o Will Foerster 920-894-1344 (h) astrowill@frontier.com SSS Sec./Tres. c/o B.Pat Knier dcnpatknier@gmail.org
DUES: "SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

2016 MEETINGs: JUN 18, AUG 18, OCT 20, DEC 15 - Call for location (920) 894-1344

CALIFORNIA



OASIS: Organization for the Advancement of Space Industrialization & Settlement Greater Los Angeles Chapter of the National Space Society PO Box 1231, Redondo Beach, CA 902 - oasis@oasis-nss.org

Events Hotline/Answering Machine: 310-364-2290 - Odyssey Ed: Kat Tanaka odyssey_editor@yahoo.com

Regular Meeting 3 pm 3rd SAT monthly -2016 May 20, Jun 18, Sep 17, Oct 15, Nov 19, Dec 17

COLORADO



DSS: Denver Space Society fka Front Range L5
1 Cherry Hills Farm Drive, Englewood, CO 80133
http://www.denverspacesociety.blogspot.com/

Eric Boethin 303-781-0800 <u>eric@boethin.com</u> - Monthly Meetings every 3rd Thursdays, 7 pm Englewood Public Library, Englewood, CO 80110 - 1000 Englewood Parkway, First Floor Civic Center 2016 MEETINGS: MAY 19, JUN 16, JUL 21, AUG 18, SEP 15, OCT 20, NOV 17, DEC 15

ILLINOIS



LDAhean@aol.com

CSFL5: Chicago Space Frontier L5 - 610 West 47th Place, Chicago, IL 60609



MSFS: Minnesota Space Frontier Society - http://www.mnsfs.org c/o Dave Buth, 433 South 7th St. #1808, Minneapolis, MN 55415

MNSFS monthly meetings are held on the first Thursday of each month at the Fairview Community Center (Great Room), 1910 County Road B West, in Roseville, MN 55113 Meetings usually start at 7:00 p.m. and last about two hours. Each meeting features Board member introductions, general announcements,

We celebrated **Yuri's Night** Saturday, April 9th, 6pm, at Unhinged Pizza, 425 Merger Street & Hwy 212, Norwood/Young America, MN

2016 MEETINGS: 1st Thurdays: MAY 5, JUN 2, JUL 7, AUG 4, SEP 1, OCT 6, NOV 3, DEC 2





Oregon L5 Society - http://www.OregonL5.org PO Box 86, Oregon City, OR 97045

(LBRT - Oregon Moonbase) moonbase@comcast.net - Charles Radley: cfrjlr@gmail.com

We meet 3rd Saturday monthly at 2:00 PM - 2016 Schedule May 20, Jun 18, Sep 17, Oct 15, Nov 19, DEC 17

PENNSYLVANIA



NSS-PASA: NSS Philadelphia Area Space Alliance 928 Clinton Street, Philadephia, PA, 19107

c/o Earl Bennett, <u>Earlisa t@verizon.net</u> - 856/261-8032 (h), 215/698-26 00 (w) http://pasa01.tripod.com/ - http://phillypasa.blogspot.com/

Meetings 3rd Thurs 2016 MAY 19, JUN 16, JUL 21, AUG 18, SEP 15, OCT 20, NOV 17, DEC 15

The NSSPASA Report for April 2016

Meeting times and dates: In April we will have meetings at several events after our main meeting (see below). Our May meeting will be at the Liberty One Food Court, May 14th, as will our June meeting on the 11th. April Events: A number of our members will be presenting and supporting space exploration at several venues: Frank O'Brien and Mitch Gordon will do outreach at The Port Richmond Public Library in Phiuladelphia, Frank will also do Sidewalk Astronomy as the primary presenter, Mitch Gordon will support a Thomas Jefferson University location, and, Associate Member Michael Stewart (who has independently done Sidewalk Astronomy also) may do it as part of NSSPASAs' service commitment as part of the Science Festival and Science Carnival. Many of us will do public outreach on April 30 at The Great Plaza on the Penns'Landing by the Delaware River in Philadelphia. Earl is presenting a new display on spacecraft propulsion.

Corrections: Hank Smith has pointed out several errors in my March Report: We meet on Saturday's, not Thursday's. He has pointed out that he enjoys being a visitor to Balticon and does not help at the event. And finally: the NASFIC science fiction convention is held when the World Science Fiction Convention is not in the United States. The World Con could be in Canada, but, the NASFIC would be held in the U.S.. Clear?

Larry reported on our web activity and his additions to the website: he has added a changing color scheme, and a weather indicator to the sites. Both sites are active with the new site he is improving getting more hits. Some of them are from New Zealand and other distant countries. He has "ported" us to a number of devices and built the interfaces to achieve this. He has collected a lot of statistics on which devices are being used to view our content. He can even determine the resolution of the display used. Excellent!

Dorothy brought material on the Science Festival noted above, but, also pointed out that the Franklin Institute will be holding 3D printing classes on May 7 and June 11. If you plan to attend these, sign up now. They tend to fill quickly. Each class is stand alone and runs from 2 to 5 p.m. . It is best to bring a laptop for the requisite software. Ticket prices are \$40 for members and \$50 for non members. See the sites for more! Several good movies including: Dark Universe and To Space and Back both at the Planetarium. And Journey To Space (in Imax format) at the large screen theater are showing. Both Dorothy and Larry will be going to Balticon, having booked a room well in advance, and Dorothy will do the all faiths service, mentioned in the previous report, on the Sunday of the event.

Hank Smith will also be attending Balticon and reports that Philcon will be held from November 18th to the 20th. The fliers he passed out gives C.J.Cherryh as the Principal Speaker and Dave Seely as Artist Guest of Honor. The rates are: \$45 till 7/31/16 for adults and a special rate for active military of \$25 (and students also). See there site for more. As Hank will assist in science programming again Mitch suggested that we submit ideas for panels and presentations now for consideration.

Mitch brought details of the Science Festival and Carnival and the Astronomy night activities on the 22nd. These happened before the rain we experienced. On April 28 Mitch and Frank will be part of a multi exhibitor group at the Port Richmond library (where I was a Page in the 1960s), and then we go to The Great Plaza on Saturday for the Carnival. Lots of fun!

Earl brought material on "Tabbys' Star and rumors of the new "Star Chip" interstellar probe (or probes!) that could be launched in the next ten years. This is moving into the really possible range due to the backers being both very wealthy and smart. I have received a posting from some friends asking about this and listing the participants. I believe this could be done, but, the energy levels are prodigious: the goal, as I understand it, is to boost the probes to .1C for the trip to the Alpha Centauri system. The equation for this (neglecting relativistic effects) is ½ M*(V) squared. The energy to boost a one kilogram mass to .1C at the end of the acceleration would rival the power of a national power network (terra joules). The plan is to use lasers to drive the craft to this speed. Even if we shrink the mass by 1000, using nano technology for example, it would still need giga watts to move it up to .1C. A space based nuclear power plant could produce the energy, but, the developers may have something better. And remember: the probe(s) will have to send data back. What will we build to communicate with them! We could repurpose our SETI networks to this job to test them. On Tabbys' Star: in the May issue of Analog Science Fiction and Fact, in the Alternate View column by John G. Cramer, is the description of a Kepler Space Telescope planet hunt that may have found signs of an extra terrestrial civilization. Something is blocking part of KIC8462852 (Tabbys' Star, after Tabitha S. Boyajian who led the team of professional and an amateur astronomers). The great thing is that observed dips in the stars output can be as high as 22%! The report in Analog mentions Olaf Stapletons "Star Maker" and Freeman Dysons' Sphere (or more accurately "swarm"). Blocking such a large part of the stars visible light would require a huge amount of material to do this. At ~1500 light years we will not be visiting soon, but, we should point some infrared instruments at it (looking for the "waste product" of long wave light from the objects intercepting the visible light mentioned). See the article and the list of references. Wow! And from a special supplement to Advanced Manufacturing on Energy (April issue of Manufacturing Engineering) is the article on what it takes to build a part for a fusion plant: "Laser Trackers Help Keep Fusion Project from Falling into Confusion" about the tooling that is used to measure the massive parts to micron levels of precision. See Levio Valettis' article on page 30 about his companies part in making the fusion plant, that is to start in 2020, work.

There is much more, but, The report must be filed! - Earl Bennett, President, NSSPASA, KD2CYA.

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