"Towards an Earth-Moon Economy – Developing Off-Planet Resources"

Moon Miners' Manifesto

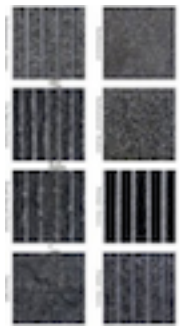
& The Moon Society Journal www.MMM-MoonMinersManifesto.com

ABOVE: Remote places on Earth with extremely difficult access have appealed to intensely spiritual persons who wished to withdraw from the "world" to better devote themselves to spiritual growth. "Difficult to reach" places on the Moon, Mars, and out among the asteroids and distant moons may someday carry on this tradition.

Feature Articles (ideas)

2. In Focus: Monasteries in Space far from the world's distractions & problems – Peter Kokh
3. Space Monastery Economics on the Moon's Farsude – Peter Kokh
4. Off the beaten track, yet special potential monastery sites on Mars – Peter Kokh
   Lunar Homes of Extruded Basalt – Dave Dietzler
7. Products we can make on the Moon from Glass and **Basalt** [basalt images below] – Dave Dietzler





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- **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.
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● **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.

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

In Focus Monasteries in Space far from the world's distractions & problems

By Peter Kokh

From Wikipedia: Monasticism (from Greek μοναχός, monachos, derived from μόνος, monos, "alone".) Monkhood is a religious way of life in which one renounces worldly pursuits to devote oneself fully to spiritual work. Monastic life plays an important role in many **Christian** churches, especially in **Catholic** and **Orthodox** traditions. Similar forms of religious life also exist in other faiths, most notably in **Buddhizm**, but also in **Hinduism** and **Jainism**, although the expressions differ considerably. In general, monks remained celibate (no sex.) ##

In many monasteries, silence is the rule, allowing individuals to go about their chores without interruption. Placing monasteries "off the beaten path in remote locations, helps them focus on meditation and prayer without interruption. But prayer is balanced with production of things of value to trade with the outside world. Of note, monasteries have played a key role in preseving ancient documents in the pre-printing press era.

While some monasteries exist in the heart of cities, most have been established well off the beaten path to minimize material distractions and visits by curious outsiders – in deserts, in mountanous areas, etc.

Would there be a place for such institutions on the Moon, Mars, and elsewhere in the Solar System? Could what they produce in trade for needs they cannot supply for themselves play a useful role as humanity spreads outwards from Earth? That's our theme topic for this issue. ##

Space Monastery Economics on the Moon's Farside

By Peter Kokh

Monasteries and their Monks must be self-sufficient and/or produce products and services in demand in "the outside world" in exchange for things they need to sustain their existance and work. Here is a partial list of such monastery products.

Scholarly Work and more

In the pre-printing press era, Monks produced many hand-scribed copies of valued manuscripts, incluing, bjg not limited to the Bible and other scriptures.

They also produced fine wines and other highly valued products

Monastery products in this day and age – a sampler (google "monastery products")

- www.anunslife.org/resources/gifts-handmade-nuns-monks
  Trappistine Quality Candy – candy and fudge as well as monastic products such as CDs, original icons and Chinese brush paintings, woolen throws, cards, and more.
- http://www.saintmeinradgiftshop.com/category.asp_Q_c_E_50027
- http://www.communityofsaintbenedict.org
- http://www.monasterygreetings.com/

Monastery products in the space age – products from isolated places

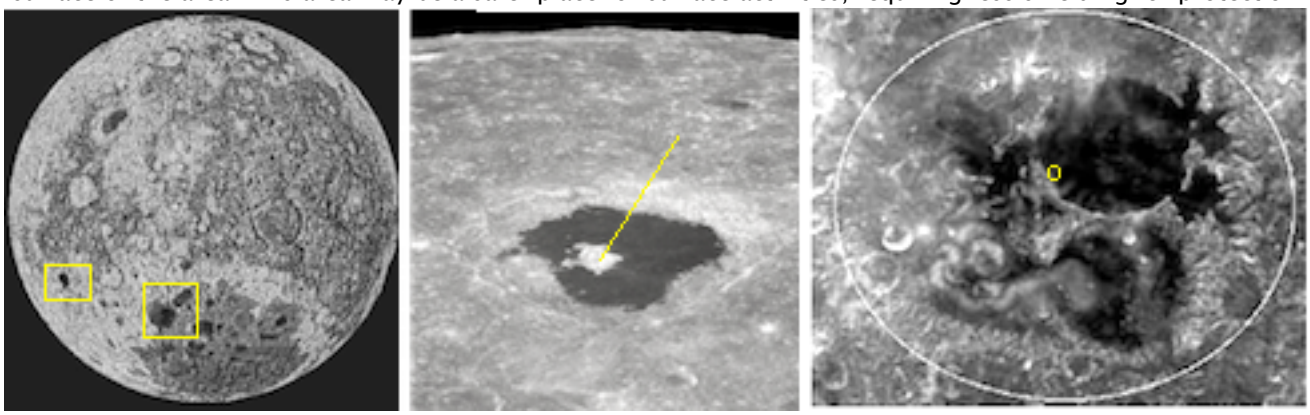
Now here is the catch! The monastery needs to be located near enough to potential customers. No one is more inclined to buy "special products" than the tourist. Yet the location has to be isolated enough to protect the monks' spiritual frame of mind free of distractions as well.

That suggests two places on the Moon's Farside.

Here on the Moon's Farside, Earth is never in view, just the heavens as dark and star-studded as one could ever hope to see – during local nightspan of course. And this is the essence of the tourist attraction.

Two areas come to mind, both of them handy to lava flows: lava basalt can be used as it for carving trinkets, statues, usable items like planters, ash trays (ick!), statures, plaques, lamp bases – the list of possible products goes on and on. And both places should be big tourist attractions for other reasons.

1. The central peak in the **Tsiolkovsky Crater** in SW Farside. A chairlift could take tourists to the peak for a stunning view. A sales shop could be built there – the monastery itself on another part of this peak, out of view.
2. A spot on the ridge of **Thomson Crater in Mare Ingenii** in SC Farside. This area is **relatively** radiation free*, allowing more out-vac recreation with lighter-weight spacesuits, for longer periods of time. [* Lunar Prospector detected a strong magnetic shield on the farside at the antipode of the impact that formed the Mare Imbrium basin, centered in south central farside. What we think happened is at the moment of impact, a magnetic plasma was ejected that surrounded the globe, coming to a focus at the impact antipodes permanently magnetizing the surface of the area. This area may be a safer place for surface activities, requiring less shielding for protection.]



Monasteries Elsewhere in the Solar System? One can think of a number of places.

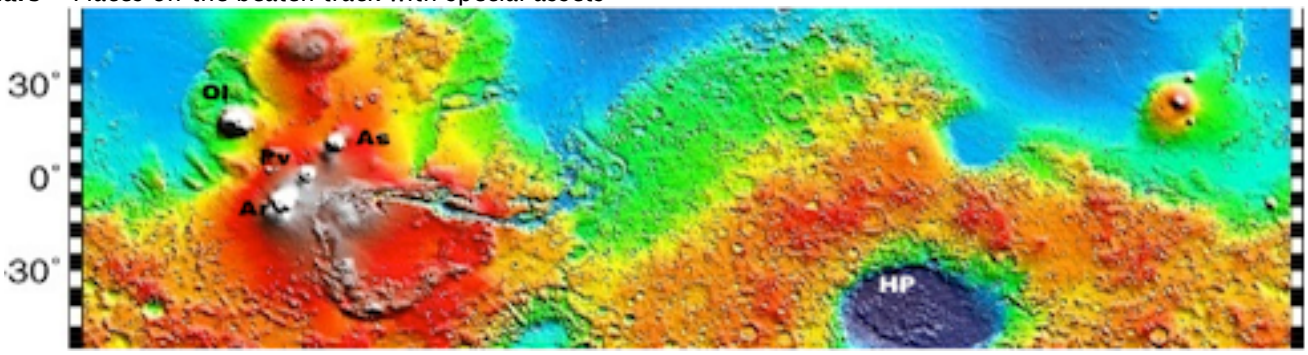
- The Asteroid **Pallas** [https://en.wikipedia.org/wiki/2_Pallas] , roughly the size of Vesta, is in a relatively high-inclination orbit, taking it 35° above and below the common plane of the Solar System known as the ecliptic, It takes a lot of energy to get there, and to return, putting Pallas "off the beaten track." But this very fact, while providing a monastery on Pallas with the needed isolation, would also make tourists visits few and far between as well as especially costly. Meanwhile, Pallas offers alternating good views of the Sun's poles, for study.
- Saturn's 3rd largest moon **Iapetus** [https://en.wikipedia.org/wiki/Iapetus_(moon)] is in a high inclination orbit – 17° above/below the plane of Saturn's rings, providing breathtaking views of the most picturesque planet in the system, after Earth of course.

One can think of other places, but they suffer from similar drawbacks. ##

Some Potential Monastery sites on Mars

By Peter Kokh

Mars – Places off the beaten track with special assets



Rim of a high shield volcano: tasks: operating giant telescopes in near vaccuum

- **Pavonis Mona (Pv)**, astrjde the equator, will be one of the busiest sites on Mars, with a possible launch track up its Western slope. **Ascreus** (**As**) to the North, **Arsia** (**Ar**) to the South, perhaps **Olympus** (**Ol**) – the tallest

- **Other sites:**

Northwestern corner of floor of Hellas Planetia (**HP**) ,the lowest part of Mars' surface, with highest air pressure where **development of Mrtian agriculture, including desired specialties, would pay the way** **PK**

Lunar (and Martian) Homes of Extruded Basalt

By Dave Dietzler

Over the years Peter Kokh, members of the St. Louis Moon Society Chapter (now merged with the local NSS chapter) and I have discussed inflatable modules for the first lunar bases. There seems to be general agreement about that. However, we cannot keep sending modules to the Moon at great cost forever. Habitat must be made on the Moon with on site materials. We have also discussed a box like module made of iron plates, cylindrical aluminum with domed ends, and even sprayed concrete inside an inflatable form that is later removed.

I am coming to rest on extruded basalt modules made with a huge 3D printer. This has been done with concrete on Earth. It is called Contour Crafting. Iron would rust out. Aluminum is difficult to produce because it requires chemicals or exotic equipment imported from Earth. Rolling mills to make curved aluminum plates and a very large engine lathe to spin the dome ends would be required to make sausage shaped aluminum modules. A lot of welding would be needed Concrete even with fiber reinforcement can crack and it takes a long time to cure. Concrete also requires plenty of water. Producing cement on the Moon would be no simple matter either. Calcium aluminate cement could be made by roasting anorthositic highland regolith at 2000 C.

Extruded molten basalt which like lava can be oozed out of a large 3D printing machine and when solidified will have the same properties as cast basalt seems like a better alternative and it could be done out in the vacuum. Concrete made with hydraulic cement would have to be extruded inside a large pressurized inflatable. Concrete and cast basalt have similar tensile strengths of 20-45 MPa for concrete and 35 MPa, about 5,000 psi, for cast basalt. A module with a 5 psi internal atmosphere (3 psi oxygen and 2 psi nitrogen) would not endure unbearable stress. Hoop stress can be determined by these simple equations:

For thin walls: x = Pr/t where P is internal pressure, r is inside radius and t is wall thickness

For thick walls: x = P(R^2 + r^2)/(R^2 – r^2) R is the outside radius or r plus wall thickness

The equation for thick walls is used when the inside radius is less than ten times the wall thickness. We will use that equation for a cylindrical module that is ten feet in diameter with a wall one foot thick. We find the hoop stress is only 27.7 psi. For a module thirty feet in diameter with a foot thick wall we find the hoop stress is only 75 psi. This is by far and away well within the 5,000 psi strength of cast basalt. It seems a rather thin shell of this material could hold a mere 5 psi within, but I believe we need walls about a foot thick for other reasons. For one thing, basalt is a rather brittle material and uneven stresses could lead to cracking. Moon quakes must also be planned for. Cast basalt has a higher shear stress than some low grade aluminum alloys. Even so, I want those walls extra thick in case of quakes. Cast or more accurately extruded basalt modules with walls a foot thick might do the trick, but how to make them and why basalt?

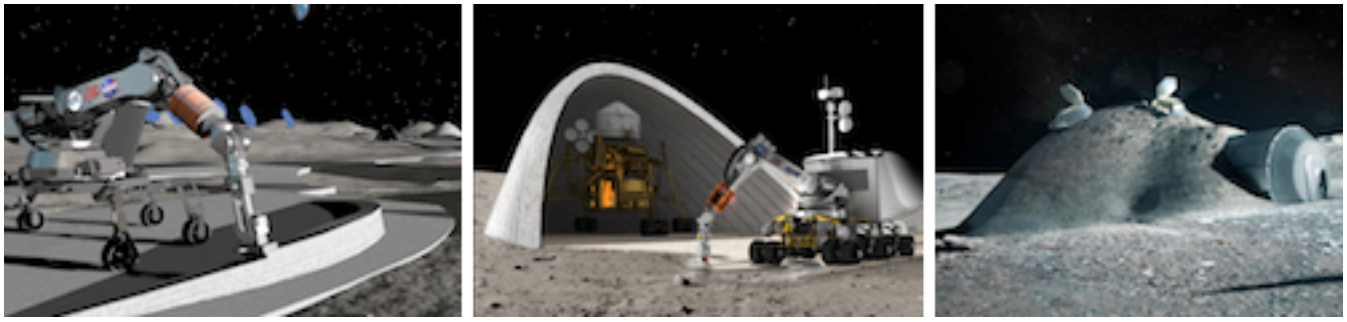
A big contour crafting gantry would just need an electrically heated bucket of molten basalt and it could extrude viscous material that cooled and hardened to form airtight structures when metal hatches with silicone elastomer seals were installed. Basalt is easy to come up with on the Moon if you aren't stuck in some highland polar location. The mare are all basalt so all we need to do is set up a slusher and dig up all the basalt we need.

The printer bucket could be made of titanium (mp 1668 C vs mp 1250 C for basalt) and we could give the titanium bucket a silica (mp 1700 C) lining to prevent corrosion of titanium at high temperatures because above 535 C the oxide layer decomposes and the titanium becomes less corrosion resistant. Sure, we could import a bucket made of molybdenum or tungsten or carbon but I want this thing to be Moon "makeable, maintainable and serviceable." Ideally we would build the contour crafting gantry while we were still living in inflatables and build it of lunar materials or we could ship the first one up there; whatever is most economical. It might pay to ship it up there and hurry up and get habitat constructed so we can land paying visitors. Time is money especially when you have loans to pay off or bondholders to pay off!!!

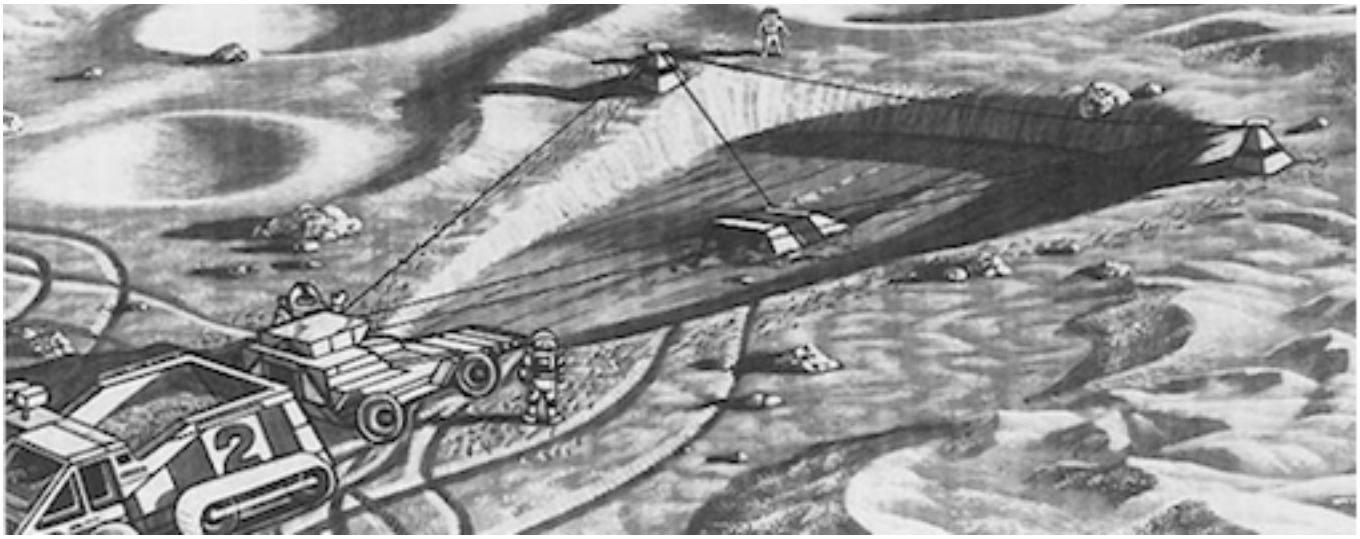
A smaller machine(s) could print basalt furniture as well as mugs, plates, planting boxes, tubs, sinks, counter tops, tiles, slabs, beams, rods, jars, bottles, machine bases, small parts, etc. A centrifugal casting machine could make all manner of basalt pipes and conduits. Basalt fibers could alse be drawn with the right stuff. So called 3D printers could also make iron molds perhaps with meteoric iron-nickel powder harvested magnetically to simply pour molten basalt into. This might be faster than printing for large numbers of simple things. It wouldn't make sense to use fancy 3D printers to make bricks or blocks that can be made just by pouring molten basalt into sand molds dug in the ground outside. A furnace to melt the basalt will be needed, but it wouldn't even need to get as hot as the furnaces needed to make cement or melt iron, titanium, silica or anorthite!

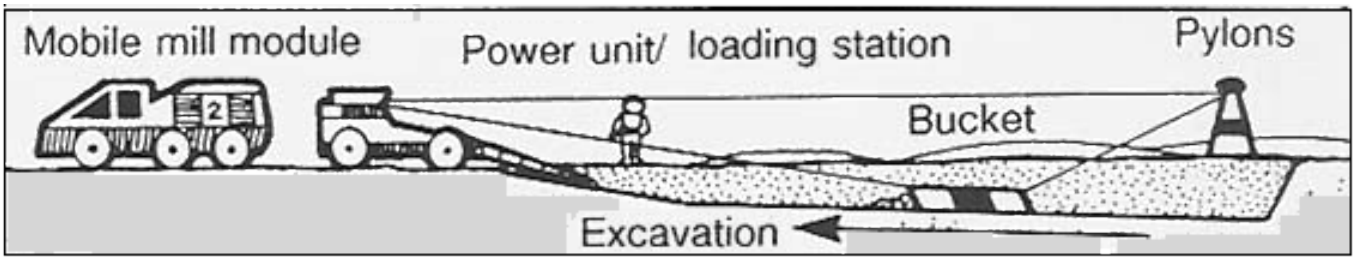
Maximum use of easily obtained basalt means a lot less machinery and energy needed as would be the case if everything was made of metals and this makes the whole project more plausible. No imported chemicals like lithium, fluorine or chlorine and no imported carbon or exotic alloy electrodes would be needed either. These might all be imported to produce metals by electrolysis but we'd need much less of these than we would if we tried to build all our structures out of metals like aluminum and titanium.

Since the modules would be covered thermal cycling should not be a problem. Thermal cycling is what makes concrete crack and then on Earth water gets in and when it freezes things really crack because ice expands, but that won't be a problem on the Moon. Even so, extreme thermal cycling must be and can be avoided by the simple expedient of covering the modules with 5 to 6 meters of moondust. Actually, you just need about one meter for thermal protection but we will have more for radiation shielding. Linear thermal expansion coefficient of cast basalt is 7.7X10^-6 m/m K at 273-373 K and 8.6X10^-6 m/m K at 274-473 K. Concrete has 14.5X10^-6 m/m K. Solid basalt has roughly half the thermal expansion of concrete so it would swell and contract less with temperature swings and be less prone to cracking than concrete but we won't let it endure thermal cycling at all by covering it with a thick blanket of regolith.



Steps in Contour-crafting an Outpost





Concrete can also crack because of uneven stresses and creep under load. Basalt might do the same over time. Buildings like all other things don't last forever. Fibers could be added to a basalt matrix that has been mixed with fluxes like sodium, potassium, magnesium or calcium to lower its melting point. This would increase its tensile strength and reduce cracking but it adds the complexity of producing fluxes and basalt fiber reinforced cast basalt composite is a material like glass fiber reinforced glass matrix composite. Very little research has been done on either of these materials. Much is known about basalt fiber. Cables made of polymer bound basalt fibers are used to pre-stress concrete structures on Earth today. At least we know that much. Research on lunar appropriate materials like glass-glass and basalt-basalt composites and 3D printing with basalt is called for.

I am not certain that extruded basalt will be used to make the popular "igloo" style shelter consisting of a dome on a floor. The pressure on the dome would push it away from the floor and the flat floor might flex and crack, but if the walls of the dome were very thick where they join the floor and if the floor was very thick this style of lunar architecture might be made to work. I picture cylindrical modules with domed or conical ends. Since 3D printing on a small scale can make very intricate parts I think that on a large scale it shouldn't have any trouble making large solid massive unitary and simple structures that can hold pressure. There might even be large spherical structures if there is any reason for that. Architects and structural engineers might come up with a variety of strong, safe and aesthetic buildings on the Moon made by 3D printing with extruded basalt.

The use of 3D printing with molten basalt must be demonstrated on Earth first. There are plenty of volcanic sources of basalt on Earth but lunar basalt is a little different. It contains more iron than terrestrial basalt and is not hydrated at all. A fair amount of anorthositic material is mixed in with lunar basalt. Lunar basalts also contain varying amounts of titanium. Research must be done using lunar basalt simulants with high, medium, low and very low titanium contents.

Real world testing must be done on the Moon, perhaps at an International Lunar Research Park. Earth's space agencies would establish bases on the Moon that provide a core for private companies to plug their research workshop modules into. The core would supply power and life support. If it proves to be possible to print up reliable modules with basalt then companies that want to plug in to the core life support and power systems could have a module printed instead of paying the higher price to move a new inflatable to the Moon. If the space agencies provide the core, a private company might send its contour crafting gantry to the Moon and start selling modules and such to following companies. The greater the role of private industry at the ILRP the better.

Why Basalt and not Metals

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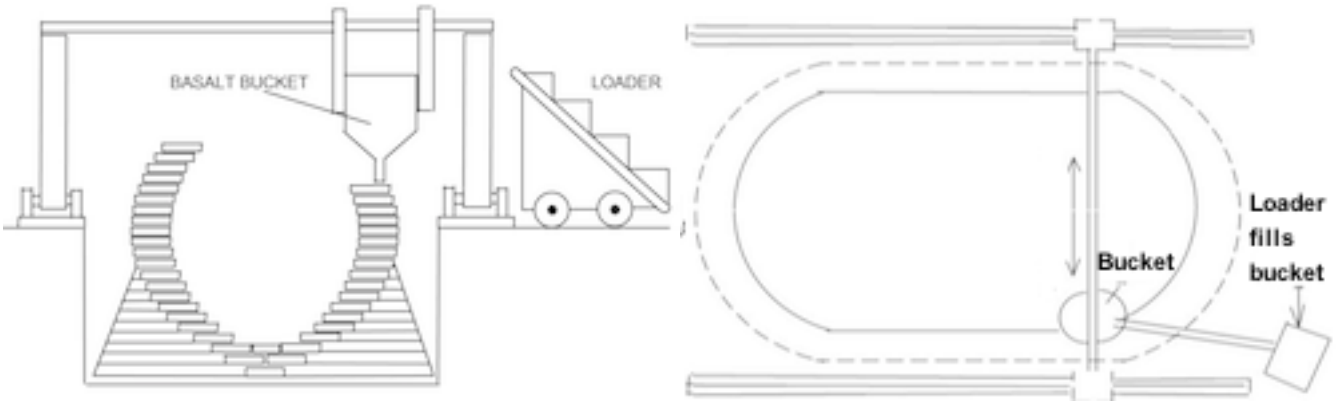
I don't think that extruded basalt will be used to make the popular "igloo" style shelter consisting of a dome on a floor. The pressure on the dome would push it away from the floor and the flat floor might flex and crack, but if the walls of the dome were very thick where they join the floor and if the floor was very thick this style of lunar architecture might be made to work. I picture cylindrical modules with domed or conical ends. Since 3D printing on a small scale can make very intricate parts I think that on a large scale it shouldn't have any trouble making large solid massive unitary and simple structures that can hold pressure. There might even be large spherical structures if there is any reason for that. Architects and structural engineers might come up with a variety of strong, safe and aesthetic buildings on the Moon made by 3D printing with extruded basalt. ##



Products we can make on the Moon of Glass and Basalt from A to Z

By Dave Dietzler

Many things can be made from glass by casting and grinding like windows, bowls, wine/cup glasses, eyeglasses, lab equipment, chandeliers, reamers, bottles, paperweights, garden accessories, insulators, aquariums, Xmas ornaments, doors, furniture tops, car windshields, stained glass windows in churches, light bulbs incandescent or fluorescent, clocks, candlesticks, cups, drinking glasses, mirrors, some lamp bases, auto headlight and taillight lenses, some lamp shades, etc. Just about anything solid where transparency or translucency is desired can be made of glass. Glass can be harvested from orange and green pyroclastic deposits on the Moon by mining and electrostatic separation. Silicon dioxide, SiO2, can be roasted out of regolith in vacuum at 1500 C.+ and it can be obtained along with plaster (CaSO4) by sulfuric acid leaching of regolith. Acid leaching equipment could be made of basalt which resists 95% sulfuric acid concentration by using large 3D printers similar to those I have proposed for making habitat modules on the Moon. Silica, SiO2 and calcium sulfate plaster could be separated with electrostatics and plaster could be wetted and placed between sheets of glass or basalt fiber fabric to make stain and mildew proof plaster board also known as drywall or sheetrock. Plaster is also used for medical casts.

Many items can be made from ceramics and I presume that melted and cast, sintered or 3D printed basalt could be used to make all sorts of things like spark plugs, air blasting nozzles, electrical parts that have to tolerate high temperatures, high voltage insulators, ornaments, toilets and brake pads. It seems spark plugs would have no use on the Moon but they will be needed to set off explosives made from tanks of magnesium and LOX slurry. Toilets and urinals of cast, sintered or printed basalt make enough sense, but why brake pads? Asbestos is not present on the Moon. In Russia basalt has been used for brake pads. It would be possible to reverse voltage and stop electric vehicles on the Moon but this will throw a lot of current at the motors and it might overheat them. Equally important, with friction brakes it will be possible for the motors to switch over to generator mode and recharge the batteries. This is the principle behind hybrid cars—regenerative braking. This will extend vehicle range and that will be of utmost importance on the Moon.

Then there are things made of basalt fiber like curtains, aprons and other protective outerwear, wire and cable insulation, rugs, "wool" insulation, sound deadener in walls, cushion stuffing, bags and sacks made of basalt fiber fabric, etc. It seems to me that 95% of all the things we need on the Moon could be made of basalt and glass. Mining these materials from large areas on the flat mare will be much easier than the hilly terrain of the anorthositic highlands; the same goes for volatiles mining and the mining of meteoric iron-nickel particles. The temperatures encountered on the mare will be more tolerable for machines than in the super cold of permanently shadowed polar craters. The value of a base location near the mare is clear.

`**Anything that can be made of ceramic should be possible to make of basalt. It should be possible to make just about everything needed to make a home on the Moon. The following list is really long; from:**
http://billandlizhunt.com/Hunt_Website/Bills_Writing/Entries/2011/2/20_Things_to_Make_in_Ceramics_(Revised).html

Address signage, Animals, Apple baker, Ashtray, Asparagus server, Baby basin, Baking dish, Beads, Bedpan, Bell, Berry bowl, Bird feeder, Birdbath, Birdhouse, Bookends, Bottle, Bowl, Box, Bread & oil plates, Bread baking pan, Brie baker, Brush stand, Business card holder, Bust, Butter dish (stick butter), Butter keeper, Butter knife, Button, Cake plate, Candle house, Candlestick, Candy dish, Canister set, Casserole, CD holder, Ceramics tools, Chalice, Cheese dome, Cheese plate, Cheese shaker, Chess set, Chip & dip platter, Clock face, Clock weights, Coffee pot, Compartmented plate, Cookie jar, Covered jar, Covered mug, Cream & sugar set, Cream pitcher, Crock, Cruet, Dinner plate, Dipper, Doll parts, Doorstop, Drum, End table, Expresso cup/saucer, Finial, Flask, Flute, Fondue pot, Fork, Fountain, Garden herb marker, Garden plaque, Garlic baker, Garlic keeper, Gravy boat, Hanging lamp, Hashi (chopsticks), Herb grower herb shaker, Holiday serving platter, Honey pot with dipper, Hooks, Hotplate, Incense burner, Jell-O mold, Jelly jar, Jug, Key holder, Kleenex box cover, Knife, Lamp, Latte cup, Lavabo, Light or fan pulls, Liturgical set: chalice & paten, Lotion dispenser, Mail holder,

Mailbox, Microwave ovenware, Mirror frame, Moonshine jug, Mug, Nameplate, Napkin holder, Napkin ring, Oil lamp, Olive bot, Olive oil dispenser, Oryoki set, Paperweight, Pasta bowl, Pendant, Perpetual calendar, Pet dish, Pet tags, Pickle/olive tray, Picture frame, Pie dish, Pie plate, Pill holder,

Pitcher, Plant stand, Planter (hanging or sitting), Plate (dinner, desert or lunch), Plate for under planter, Platter, Potato baker, Potter's water container, Ramekin, Rattle, Ring holder, Salt & pepper shakers, Scoop, Sculpture, Shot glass, Signage, Sink, Skillet, Soap dish, Soap dispenser, Soy bottle, Spoon,

Spoon rest, Spork (or foon), Stein, Sushi tray, Switch plates, Table, Tea ball (for loose tea), Tea caddy, Teabowl, Teapot, Terrine. Tobacco pipe, Toilet, Toothbrush holder, Tortilla warmer, Toys, Trashcan, Tray, Trivet, Trumpet, Tub, Tuba, Tulip display pot, Urinal, Utensil jar,Vase, Vibraphone, Vinegar & oil set, Wall vase, Watering can, Wedding vase, Whistle, Wind chime, Wine cooler, Xylophone. ##

Editor: Quite a list of reasons to choose a site that is basaltic (on one of the Moon's Maria ("seas") and yet adjacent to nearby circumpolar craters found to have ice deposits: **Mare Frigoris** and the **Thales** crater. ##

Early Metal Products: Massive, Unitary, Simple Things

by Dave Dietzler

Metal products without casting, by rolling, extruding, spinning

It is not always necessary to melt and cast metals. That requires lots of energy, time and labor by men and machines. Cold metals can be shaped by rolling, extrusion and spinning. This work hardens the metal. When this is not wanted, metals can be hot worked. That takes more energy but not as much as melting does.

Metal ingots, slabs and billets can be rolled into flat or curved plates of varying thickness, sheets and foils. Plates can be cut into different sizes and shapes with computer guided lasers on cutting tables outside in the vacuum. Extruders can make rods, rails, bars, beams and tubes with different cross sectional shapes and dimensions by fitting the extruders with different dies. Rods can be drawn into wires. Rails, rods, bars, beams and pipes can also be rolled. Domes can be spun from circular plates on large lathes. Enormous presses to make domes are not needed. Many things can be made from these simple objects by welding or bolting things together.

- **Flat Plates:** slusher buckets or scrapers, excavator buckets, bulldozer and road scraper blades, ground vehicle parts, spacecraft frames, metal floors, fluidized beds (with some tubes and other parts), appliance parts and casings, even pots and pans by stamping small circular thin metal plates.
- **Curved Plates and Spun Domes:** rocket propellant tanks, fuel cell reactant tanks, water tanks, oxygen (and other gases) tanks, pressurized ground and space vehicle cabins, solar trough reflectors, spun domes for radio and solar concentrator dishes.
- **Rails, Bars, Beams:** ground vehicle and earth moving equipment frames as well as other parts, building support structures, railroad tracks.
- **Rods:** axels, "tent" or canopy poles, radio antennas, rebar, "telephone" poles for power lines and phone lines.
- **Wires:** power lines, phone lines, electrical wiring, motor coils, steel cables for earth moving equipment.

Metals other than Iron?

Aluminum, pure iron, meteoric iron-nickel and steel will be most useful.

Magnesium is soft but not very ductile unless it's hot.

Titanium is hard to cold work but can be hot worked. Many titanium parts could be made from powder by electron beam fusing or sintering, a kind of 3D printing, outside in the vacuum.

Copper is rare on the Moon

We will want to experiment with workable substitutes as best we can, to avoid expensive imports.

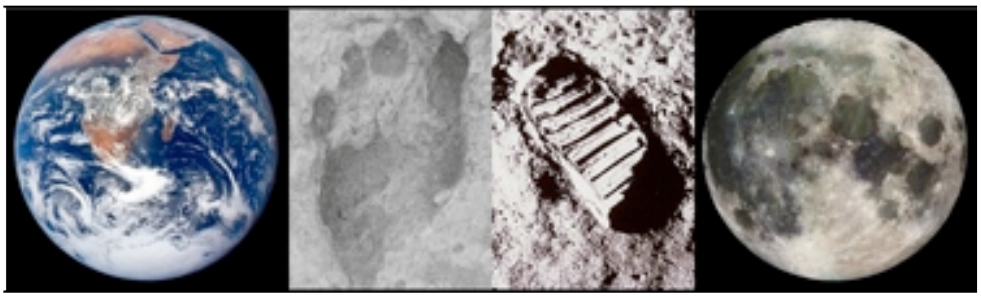
Pure aluminum (not alloyed, alloys actually have lower conductance) wire is good stuff...it is used for long distance power lines because it is lighter and cheaper than copper.....in home wiring you have to use the right connectors....aluminum is fairly common on the Moon, it's just more complex to produce than many other materials unless we have a fancy gizmo resembling a mass spectrometer.....calcium wire might be used for long distance power cables...I think the Artemis project people talked about that....well...I don't know what to add to the Metal MUS Products article...but give me a little time on that....pictures to help the reader see things might be better than more words....

Aluminum provides a better conductivity to weight ratio than copper, and therefore is used in power wiring of some aircraft. Early problems have been addressed.

http://www.carsondunlop.com/home-inspector-training/**the-true-story-behind-aluminum-wiring**-part-one/
http://gcedestin.com/destin-electrician-gcedestin-aluminum-wiring.pdf
https://en.wikipedia.org/wiki/Aluminum_wire
http://www.alwirerepair.com/aluminum-wiring-whats-the-problem ##

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

The Moon Society Salutes Space Industry Embrace of 'Cislunar Econosphere'

The Moon Society is pleased to have seen the increasing promulgation of the idea of economic growth in 'cislunar' (bounded by the Moon and its orbit) space. This volume of space encompasses all of our human space flight activities to date, and is home to billions of dollars of assets contributing substantially to the global economy.

In early 2012, Moon Society president Ken Murphy authored a paper at The Space Review entitled "The Cislunar Econosphere"

[1] That explored how space activities in near-Earth space might evolve in the near future. This article built upon Ken's prior work on the topic, including a previous Space Review article "EML-1: The Next Logical Destination"

[2] And his International Space University Masters project on "Cislunar Infrastructure Architectures"

[3] Undertaken during his ISU internship at Boeing's Human Spaceflight & Exploration division in 2001.

To help explore the concept further, The Moon Society ran tracks at the 2012 [A] and 2013 [B] International Space Development Conferences on the Cislunar Econosphere topic. The Moon Society also culled a number of articles from their newsletter, the Moon Miners' Manifesto, to create a Theme Issue on the Lunar Economy [C].

http://www.moonsociety.org/publications/mmm_themes/mmmt_**LunarEconomy.pdf**

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

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

In August of 2012, the article was cited in le Monde diplomatique in a piece entitled "A l'assaut du huitième continent" [4] ('Storming the 8th Continent') which included a re-worked graphic of the cislunar econosphere [5]. It was also cited in late 2013 in an EU White Paper on "An Astrostrategy for the EU" [6], and even NASA took notice [8], using the article as a seed germ for their report "Germinating the 2050 Cis-Lunar Econosphere " [9]. By early 2014, it had caught the attention of members of the IAA [7], and in 2015, even industry began to pay notice, with United Launch Alliance including another re-working of the Cislunar Econosphere graphic in their report "The Business Case for Space" [10].

Notes Ken, "Many of the most exciting developments we've seen over the last several years, from suborbital efforts to in-space activities, have been in cislunar space. As more people understand that the Earth and Moon are a closely linked system, and that the Moon can offer us resources and energy in addition to scientific data, then you will see an increasing focus of efforts in this near-space domain and increasing human activity beyond the atmosphere of Earth."

The Moon Society salutes the increasing recognition of cislunar space as a place for humans to live and work, providing opportunities to grow our economy and employment as well as our databases. We will continue working to make the case for investment in growing this economic domain, to support not only our future posterity's prosperity, but also a robust human expansion throughout the Solar System.

Questions regarding the Cislunar Econosphere can be sent to president@moonsociety.org.

The Moon Society is a 501c3 non-profit organization dedicated to the proposition of humans living and working on the Moon. Founded in 2000 as the successor to the Artemis Society, The Moon Society works to educate about our Moon and engage in projects that advance our Lunar knowledge. It's newsletter, the Moon Miners' Manifesto is an award-winning and respected publication. More details can be found at www.moonsociety.org.

[1] Murphy, Ken, "The Cislunar Econosphere". The Space Review. February 2012.
Part 1: http://www.thespacereview.com/article/2027/1
Part 2: http://www.thespacereview.com/article/2033/1

[2] Murphy, Ken, "EML-1: The Next Logical Destination". The Space Review. January 2011.
http://www.thespacereview.com/article/1764/1

[3] Murphy, Ken, "Cislunar Infrastructure Architectures". International Space University. March 2001.

[A] http://isdc.nss.org/2012/PDF/ISDCPublicProgramAgenda.pdf

[B] http://isdc.nss.org/2013/tracks-lunar.shtml

[C] http://www.moonsociety.org/publications/mmm_themes/mmmt_LunarEconomy.pdf

[4] Riviere, Phillipe, "A l'assaut du huitième continent". Le Monde diplomatique. August 2012.
https://www.monde-diplomatique.fr/2012/08/RIVIERE/48044

[5] Rekacewicz, Philippe, "De la Terre à Mars" . Le Monde diplomatique. August 2012.
https://www.monde-diplomatique.fr/cartes/mars

[6] Bowen, Belddyn, "An Astrostrategy for the EU: Spaceship Europe at Sanctuary's End". Centre for European and North Atlantic Affairs (CENAA). November 2013.
http://cenaa.org/en/wp-content/uploads/2014/05/Bleddyn-Bowen-PP-No.-14-2013-Vol.-2.pdf

[7] International Academy of Astronautics Commission-III, "Spring Meetings 2014 Agenda". March, 2014. p. 72. (Uncited) http://iaaweb.org/iaa/Scientific%20Activity/Commissions/co3minutesparis2014.pdf

[8] Burgess, Matt, "By 2050, the Earth-Moon Region Could Be A Settled, Commercial Haven: NASA Researchers". Factor-Tech.com. June 2015.
http://factor-tech.com/feature/by-2050-the-earth-moon-region-could-be-a-settled-commercial-haven-nasa-researchers/

[9] Scott, David et al, "Germinating the 2050 Cis-Lunar Econosphere". NASA Marshall Space Flight Center. March 2015: http://ntrs.nasa.gov/search.jsp?R=20150006953

[10] Sowers, George, "The Business Case for Space". United Launch Alliance. September 2015. p. 5. (Uncited)
http://www.ulalaunch.com/uploads/docs/Published_Papers/Commercial_Space/Business_Case_ForSpace_AIAA Space_2015.pdf

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The Moon in the International News: www.space.com/31488-**european-moon-base-2030s**.html
www.space-travel.com/reports/**Momentum_builds_for_creation_of_moon_villages**_999.html
www.space-travel.com/reports/**South_Korea_to_launch_lunar_exploration_in_2016_land_by_2020**_999.html

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

Some Things for which the Moon Society & NSS might Lobby

By Peter kokh

Future Science Missions to the Moon

From the very beginning, science missions to the Moon have been picked to addresss the scientific curiosities of scientists. Yes it is important to know more about the Moon and how it got to be what it is. The problem is that we also need scientific knowledge that will affect what we cab do on the Moon and with its assets.

The current push is for manned missions to the South Pole to mine ice for water from which to extract rocket fuel. Too many look at the Moon as a handy refueling station for missions elsewhere and not as a world it might be ueful to settle. If we are going to settle and develop a lunar economy that goes beyond hydrogen rocket fuel, then we will need to know more about the Moon.

Lava Tube Exploration and Mapping

These are features we find in the lunar maria ILating word for "seas" – i.e. Seas of frozen lava flows and floods – and as there are none near either lunar pole, scientists drawn like moths to the poles as places of almost constant sunlight from one direction or another, have no interest in them.

But the Moon's extensive lava tube networks would be ideal "pre-shielded" volumes for area-hungry operations sucha as manufacturing, warehousing, agriculture, etc. NASA has been on the lookout for lavatube openings, or skylights" – places where by chance a meteor of size has hit just over the path of a lavatube and created a "skylight" opening. Indeed, people at the Jet Propulsion Laboratory, "JPL" have come up with an idea for a mision to winch down a probe into such s skylight and have a lookd around. But NASA leadership dominated by South Pole Ice Miners seems to have ignored the suggestion.

Some Maria, Mare Smythii on the Moon's Eastern limb for example, seem to have had just one shallow lava flooding as the terrain within this "sea" is frull of the protruding rims of pre-existing craters. Others, like Mare Crisium, are all but crater free. This Mare must have many layers of lava flooding, each with its own network of lavatubes which form in the process of lava flooding.

Can NASA not come up with a way to map lava tube networks in at least the top layer in each mare?

Could we use that equipment within a lava tube, to sense tubes in the layer below?

Basalt as an early, relatively easy, cosntruction material.

The word "basalt" covders a wide range of geochemical materials, all formed from solidigying lava flows. The point is that this material can be hewn from solid deposits, and fused from pulverized depostis all fairly simply (compared to making steel, aluminum, or magnesium alloys) and made into quite a big list of things needed in an outpost or settlement early on, well before we can make them from the working metals, and those objects will greatly reduce the number and total mass of things that will otherwise have to brought up the steep gravity well from Earth; planters and plant pots, sinks, tubs, lamp bases, dishes, floor tiles, and on and on.

Most importantly, **cast basalt pipes** and sluices are abraison resistant. We need them to handle moondust of any and all kinds wherever we settle. Steel chutes upported from Earth at great cost, will need regular replacement as they quickly wear through. This is perhaps the number one fact that the South Pole crowd totally ignores; to its discredit.

We need to start in a mare, a mare with access to ice. Lunar Prospector mapped ice deposits at both poles and they aoccur in craters up to 30° from each pole. Now in the Moon's southern hemisphere, there are no maria anywhere near that 60° N or S latitude cut off point. But in the Northern Hemisphere, there are craters with ice just above the northern "shores" of Mare Frigoris. **This consideration**, in our opinion, t**rumps the percentage of time that sunlight is available**. We can store power to get through the nightspan, NASA is under the thumb of those who shudder at the idea of having to "store" power. Funny! **The history of civilization is based not on metals or any other material but on development of ways to store power**: piles of cut lumber, fruit cellars, **damns**!

Damns on the Moon? Crazy? There are many places such as crater rims with substantial elevation level differences. A dam on Earth with a few meters rise can produce power. Even at 1/6th G, a crater rim thousands of meters/feet high could host a pump systme with many, many times the power potential of our hightest dams.

Our goal should not be to make the Moon a fuel station for missions to elsewhere

The Moon has what it needs to create a second home for mankind, within easy regular reach of Earth, **as the anchor of an Earth-Moon economy that will enable us to settle Mars and elsewhere.** It may take longer this way to develop the Moon as a fuel station to Mars. But once develope as above, we'll be able to support settling and development of Mars the way Mars deserves to be developed and settled.

Impatience always loses. Let's do it right! **We need to start with lava tube network mapping.** PK

March Chapters & Outposts 2015

ORGANIZING "OUTPOSTS"

Bay Area Moon Society, CA Outpost – South San Francisco Bay – http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net Meeting the 1st Tuesday of the Month at Henry's home

Moon Society Nashville Outpost – Contact: Chuck Schlemm - cschlemm@comcast.net

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 Saturday 1–4 pm monthly except July, August,
At Mayfair Mall lower level Community **room G150 for all meetings except December, in G110:**
At our January 2016 meeting, we watched the Sci-Fi film "Men in Black 3" with Will Smith**.**
January 9th 14th Meeting Report: Charotte & Gene brought a moivie: Men in BlaCK 3
Meetings 2016 : FEB 13, MAR 12, APR 9. MAY 14, JUN 11, ~~JUL~~/~~AUG~~, SEP 10, OCT 8, NOV 12, DEC 10

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. Meetings **4th Saturday of the month**.
2016 FEB 27, MAR 26, APR 23, MAY 28, JUN 25, JUL 23, AUG 27, SEP 24, OCT 22, NOV 26, DEC 17

NSS/Moon Society Phoenix Chapter - http://nssphoenix.wordpress.com/ – c/o Mike Mackowski.
http://www.**meetup.com/NSSPhoenix**/events/161939572/
Meeting 3rd Saturdays monthly at **Humanist Community Center, Mesa**, 627 W. Rio Salado Parkway.
surfer_bob@charter.net – **2016 Feb 20, Mar 19, Apr 16, May 20, Jun 18, Sep 17, Oct 15, Nov 19**, Dec
January Meeting ReportL Our January 16 meeting had eight members visit ASU for a tour of the planetary science xhibits in the ISTB4 building and a fine planetarium show on exoplanets. We had a new member who recently moved from Huntsville, Anthony Bartens. Our February meeting will be a trip to Biosphere 2 north of Tucson which will be a joint event with the Tucson chapter

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
2016 FEB 13, MAR 12, APR 9. MAY 14, JUN 11, JUL 9, AUG 13, SEP 10, OCT 8, NOV 12, D

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 Bay Area Community Cntr, Clear Lake Park: **2016 FEB 15, APR 18, JUN 20, AUG 15, OCT 17, DEC 19**
Recent and Coming Activities

The Clear Lake Area National Space Society and Moon Society Chapter hosted its annual Christmas party Monday evening, December 14th, 7–10 pm at the home of one of our members in Nassau Bay very near the Space Center. There was food and beverages from Anita's well-stocked bar.

Another event that week was the Combined Professional Society Holiday Mixer put on by INCOSE, SWE, AIAA-Houston Section and the Mars Astronautics Space Technologies group. It was held Wednesday night, December 9th, at Sam's Boat in Seabrook from 6:00 to 8:30 p.m. The organizers requested that we bring an unwrapped toy ($15 value or less) for Toys for Tots.

The next regularly scheduled meeting of CLANSS/MS will be at the Bay Area Community Center in Clear Lake Park on Monday evening, **February 15th**...President's Day. ---Eric.

JAN/FEB 2015 SPACE NEWS BROWSING LINKS

SPACE STATIONS + ROCKETS + COMMERCIAL SPACE

www.space.com/31420-**spacex-rocket-landing-success**.html
www.space.com/31102-**air-force-3d-printing-rocket-engines**.html
www.nasa.gov/press-release/**nasa-orders-second-boeing-crew-mission-to-international-space-station**
www.space.com/31499-**us-makes-plutonium-deep-space-fuel**.html
www.nasa.gov/press-release/**nasa-research-could-save-commercial-airlines-billions-in-new-era-of-aviation**
www.space.com/31719-**blue-origin-2nd-rocket-launch-landing-video**.html
www.spacedaily.com/reports/**2016_Goals_Vital_to_Commercial_Crew_Success**_999.html
www.spacedaily.com/reports/**Fishing_For_Answers_on_Bone_Loss_in_Space**_999.html

EARTH + NEAR SPACE

www.nasa.gov/press-release/**new-nasa-satellite-maps-show-human-fingerprint-on-global-air-quality**
www.space.com/31577-**earth-life-jupiter-saturn-giant-impacts**.html
www.space.com/31640-**nasa-campaign-studies-coral-reefs**.html
www.nasa.gov/press-release/**jason-3-launches-to-monitor-global-sea-level-rise**
www.nasa.gov/press-release/**nasa-noaa-analyses-reveal-record-shattering-global-warm-temperatures**-in-2015
www.spacedaily.com/reports/**Building_a_Robust_Commercial_Market_in_Low_Earth_Orbit**_999.html

MOON

www.space-travel.com/reports/**LADEE_Mission_Shows_Force_of_Meteoroid_Strikes_on_Lunar_Exosphere**_999.html
www.spacedaily.com/reports/**Chinese_rover_analyzes_moon_rocks_First_new_ground_truth_in_40_years**_999.html
www.leonarddavid.com/**europes-moon-a-next-destination/**
www.space-travel.com/reports/**XPRIZE_Verifies_Moon_Express_Launch_Contract_Kicking_Off_New_Space_Race**_999.html
www.space-travel.com/reports/**South_Korea_to_launch_lunar_exploration_in_2016_land_by_2020**_999.html
www.space-travel.com/reports/**Russia_Postpones_Plans_on_Extensive_Moon_Exploration_Until_2025**_999.html
www.space.com/31544-**china-moon-rover-lunar-rock-discovery**.html
www.space-travel.com/reports/**Lunar_mission_moves_a_step_closer**_999.html
http://phys.org/news/2016-01-**china-dark-side-moon**.html
www.space.com/31559-**europe-woerner-moon-awakens-push**.html
www.space-travel.com/reports/**Audi_joins_Google_Lunar_XPrize_competition**_999.html
www.space-travel.com/reports/**Momentum_builds_for_creation_of_moon_villages**_999.html
www.space-travel.com/reports/**Russia_postpones_manned_Lunar_mission_to_2035**_999.html

MARS

www.space.com/31312-**mock-mars-mission-devon-island**.html
www.space.com/31402-**dust-devil-swarm-spied-rumbling-across-martian-plain**.html
www.marsdaily.com/reports/**Martian_gullies_likely_contain_no_water_study**_999.html
www.space.com/31448-**nasa-mars-lander-insight-launch-delay**.html
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www.space.com/31772-**fungi-survive-mars-conditions-space-station**.html
www.space.com/31350-russian-monkeys-mars-mission-peta-protest.html
www.marsdaily.com/reports/**Getting_real___on_Mars**_999.html
http://marsforthemany.com/news/technology/**russia-plans-nuclear-rocket-engine-for-deep-space-exploration/**

ASTEROIDS + COMETS

www.spacedaily.com/reports/prnewswire-space-news.html?rkey=20151217DC84363&filter=1639
www.space.com/31323-**dwarf-planet-ceres-bright-spots-likely-salt**.html
www.space.com/31455-**earth-smashing-space-rocks-undercounted**.html
www.space.com/31553-**asteroid-metal-3d-printing-test-planetary-resources**.html
www.spacedaily.com/reports/**NASA_counting_on_humanoid_robots_in_deep_space_exploration**_999.html
www.space.com/31551-**nasa-planetary-defense-office-launched**.html
www.space.com/31604-**dwarf-planet-ceres-crater-photos-dawn**.html
www.space.com/31607-**water-ice-comet-rosetta-mission**.html
www.esa.int/Our_Activities/Space_Science/Rosetta/**Exposed_ice_on_Rosetta_s_comet_confirmed_as_water**
www.esa.int/spaceinimages/Images/2016/01/**Exploring_Imhotep**

OTHER PLANETS + MOONS

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www.space.com/31407-**nasa-europa-mission-lander**.html
www.spacedaily.com/reports/**NASA_team_discover_how_water_escapes_from_Saturn**_999.html
www.space.com/31385-**saturn-moon-enceladus-geysers-losing-steam**.html
www.spacedaily.com/reports/**Peering_Through_Titans_Haze**_999.html
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www.sciencemag.org/news/2016/01/feature-**astronomers-say-neptune-sized-planet-lurks-unseen-solar-system**
www.space.com/31746-**planet-nine-prediction-nasa-caution**.html

ASTRONOMY + ASTROBIOTICS

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www.space.com/31456-**rocky-planet-found-unlikely-star**.html
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www.space.com/31691-**rare-cannonball-carbon-star-supernova**.html
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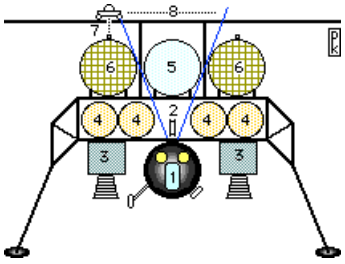
THE book WORM

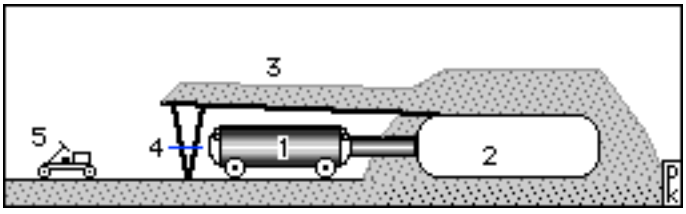
Mars via the Moon by Erik Seedhouse, Springer-Praxis, 2015 – softcover, 170 pp., illus.
ISBN 978-3-319-21887-8 – US$34.99 – Review by Anthony Young January 11, 2016
http://www.thespacereview.com/article/2896/1

- Seedhouse advocates for lunar missions as essential to proving the hardware, methods, and human adaptation to long-term human spaceflight.
- As Seedhouse states, there must be economic incentives in human missions to the Moon and beyond. The profit motive has been foundational to global exploration in all forms for several thousand years. ##

Selections from the Moon Miners' Manifesto GLOSSARY "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.





The **Toad** version is designed for permanent lunar surface duty, e.g. as a motor coach,after landing on the Moon.

ISDC 2016, San Juan, Puerto Rico

"A Bridge to Commercial Space"

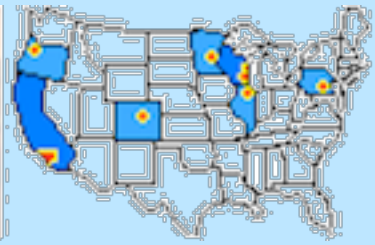
200 Convention Boulevard · San Juan, Puerto Rico, 00907 - Phone: (787) 993-3500

Program Theme: A Bridge to Commercial Space

Early Bird Regitration – www.nss.org/cgi-bin/register/tdregister?$Origin=ISDC16

(Full = Wednesday, May 18 to Sunday, May 22)	Full Conference – (meals separate)
Non-Member Adult	$200
Sponsor* / **Co-Sponsor*** (see Section I to activate)	$185
Join NSS for Member rate (includes $20 for first year of membership)	$170
NSS Member* rate (see Section I to activate)	$150
Student* / **Youth*** (Must be full-time student or under 22 years of age)	$ 50
NSS Senior Member* (Must be over 64 years of age) (see Section I to activate)	$ 50

NSS Chapters that share Moon Miners' Manifesto



Space Chapter HUB Webiste: http://nsschapters.org/hub/
Feature Page: Project Menus Unlimited http://nsschapters.org/hub/projects.htm

WISCONSIN

MLRS – Milwaukee Lunar Reclamation Society

PO Box 2101, Milwaukee, WI 53201 – www.moonsociety.org/chapters/milwaukee/
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!

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

At our January 2016 meeting, we watched the Sci-Fi film "Men in Black 3" with Will Smith
Our 2015 Meeting Schedule: We switch to **room G150 for all meetings** except December, in G110:
Meetings 2016 : FEB 13, MAR 12, APR 9. MAY 14, JUN 11, (summer break)**, SEP 10, OCT 8, NOV 12, DEC 10**

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: **FEB** 17, **APR** 21, **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

Events Hotline/Answering Machine: 310-364-2290 – **Newsletter** http://www.oasis-nss.org/wordpress/
Meeting 3 pm 3rd SAT monthly: 2016 Feb 20, Mar 19, Apr 16, May 20, Jun 18, Sep 17, Oct 15, Nov 19

ILLINOIS

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

LDAhean@aol.com

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

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 eric@boethin.com – Monthly Meetings every **3rd Thursdays**, 7 pm
Englewood Public Library, **Englewood, CO 80110** – 1000 Englewood Parkway, First Floor Civic Center
2016 MEETINGS: FEB 18, MAR 17. APR 21. MAY 19, JUN 16, JUL 21, AUG 18, SEP 15, OCT 20, NOV 17, DEC 16

MINNESOTA

MSFS: Minnesota Space Frontier Society – http://www.mnsfs.org
c/o Dave Buth, 433 South 7th St. #1808, Minneapolis, MN 55415
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,
2016 MEETINGS: FEB 4, MAR 3. APR 7. MAY 5, JUN 2, JUL 7, AUG 4, SEP 1, OCT 6, NOV 3, DEC 2

OREGON

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 the 3rd Saturday of the Month at 2:00 PM – **2016 Schedule Feb 20, Mar 19. Apr 16, 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 http://pasa01.tripod.com/ - http://phillypasa.blogspot.com
c/o Earl Bennett, Earlisat@verizon.net – 856/261-8032 (h), 215/698-26 **Meetings 3rd Thursday monthly;**
2016 Meetings: FEB 18, MAR 17. APR 21. MAY 19, JUN 16, JUL 21, AUG 18, SEP 15, OCT 20, NOV 17, DEC 16

The NSSPASA Report for 2016 Meeting times and locations: Our next two meetings will be at the Liberty One Food Court on: February 13 (snow date Feb. 20th) and March 12 with March 19 as the snow date. We are being part of several special events in February and March: The George Washington Carver Science Fair in both months, and, in March a possible event at the New Jersey State Museum in conjunction with New Jersey Maker Day on March 19th . And Mitch is working on an event in University City.

Business first: we have received a bill for our subscription to Moon Miners after several years and are working out a payment plan. Some recipients elected to give funds directly to the publication. This is a gift to NSSPASA as will be the awards to the Carver Fair winners this year. Surprise, Mitch! He's our treasurer.

Speaking of Mitch: He brought the 2016 NSS brochures to the meeting, the good news, and told us bad news as well: there was a problem with arrangements for the January 16 event and a new date has not been set. We need an alumni connection for some of the University venues. Mitch is putting together the end of the year report for NSS and we should be a chapter in good standing again this year! During a later discussion of Philcon Mitch suggested another venue called The Senesta Hotel in Philadelphia for the Philcon convention in the future.

Larry has changed the website and has color coded the current day and has put a count down to the next meeting on the site. And he informed us that Earl has to authorize our connection to the NSS chapters page to put our content into the national chapters site. Larry also brought a tablet and displayed the changes to the website and also gave us the annual usage report on our website.

Dorothy reported on The Franklin Institutes 3D printing classes and what to bring: February 27th and March 19th. Bring your laptop and get printing! Also: The Institute will be screening Journey to Space in late February.

Also: one of her families' children is working for Space X! He is very happy, as are we all, that the recent Falcon launch was successful (January). Hank talked about elections at PSFS and informs us that Todd Dashoff will chair Philcon this year. As noted above, Mitch and Hank have continued to bring up a new hotel location in Philadelphia again. Hank is going to offer to his help with the Space Science programming at the event this November. His e-mail is: hank-smith@hotmail.com. Contact him about the science fiction activities at this event and others in the mid Atlantic region.

Dennis Pearson attended and made clear that our annual report, to remain in good standing. Earl brought material from several publications, but, mention needs to be made about a recent entertainers death: over the decades David Bowie has been someone almost everyone in the space movement should remember. During the late 1960s and onward he created a number of songs that highlighted the future and space. And some even played his songs in space : "Space Oddity" was a hit again thanks to Captain Chris Hatfields' rendition on the I.S.S..But David kept space and the future, good and dystopian, in circulation during the beginning of The Great Inward Turning in the late 1960s. Along with Queen, Elton John and others young people heard about the space in its' application to them personally. He did good by us and the future.

Several publications and observations from the last year: In the Microwaves and R.F. Journal was an article on the use of Graphene as an active device in circuitry above 100Ghz: this is the region where a number of applications on Earth and in space would benefit from improved devices. On Earth they could increase the available bandwidth of the backbone of our communications networks with lowered noise figures for the receivers (1db at the desired frequencies) and efficient power generation. In space we might be able to use the technology for inter satellite communications links, which has happened with older technology, with much better power budgets, and, also for sensors and detectors for scientific purposes. The need for testing of the effects of various forms of radiation on this new technology should result in some P.H.Ds. in material science and better communications all around. From The November 28th Science News: Christopher Crockett wrote on "Oxygen in Comet Surprises Scientists" with the recently visited comet 67p/Churyumov-Gerasimenko showing oxygen in its' gas jets. Since the comet is coming into our neighborhood we should get lots of data on comet composition. Philae should send great data. And much more, but, I will limit the quantity: from the Winter N.S.S.s Ad Astra "Tis Not Too Late to Seek A Newer World" by Lance Frazer on the efforts to find extra solar planets with life, or at least life indicators, using the NexSS (The Nexus for Exoplanet Systems Science) plan. Scientists in a number of disciplines divided into 16 teams which will work "to better understand how biology interacts with the atmosphere, geology, oceans and interior of a planet, and how these interactions are affected by the host star". The first section heading is very informative: "NExSS: What Are We Missing?" See the report starting on Page 28. From The Amsat Journal: "Amsat is Back in Space" in the Apogee View editorial report from President Barry Baines,wd4asw. The Fox 1A was launched on October 8th and was christened AO-85. This is one in a group of CubeSats that the amateur community is building and working on launches for. There are several other reports, including on decoding telemetry from the Fox-1 satellite, and early results from the satellite. From the many excellent articles in NASA Tech Briefs for January: "Venus Heat Flux Sensor" by a combined team from several organizations: Caltech, Energy Science Laboratories ,and, Colorado Geological Survey for the Jet Propulsion Laboratory. The technique relies on using a thermoelectric device that is adapted from the isotope power generators used to power equipment in space and on rovers. I think the fact that a sensor for use on the surface of Venus is really interesting here. Could the U.S. try a landing in this decade? See page 26. Lots of interesting material on communications technology for satellites and there positions in the swarm(s). There is also material on what is called ubiquitous sensing technology : the deployment of myriads of low cost sensors that would allow continuous monitoring of the space surrounding the sensors. See the article on page 28. The work was done at The Langley Research Center.

From the NASA Medical Design Briefs for December 2015: "Epidermal electronics use cut-and-paste method for speed" from The University of Texas. The report details the work done to get skin surface compatible sensing technology that is easy to apply to human skin and is low cost. A number of applications that could work on Earth as well as space were mentioned. The devices are called wearable patches. A very good, somewhat specialized, NASA publication: what will we need in Space? Everything!

Also: two interesting books: "Ten Billion Tomorrows" is about science fiction and the ideas that came from writers imaginations and peoples' dreams: flying, telepathy, artificial intelligence, robots ,and of course, ray guns. Are just a few of the topics in Mr. Cleggs' interesting book. The author writes about the Moon landings but, he has another book devoted to space flight. He is prolific in the area of hard science. The other book, "The Saturn Run" by John Sandford and Ctein (not an auto correct artifact, that's the spelling) is a hard science fiction. No f.t.l. drives, worm holes, or even bug eyed monsters. However: there is aliens and mysterious gadgets that could exist. The space ships of humanity are almost buildable now, but, given the next 50 years of technological perfection, could be made. Mr Sanford has a number of books out in the area of crime investigation and has collaborated with Ctein, who is a Physics Professor, to create a very good novel. One more thing: Buzz Aldrin will be coming to The Free Library of Philadelphia in April: an evening event in a small theater setting. See the website(s); His and theres'.

Earl Bennett, President NSSPAS, KD2CYA.

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