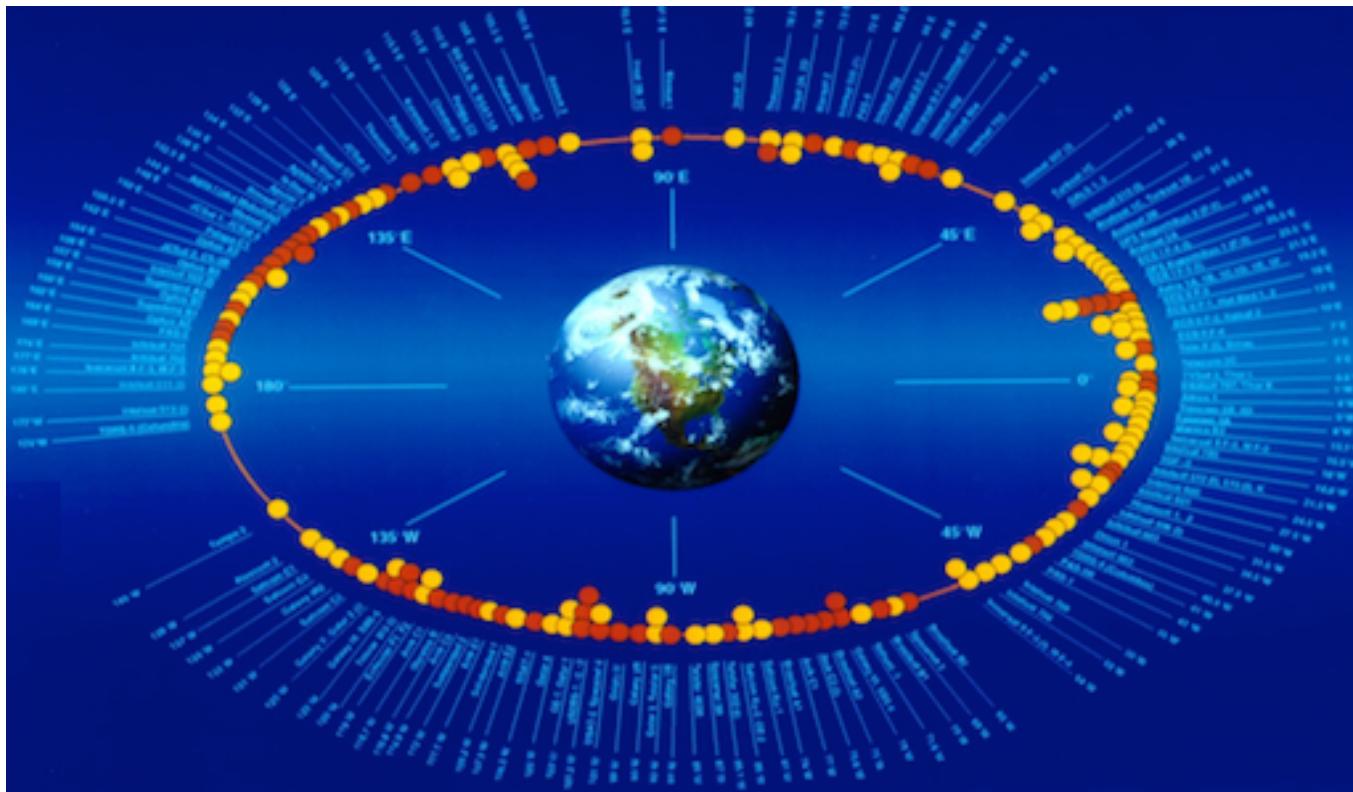


"Towards an Earth-Moon Economy – Developing Off-Planet Resources"

# Moon Miners' Manifesto

<http://legacy.moonsociety.org/publications/index.php>



Crowded GEOSYNCHRONOUS Orbit: the most valuable "real estate" in the Solar System

Solar Arrays, Power Relays, megastructures sharing orbits, Trillions of Dollars of Economic Impact

For a more detailed map of Earth and Geo, zoom in: <http://img.docstoccdn.com/thumb/orig/130165236.png>

2. In Focus: Between "suburban" Earthside & the Moon: Geosynchronous Orbit Activities could be Earth's Economy
3. Building-out GEO with Materials from where on the Moon? Two Options, Peter Kokh.
4. Making Heavy Equipment on the Moon, Dave Dietzler
6. A Brief Assessment of Regolith Processing Systems, Dave Dietzler
7. Space Solar vs. Elon Musk's Rooftop Solar, Dave Dietzler
8. Book Review: A Case for the Moon by Robert Walker

Earth's Economy has expanded to 7 times Earth's physical diameter



Past articles [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)  
Or arranged by themes: [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

## About Moon Miners' Manifesto – “The Moon - it's not Earth, but it's Earth's!”

- **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 this location: [http://legacy.MoonSociety.org/publications/mmm\\_classics/](http://legacy.MoonSociety.org/publications/mmm_classics/)
- **MMM THEME Issues:** 14 collections of articles according to themes:  
[http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)
- **M3 Glossary:** new terms, old terms/new meanings:  
<http://legacy.moonsociety.org/publications/m3glossary.html>
- **MMM retains its editorial independence** and serves many groups, each with its own philosophy, agenda, and programs. Sharing MMM may suggest overall satisfaction with themes and treatment, requires no other litmus test. **Opinions expressed herein**, including editorials, are those of individual writers and may not reflect positions or policies of the **National Space Society**, **Milwaukee Lunar Reclamation Society**, or **The Moon Society**. **Copyrights** remain with the individual writers. Reproduction rights, with credit, are granted to NSS & TMS chapter newsletters.
- **MMM color online downloadable PDF file version option for Moon Society Members** using their username and password – do write [secretary@moonsociety.org](mailto:secretary@moonsociety.org) if you need help with your password.
- **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://legacy.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](http://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](mailto: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 In between “SubOrban Earthside” and the Moon, Geosynchronous Orbit Activities may rise to half Earth's Economy

By Peter Kokh

A **geosynchronous orbit** (sometimes abbreviated **GSO**) is an orbit around the Earth with an orbital period of one sidereal day, intentionally matching the Earth's sidereal rotation period (approximately 23 hours 56 minutes and 4 seconds). If a satellite is parked above Panama, or Singapore, or any other tropical city, it will stay parked there. [https://en.wikipedia.org/wiki/Geosynchronous\\_orbit](https://en.wikipedia.org/wiki/Geosynchronous_orbit) Science fiction writer Arthur C. Clarke was the first to realize the economic potential of this orbit, hence, originally dubbed the “Clarke Orbit” TV satellite relays and weather satellites stay parked overhead of the portion of Earth they are serving.

As demand grew, by international agreement, there are only 180 “slots” – 2 degrees apart – where satellites can be parked in GEO. GEO, if it were a “nation,” would already be a member of the top 20 economies n the value of its services. If we could find a way to park more satellites safely at each of these 180 slots, that figure could grow enormously. GEO services could become an essential pillar of Earth's economy.

**But GEO is already near capacity:**

*Past articles [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)  
Or arranged by themes: [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)*

To boost capacity we might establish satellite farms: platform structures on which many satellites could be parked, sharing power sources. Mechanical robots could crawl all over each platform, providing repair services etc.

With such platforms, the capacity of GEO could grow a hundredfold or more. Read "megabuck\$." **But! But we would need building materials to build such hosting structures.** Boosting them up from Earth would be prohibitively expensive, and put a strong damper on any such expansion

But "functionally similar" building materials produced on the Moon would cut the cost of such platform's to a fraction – 1/6<sup>th</sup> – because the Moon's gravity is so much lighter than Earth's. Given, for the sake of argument, that building materials suitable for these purposes can be produced on the Moon, then the Moon becomes an essential partner in a Moon–GEO–Earth megaeconomy.

### **Without the Moon, this expansion of a Greater Earth Economy would not be possible.**

Not only would it be economically feasible to construct these slot-sharing megaplatforms, **but we could afford to build solar power satellites in GEO**, going a long way to help clean-up our irreplaceable Mother Earth and at the same time safely grow Earth's global economy significantly.

- **GEO's Economic Importance is its "Synchronicity" with Earth's surface**

- **The Moon's Economic Importance is its 1/6<sup>th</sup> lighter gravity**

The question, of course, is can suitable "building materials" be produced on the Moon from moondust. The articles below take up that question.

Our thesis is that building materials to construct megastructures in GeoSynchronous Orbit can be imported from the Moon' surface at much less cost than from Earth. At issue here are robot-serviced platforms holding hundreds or more individual satellites in each of the allowed 180 slots, 2° apart, solar power satellites, power relay satellites, and more: spacious and luxurius space hotels and resorts, for example.

#### POSSIBLE PRODUCTS DOWNSHIPPED FROM THE MOON

- Cast, carved, and spun basalt, basalt fiber composites (already a proven product line here on Earth)
- Glass-glass composites
- Metal alloy products
- 3D printed products
- Sorted regolith
- Even dehydrated foods grown on the Moon will be cheaper in GEO than food brought up from Earth.

To Read: [http://legacy.moonsociety.org/publications/mmm\\_papers/glass\\_composites\\_paper.htm](http://legacy.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm)

[http://legacy.moonsociety.org/publications/mmm\\_papers/muscle\\_paper.htm](http://legacy.moonsociety.org/publications/mmm_papers/muscle_paper.htm)

The above muscle (MUS/cle) paper tells what should be made on the Moon (MUS); what on Earth (cle)

"M.U.S (Massive, Unitary, Simple) parts to be made by the settlement and the c.l.e. (Complex, Lightweight, and Electronic) components to be made on Earth for upport and mating on the Moon (or early space colony)"

Chemical Fuels (Hydrogen\*), Thorium, Helium 3 (In our view, shipping Hydrogen off the Moon would be a crime against the Moon's future, especially so, since there are alternatives.)

The goal: Anchoring a new greatly expanded Earth–Moon economy in Geosynchronous orbit.

## Building-out GEO with Materials from where on the Moon? Two Options

By Peter Kokh

### **The scientist-favored South Polar Site does not meet the needs –**

- Shying away from "power storage" – (the very idea gives the proposal backers nightmares)
- Depth and access problems, repairs, rescues, etc.
- Concentrating on producing hydrogen and oxygen only

The South Pole (North too, for that matter) is attractive because it has sunshine 95%+ % pf the time.

The idea of having to live and operate on stored power scares the ??? out of these scientists:

Yet civilization was built and continues to grow on "Storing Power" – from wood for fires, to fruit cellars, to damming rivers. [In fact, the Moon's high crater rims make hydroelectric circulating water systems a super option.] The ice at the bottom of polar craters is hypercold, up to 2 miles (3 km) below the crater rims, in pitch darkness. "Ice mining" equipment must be lowered down that distance, then hauled up for maintenance and repairs, quite a burden.

Neighboring terrain is lit by sunlight at very low angles just above the horizon, with the visual patchwork of lit terrain and pitch dark shallows changing day by day in a 28+day pattern. Vehicles will need radar to determine if a black patch is a shallow depression or a deep pit.

And, worst of all, at both poles, local resources are limited to the "Highlands" suite of materials.

### **The vastly superior Mare Frigoris Option –**

- Lunar Prospector located a number of ice-filled craters as far as 30° from both poles.

[https://images.sciencedaily.com/2010/03/100302085214\\_1\\_900x600.jpg](https://images.sciencedaily.com/2010/03/100302085214_1_900x600.jpg) – There may not be as much ice, and

that ice will cover only a third of the crater bottoms. But equipment can be placed on the non-ice-covered portions of the craters for service and repairs, and easily driven onto the ice in the shadows.

- Not as much ice, perhaps, but more easily and safely harvested, and enough for decades at least.
- But in any such craters that far from a pole, sunlight is available only half the month.

#### The Mare Frigoris Option



**Mare Frigoris is outlined in red.** Actually, this mare area extends 150° to the West into Sinus Roris (SR)  
Other features: (I) Mare Imbrium, (S) Mare Serenitatis, (T) Mare Tranquilitatis, (C) Mare Crisium

While no spot along Mare Frigoris' north shore enjoys more than a half month ("sunth") of sunshine and is then in darkness for an equal length of time,

- Ice mining stations all along Mare Frigoris/Sinus Roris north shore could together be productive over 90% of the lunar month – quite competitive with polar operations.
- Power stations along the route, connecting all the ice-mining "towns" by cable along the entire route, would provide power to all the involved settlements 90 plus percent of the time, quite competitive with polar options.

#### The Clincher

Such a string of settlements and ice mining operations would provide **access to both highland and mare materials, a significantly stronger basis for lunar industry than that offered at either pole.** Add that to easier and safer access to the ice in craters that far from either pole, means far less danger, risk, problems.

Other minerals vary along this entire route, providing a foundation for a very diversified industry

<http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2947.pdf> .

The idea is not just to provide rocket fuel, much less rocket fuel robbed from the Moon's limited ice reserves, but to provide a whole suite of construction materials both to support lunar settlements and to build satellite platforms, space hotels, shipyards and more in GeoSynchronous orbit, thereby greatly (and safely) expanding the economy not only of all of Earth, but in GEO and on the Moon

Our goal should be to provide much much more than rocket fuel! PK

## Making Heavy Equipment on the Moon

By Dave Dietzler

**Foreward:** Peter Kokh has reminded me that the L5 Society approach included making lots of stuff out of glass-fiber/glass composites (which he dubbed glax), and that he thought that basalt fiber/basalt composites would also be useful for building solar power satellite systems in space.

- [http://www.moonsociety.org/publications/mmm\\_papers/glass\\_composites\\_paper.htm](http://www.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm)
- [http://www.moonsociety.org/publications/mmm\\_papers/muscle\\_paper.htm](http://www.moonsociety.org/publications/mmm_papers/muscle_paper.htm)

However, if we are to have digging machines, vehicles, railroads, electric power systems, electric motors, mass drivers, etc. we will need metals.....machines for working metal will be made of steel....

#### What we have to do

A rolling mill could weigh 40,000 pounds or more and an extruder up to 20,000 pounds or more. A Falcon 9 Heavy rocket could put over 100,000 pounds in LEO, so the problem is not getting it up there. If 1000 tons of stuff was lifted to the Moon a rolling mill would only be about two percent of the total. Several pieces of heavy equipment besides a rolling mill like extruders and forging presses could be sent to the Moon and there would still be plenty of space left over for other things if 1000 tons is the mark. The question is, might it not be better to send the machinery for making heavy equipment on the Moon? Then make the heavy equipment on the Moon? How would this be done?

There can be no doubt that materials production devices from meteoric iron harvesting rovers to solar and electrical furnaces and other things including solar panels for power must be sent to the Moon ready to work and supply materials or nothing can happen at all.

Some production devices like 3D printers must be sent up ready to work also. Once we have all sorts of iron molds made by 3D printing of meteoric iron fines for casting and sintering basalt we can start production with that simple material.

Working with metals will require furnaces for melting and heat treating and heavy machines like rolling mills to work the metals into useful things. Meteoric iron could be converted to steel by roasting it with carbon. This is the ancient crucible steel process. Casting that steel into large rollers a meter or more in diameter and two meters long that are later ground and polished with CNC machines to within two ten thousandths of an inch presents a problem.

Fairly pure silica or olivine sand will be needed for expendable molds along with clay and water to bind the mold. While sand might come from regolith, clay is non-existent on the Moon and water is precious. In the vacuum the water will sublime and the wet mold will dry up. Unless this job is done inside a pressurized structure so that the water can be recovered from the air within that water will be lost.

#### **What about using binders other than clay?**

Sand molds can be made with resin but the Moon lacks the light elements needed to make resin so it would be imported and recycled. The resin bonded sand mold would have to be contained in a sealed metal box so that when hot metal was poured in and the resin volatilized it could be recaptured. Sodium silicate is another potential binder. This compound can be made on the Moon but it must be dissolved in water then mixed with sand. In the vacuum the water would evaporate, so the job must be done inside a pressurized structure and the sodium silicate must be allowed to dry out before moving the mold outside and pouring metal.

Making molds or cores from plaster or cement will also require a pressurized structure where water vapor is condensed from the air. Not only that, there is no way to mix plaster or cement with water out in the vacuum. The water will evaporate in a flash. At least the actual metal casting can be done outside. Casting large parts inside some kind of habitat module would release a lot of heat and that would demand a powerful air conditioning system. It might get so hot inside that only robots can work within.

Maybe there is another way that might not be worthwhile on Earth but could be worthwhile on the Moon. Perhaps large heavy parts like steel rollers could be made by CNC (computerized numerical control) machining of large ingots or billets of metal. Steel made by the crucible steel process on the Moon could be melted and poured into large cavities dug in the ground outside in the vacuum. A lid might be placed over this crude mold to prevent evaporation of molten metal. Regolith will melt and form a crust when the mass cools and this crust will be chipped, ground and wire brushed off by robots. Shards of metal might fly off during milling and be caught by some kind of barrier, perhaps imported kevlar sheets or Moon made sheets of basalt fiber. The metal shards would be recycled. If it is possible to grind out massive, unitary and simple parts on the Moon and import the complex, lightweight and electronic parts it should be possible to achieve substantial savings. CNC machining is not so popular these days among space enthusiasts because it is a subtractive process unlike additive manufacturing or 3D printing which is all the rage. Everyone wants a Star Trek replicator and conventional manufacturing processes are getting the short shift. The challenge is figuring out how to apply conventional manufacturing processes in the unique environment of the Moon.

A CNC machining set up will not be terribly massive. It would consist of basically a robot arm and a grinder. Replacing the worn out grinding tools/cutters will require imports unless they can be made on the Moon. There are CNC milling machines that can machine 132,000 pound workpieces, but they are as big as a two car garage. See: [http://www.k-mm.com/large-machining/#large\\_machining\\_111](http://www.k-mm.com/large-machining/#large_machining_111) On the Moon, workpieces to be shaped into rollers would only amass about 20,000 to 30,000 pounds. In low gravity they would weigh one sixth as much and be easier to move around. Another possibility is the use of high powered lasers. Large ingots of metal could be cut into cylinders with lasers and the CNC machines could do the final grinding and polishing. Perhaps the lasers would knock off the edges of the ingot first then carve it down to a cylinder. However, lasers might be too good to be true. According to Samuel M. Goldwasser at <http://www.repairfaq.org/sam/laserco2.htm>, "Typical industrial CO<sub>2</sub> lasers produce between 500 and 5,000 watts...The largest known laser for industrial use produces 120 kW continuous (for up to 1 hour at a time)-it's located at the San Francisco Naval Shipyard and is used for welding aircraft carrier hulls. It's capable of doing a full-penetration weld 12" deep at 100 IPM. The laser is also huge-about the size of a three bedroom house." Unfortunately, a laser like that would be needed to cut a block of steel over a meter in diameter into a roller, and this laser would be far too big to send to the Moon. Perhaps defense research will produce a more compact lightweight high energy laser suitable for work on the Moon. The only other possibility would be huge plasma cutters of an unheard of size.

Rolling mills will require heavy frames to support the rollers. Crude, very crude, castings could be made in cavities dug in the ground. Regolith in contact with molten steel at 1500 C. will melt and form a crust on the parts. This crust could be chipped off and CNC machines could grind the crude frame casting into a finished product.

If CNC machines can make large heavy or massive, unitary and simple parts on the Moon it will amount to huge savings.

Since steel casting presents the problem of the Moon's lack of sand, water and clay, unlike Mars where everything is easy, and the need for a pressurized foundry even if the sand, water and clay are available, it might be that CNC machining will turn out to be the best way to shape steel parts of all sizes that would ordinarily be made by sand casting on the Moon. The 3D printers could make small intricate steel parts needed in limited numbers and the rolling mills would produce steel and aluminum plates and sheets, beams, rails, pipes, etc. DD ##

## A Brief Assessment of Lunar Regolith Processing Systems

By David Dietzler

**Regolith processing systems come in two groups:**

- 1) those that use high temperatures and exotic materials and
- 2) 2) those that use imported halogens.

### High Temperature Processes

- Dr. Peter Schubert's Super-sonic Dust Roaster and All Isotope Separator. This system uses high temperatures to volatilize and dissociate regolith compounds and a device that works on the same principle as a mass spectrometer to separate the elements. Most of this machine can be made of lunar materials except for the platinum-rhodium bushings and the thorium oxide free fall shaft.[1]
- Magma or molten oxide electrolysis. This system works at up to 1600 C. and uses platinum electrodes. It does not separate all elements as does the previous system but allows a one step production of oxygen, ceramic slag and ferrosilicon without any beneficiation of regolith. [2]
- Vapor pyrolysis. This might use temperatures as high as 8000 C. and might yield all elements. It uses a lot of energy. If element separation is not included this too allows a one step system for production of oxygen which can be gotten at temperatures as low as 2000 C.[3]
- Ilmenite reduction with hydrogen. This system works at about 1000 C. and can produce oxygen, titanium oxide and iron. Ilmenite must be concentrated probably by electrostatic separation.[4]

### Processes that use Halogens

- Dr. Geoffrey Landiss's fluorine reaction system that can produce oxygen, silicon, iron, aluminum, titanium, magnesium oxide and calcium oxide.[5]
- Landiss has proposed another process that uses metallic calcium to reduce all elements in the regolith which would presumably be separated by vacuum distillation. The calcium oxide that forms would be recycled by using the FFC Cambridge process that relies on a calcium chloride electrolyte and carbon electrodes that would have to be recycled although there might be inert electrodes. This process works at under 1000 C. [6]
- The EMEC process would reduce anorthite with aluminum to get silicon. The calcium aluminate would then be subjected to electrolysis in a flux of calcium and lithium fluorides. This process might also use high temperatures of about 2000 C. to purify anorthite to calcium aluminate.[7]
- The Hydrofluoric Acid leach process will produce silicon. More chemical and electrical processing will produce other elements in regolith.[8]
- The Melt–Quench–Leach–Chloride electrolysis process involves concentrating anorthite, melting it to a glass to break down the crystalline structure, quenching perhaps with LUNOX, grinding and leaching with sulfuric acid to obtain aluminum sulfate which is roasted to aluminum oxide that is carbochlorinated and subjected to electrolysis in a flux of sodium and lithium chloride to obtain aluminum.[9]

**High temperatures** often means exotic materials that must be imported and there can be gradual erosion of equipment by hot materials. **Halogens** must be imported, recycled, and corrosion of equipment will limit its working lifetime.

**There is no free lunch with any process.** Many experiments will be needed at an International Lunar Research Park to figure out the economics of these processes. It would not be wise to just dive in and choose a process based on personal preference.

### References

- 3 <http://nsschapters.org/hub/pdf/MoonRockstoSaveEarth.pdf> and  
<http://enu.kz/repository/2010/AIAA-2010-8703.pdf>
- 4 <http://www.nss.org/settlement/nasa/spaceresvol3/oflsmse1.htm>
- 5 <http://www.nss.org/settlement/nasa/spaceresvol3/vaporpp1.htm> and  
<http://www.nss.org/settlement/nasa/spaceresvol3/plassep1.htm>
- 6 <http://www.uapress.arizona.edu/onlinebks/ResourcesNearEarthSpace/resources04.pdf>

- 7 <http://www.asi.org/adb/02/13/02/silicon-production.html>
- 8 <http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20140017767.pdf>
- 9 <http://www.nss.org/settlement/nasa/spaceresvol3/plsoom1.htm> and  
<http://knowledge.electrochem.org/encycl/art-s01-space-proc.htm>
- 10 <http://www.islandone.org/MMSG/aasm/AASM5E.html#5e>
- 11 <http://settlement.arc.nasa.gov/spaceres/V-5.html> ##

**Nice article:** [Glass – Wikipedia, the free encyclopedia](#) You know about soda-lime glass....on the Moon, besides Na and Ca we have oxides of K, Mg, Al, Cr, Mn, Ti, phosphates, Fe, Ni, and REEs but we don't have lead....or boron or barium

We absolutely need research into lunar glass-glass composites, basalt-basalt fiber composites, and glass fiber reinforced cast basalt composites....if we can get the pure SiO<sub>2</sub> out of regolith and make fibers mp 1700 C and mix with basalt matrix 1150 to 1350 C mp we might not need to produce all those dopants....I only know two ways to get SiO<sub>2</sub> out of regolith--sulfuric acid leaching and roasting at over 1500 C which releases MgO to and they'd have to be separated....then there is mining for pyroclastic glass and that might be best. Those orange and green glasses have Mg in them and I don't know what else so they might be doped by Nature and have lower mp....Zone refining could get that stuff pure...no chemicals required.

it will be easier to produce these materials than millions of tons of aluminum for SBSP..... Ten powersats would amass about a million tons and I suppose the aluminum frame would be the most part of it.....We only produce a couple a million tons of aluminum in the USA every year.....I wrote an article about that years ago....I don't think aluminum production for hundreds of SPS built in a reasonable time is practical.

We must have GGC, BBC and GBC made of lunar mats researched.....These mats will have important lunar uses like utility line poles and towers, solar furnace reflector supports, indoor furnishings....etc.

We can only hope that in the future young people find the MMM archives in the NSS library....which they named after you. Once we are dead it is out of our hands...in the meantime all we can do is keep writing about it.

====

<http://www.permanent.com/space-industry-glasses.html>  
<http://articles.adsabs.harvard.edu//full/1985lbsa.conf..487B/0000487.000.html>  
<http://www.moonminer.info/unique-lunar-products.html>

I know they also talked about foamed glass....what about foamed basalt???????

## Space Solar vs. Elon Musk's Rooftop Solar

By Dave Dietzler

**Elon Musk does not believe in space solar power.**

**Musk thinks the USA can be powered by rooftop solar panels and home batteries.**

This might work in the desert southwest but I doubt it will work in the rest of the continent. Calculations that I have seen indicate that rooftop solar could supply enough energy for household use but not transportation too especially when there are three or more cars at a home.

What about transportation and industrial power??? These each demand about as much power as residential and commercial buildings do. We'd need three times as much rooftop area! **Rooftops will not be enough.**

What about a cloudy day? You couldn't store up enough power for night in your battery much less produce enough power for the daytime. Sometimes it is cloudy for days, even weeks and months on end. During the winter snowfall can cover your roof for days, even weeks and months at a time. Power demands for electric heat will be really huge and clouds and snow cover with rooftop solar panels could mean freezing to death if you didn't have back-up natural gas furnaces and a connection to the grid.

Doesn't seem like this will do much to curb carbon dioxide emissions. In the high north during the winter days are very short, the Sun is very low, and above the Arctic Circle the Sun doesn't shine at all for long periods of time. In the future as the population grows there will be more and more people living in apartment buildings that don't have enough roof space to supply power to several families for lighting, appliances, heat, AC and automobiles.

Rooftop solar just isn't going to cut it. We need an extensive mathematical analysis of this situation to prove that space solar in the form of power generating satellites and intercontinental power relays to get power from deserts is the only way to power the populous and industrial world of the future if fusion is never practical. What about trees? Shade trees block out lots of sunshine in many neighborhoods and suburbs.

Rooftop solar would force us to cut down all our beautiful trees.

What about hail damage? Will rooftop solar demand a thick plexiglass cover to protect the panels? How much cost will solar panels and big lithium ion batteries add to the price of a house??? Musk may be an energetic genius, but he is wrong about this one. DD

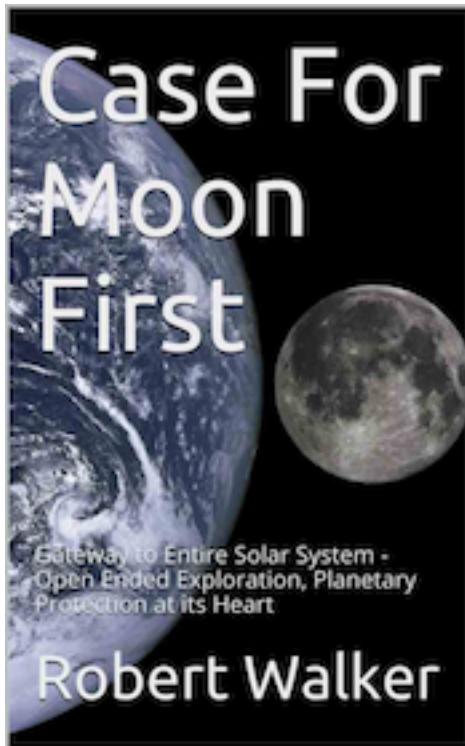
As a movement, the Pro-Space Community must show that the options we offer will **better help preserve Earth as a livable world**. Those who continue to insist that the Global Climate is "just fine" do so for their own pocketbooks' sake, not for their children's future, as they claim.

We offer not only the option of nearly limitless clean power that will preserve our world as we inherited it – we also offer the new technologies that will be necessary for settlements on other worlds, where there is no breathable air, nor massive oceans. –

Space pioneers must learn to "**live downwind and downstream of themselves**" = closely recycling both used water and used air. – Editor

## New Book Notice: CASE FOR MOON by Robert Walker

Humanity's Gateway to the Solar System  
Open Ended Exploration with Planetary Protection at its Heart



Full Review: <http://robertinventor.com/booklets/Online-Case-for-Moon.htm>

### Chapters

The Moon is Resource Rich

Executive summary

Who this is for

Search for inspiration

Positive vision for humans in space

The Moon is resource rich

Where to build our first lunar base for humans

The Moon is turning out to be much more interesting than expected

Buzz Aldrin's "been there done that" – not meant to be taken seriously

Moon firsters – ESA, Russia, Many astronauts, former US Vision for Space Exploration etc

Alternative positive vision for exploration of our solar system – main points

Moon as our gateway

This approach doesn't mean that humans can never land on Mars ever

Searching for a non confrontational way ahead

When will we know enough about Mars?

Precautionary principle and super positive outcomes

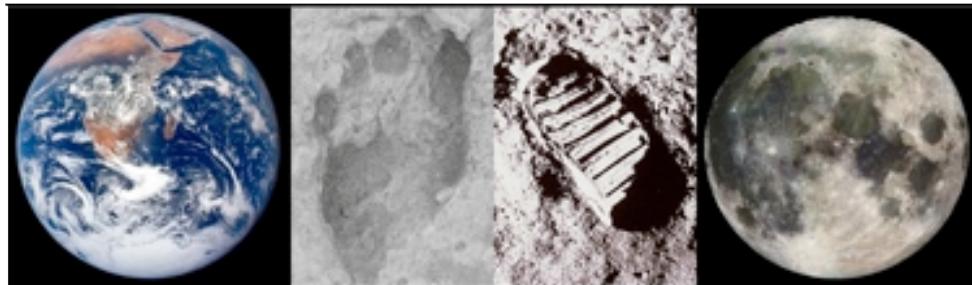
**Summary of the Vision ##**

Past articles [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)

Or arranged by themes: [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

**THE MOON SOCIETY – LUNAR FRONTIER SETTLEMENT – [WWW.MOONSOCIETY.ORG](http://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  
industrializa-  
tion 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”** – 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](mailto:president@moonsociety.org)

**From Moon Society President  Ken Murphy****An Update on Current Moon Society Projects**

So with another successful Moon Day event in Dallas, I've been thinking of late about projects. How can we as The Moon Society undertake projects that broaden the knowledge base amongst the populace regarding Lunar topics? It is a key aspect of humanity's first steps out into the Solar System, but few know very much about it. This hampers efforts to make progress, which keeps things in the stalled-out state in which we find ourselves.

So what kind of projects can we do that would change this status quo? Here are a few of the project ideas I've had, some of which I've run up the flagpole previously.

**1) Planetarium show on Cislunar Space.** I'm often asked after my talks where I learned all of the stuff I've presented, and told of how they had no idea about lagrange points or interplanetary superhighways and many of the other wonderful things to be found in cislunar space. One way to reach a broader audience would be to create a planetarium show that covers many of the aspects of what could be considered our cosmic back yard. CGI could provide 3-D perspective on the warped space of the Earth-Moon system. Audiences would leave with a much stronger understanding of satellites, space stations, in-space transportation needs, and other destinations of interest in near-Earth space

## The Moon Society – Lunar Frontier Settlement – [www.moonsociety.org](http://www.moonsociety.org) p.2

**2) State of Cislunar Space White Paper.** This would follow the same structure as my Cislunar Econosphere article from a few years back, and provide an update on where things stand in particular sectors, from suborbital to LEO to GEO to EML-1 to the Moon. Individual (funded) projects addressing each sector could be highlighted, and companies addressing market needs could be showcased. The White Paper would be sent to thought and public sector leaders, and be available to everyone. The goal, again, is to broaden public awareness of the importance of this economic sector and highlight how it can improve our future economic prosperity.

**3) STEM Projects.** The goal here is to address future Moon enthusiasts. The methodology is to create a set of Moon-themed or Moon-centric STEM projects that could be undertaken by kids from elementary school through high school, perhaps as science fair projects. Topics addressed would include science (Moon rocks, chemistry), technology (robot project a la Moonbots), engineering (some kind of MAKE-style project, like our power-beaming demo) and math (good ol' orbital mechanics). This would serve a key role in not only bringing the Moon Society name to a whole new audience every year, but also show that Moon-themed projects are not a fantasy.

**4) Public Events.** This is where creativity can be unleashed. For this year's Moon Day event in Dallas, I reached out to a local grocer, who prepared 500 Astronaut Snack Packs, which included juice pouches, protein bars, and other space-themed items (including a small bottle of Tang water additive). And yes, Moon Pies. By all accounts these were enormously popular, and will probably be featured again at future Moon Days. It's the kind of item that could be distributed at really any STEM event, but especially space events, and helps to highlight how the space industry has even affected the food we eat. Creativity is the focus here. How do we engage people and show them how industry in cislunar space makes their lives better?

**5) Moon conference.** It has recently been proposed that the international scientific community celebrate an International Lunar Decade as a way to help focus scientific effort on the Moon, modeled in part on the International Geophysical Year that helped lead to Sputnik. My own thoughts are that a Decade of the Earth-Moon System is a better approach, as it more closely associates the Moon with terrestrial affairs. Pete Kokh's recent article in The Space Review highlights the kinds of research that could be a result. Conferences are ambitious though, and would require a dedicated team.

**6) Our website.** Our efforts to migrate to a new website, **one friendlier to the various forms of internet access by devices like tablets and smartphones**, continue. The real challenge we face here is that there is so much quality content at the legacy website, but migrating it to the new site is a laborious task. We've had lots of members offer up advice on what to do, but only a handful of our members are working behind the scenes to keep the website up and running, and transitioning to the new site. Ultimately it would be nice to have a website that could be used as a reference site by academics, but a huge amount of organizing and editing needs to be done, a task somewhat akin to the cleaning of the Augean stables.

### So what are your ideas? How else can we make the Moon a more relevant part of people's lives?

How can we spread the word about the resources and the opportunities that exist there, as well as the space in between. I want to hear from you, the membership, about what we could be doing to better get the word out. Please, e-mail me at [President@MoonSociety.org](mailto:President@MoonSociety.org), and let me know your thoughts.

## How to Throw a Star Party: A Stargazing Guide

[www.space.com/33031-how-to-throw-a-star-party.html](http://www.space.com/33031-how-to-throw-a-star-party.html)

Amateur astronomy may very well be the oldest of the scientific hobbies. If you or your local astronomy club have ever thought about conducting a "star party," here are some tips.

**Pick a good site** [www.space.com/32816-summer-stargazing-national-state-parks-travel.html](http://www.space.com/32816-summer-stargazing-national-state-parks-travel.html)

Most people reside in big cities and their immediate suburbs. In those locations, it is all but impossible to see the night sky in all of its grandeur. As the warmer summer months get closer, many are contemplating where to spend their vacation. For stargazing, the very best place you can go is a state or national park. ##

If you live in an urban area, try to find a location that offers as wide a view of the sky as possible, free from obstructions such as tall buildings. For a large gathering, with several telescopes or more, try promoting the event through your local newspaper or radio station. (Have an alternate night set up in case of cloudy weather.)

**Use just your eyes at first – Next comes your telescope** – Naked-eye astronomy is also especially rewarding if you're observing with children. Then, after you point out the more prominent sky objects, you can direct your audience to look at a particular object through your telescope. ....

**What to use for a pointer** – If you plan on pointing out stars and constellations at a star party, using your index finger in the dark is simply not going to cut it, especially if you have a large group of people surrounding you.

**Final suggestions** If you have a telescope and don't already belong to an amateur astronomical organization , local or national, you ought to join one.

*Past articles* [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)

*Or arranged by themes:* [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

May



## Chapters & Outposts 2016

### ORGANIZED CHAPTERS

(Currently all joint merged chapters of the Moon Society & the National Space Society)

**Milwaukee Lunar Reclamation Society** – <http://legacy.moonsociety.org/chapters/milwaukee/>  
<http://www.meetup.com/Milwaukee-Space-Exploration-Meetup/>

Contact: Peter Kokh – [kokhmmm@aol.com](mailto: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: SEP 10, OCT 8, NOV 12, DEC 10 ( MLRS \* MMM 30<sup>th</sup> Anniversary Banquet )

**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](mailto:surfer_bob@charter.net) – Meetings 4th Saturday of the month in room 162 of McDonnell Hall of Washington Univ. (2016) AUG 27, SEPT 24, OCT 22, NOV 26, DEC 24

**Gateway to Space 2016** was a highly successful day and a half event at 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/>

Meeting 3rd Saturdays monthly at Humanist Community Center, Mesa, 627 W. Rio Salado Parkway.

**NEXT MEETINGS (2016) AUG 20, SEP 17.**

**Our May 21, 2016 meeting:** Mike Mackowski give a talk on the subject of "Whatever Happened to SSTO?" It seems that twenty years ago all the buzz was about NASP and single stage to orbit rockets. What happened? Mike explained the history and technology and made some guesses as to whether SSTO is even technically possible.

We had about 12 attendees and most went to lunch afterwards at a nearby restaurant. We discussed plans for the summer[ since new ideas for meetings were lacking we decided to take the summer off as far as formal meetings. We will look for other opportunities to get together like space documentary films and similar social functionsL Submitted by: Mike Mackowski

**Tucson L5 Space Society** – Now serving Moon Society Members [www.tucsonspacesociety.org/](http://www.tucsonspacesociety.org/) (not updated) – [www.meetup.com/NSSPhoenix/events/161939572/](http://www.meetup.com/NSSPhoenix/events/161939572/) (not updated) Contact: Al Anzaldua – Meets monthly, every 2nd Saturday, 6:30 PM – (2016) AUG 13, SEP 10, OCT 8, NOV 12, DEC 10

**Clear Lake NSS/Moon Society Chapter (Houston)** – <http://www.moonsociety.org/chapters/houston/>

Contact: Eric Bowen [eric@streamlinerschedules.com](mailto:eric@streamlinerschedules.com) – Meeting 7 pm 3<sup>rd</sup> Mondays of even # months in the conference room of the Bay Area Community Center at Clear Lake Park: (2016)

The Houston chapter held its regular meeting at the Bay Area Community Center on June 20, 2016. Turnout was good and everyone enjoyed the chicken McNuggets and chips as well as Doug Hall's contribution of donuts. Our next regular meeting will be Monday evening, August 15th at 7:00 p.m.

The Houston Chapter will be hosting a hamburger/hot dog cookout and pool party at Anita's "Party Palace" in Nassau Bay across from the Space Center on the evening of Saturday, July 2 from 5 p.m. to approximately 9:30 p.m. We'd like to reach out to other space enthusiasts in the area, so visitors are welcome. We just need to have an accurate head count so we know how much food to provide. If you'd like to come, send an email to [info@nss-houston-moon.org](mailto:info@nss-houston-moon.org) telling us how many to expect, and we will reply with detailed directions and information. We are asking guests to bring a side dish or a dessert and we will be accepting voluntary contributions towards the meat and the beverages. Children are welcome (with proper supervision, of course) but note that alcohol will be available; plan accordingly.

Marianne Dyson, former flight controller, current author, and long-time chapter officer is hosting a book signing at the Barnes & Noble at 7626 Westheimer in Houston the evening of Friday. It will be held in conjunction with a Star Wars theme night at the bookstore. Plan to come by and see her new book, Welcome to Mars,

**JULY/AUGUST 2016 SPACE NEWS BROWSING LINKS****SPACE STATIONS + ROCKETS + COMMERCIAL SPACE**

[www.space.com/33216-blue-origin-4th-rocket-launch-landing-in-photos.html](http://www.space.com/33216-blue-origin-4th-rocket-launch-landing-in-photos.html)  
<http://phys.org/news/2016-06-astronauts-world-inflatable-space-lodge.html>  
[www.space.com/33166-space-station-commercial-3d-printer-first-tool-photos.html?utm\\_source=feedburner](http://www.space.com/33166-space-station-commercial-3d-printer-first-tool-photos.html?utm_source=feedburner)  
<http://phys.org/news/2016-06-china-year-space-station.html>  
[www.nasa.gov/press-release/nasa-uae-sign-significant-outer-space-aeronautics-cooperation-agreement](http://www.nasa.gov/press-release/nasa-uae-sign-significant-outer-space-aeronautics-cooperation-agreement)  
[www.space.com/33588-new-space-boots-help-astronauts-navigate.html](http://www.space.com/33588-new-space-boots-help-astronauts-navigate.html)  
[www.nasa.gov/mission\\_pages/LRO/main/index.html](http://www.nasa.gov/mission_pages/LRO/main/index.html)  
[www.tethers.com/HYDROS.html](http://www.tethers.com/HYDROS.html)  
[www.space.com/33443-spacex-dragon-launch-rocket-landing.html](http://www.space.com/33443-spacex-dragon-launch-rocket-landing.html)

**EARTH + NEAR SPACE**

[www.nasa.gov/press-release/nasa-satellite-finds-unreported-sources-of-toxic-air-pollution](http://www.nasa.gov/press-release/nasa-satellite-finds-unreported-sources-of-toxic-air-pollution)  
[www.spacedaily.com/reports/Study\\_finds\\_link\\_between\\_2015\\_melting\\_Greenland\\_ice\\_faster\\_Arctic\\_warming\\_99.html](http://www.spacedaily.com/reports/Study_finds_link_between_2015_melting_Greenland_ice_faster_Arctic_warming_99.html)  
[www.nasa.gov/press-release/nasa-satellite-finds-unreported-sources-of-toxic-air-pollution](http://www.nasa.gov/press-release/nasa-satellite-finds-unreported-sources-of-toxic-air-pollution)  
[www.spacedaily.com/reports/Study\\_finds\\_link\\_between\\_2015\\_melting\\_Greenland\\_ice\\_faster\\_Arctic\\_warming\\_99.html](http://www.spacedaily.com/reports/Study_finds_link_between_2015_melting_Greenland_ice_faster_Arctic_warming_99.html)  
[www.washingtonpost.com/news/energy-environment/wp/2016/06/27/its-official-humans-are-making-the-earth-much-greener/](http://www.washingtonpost.com/news/energy-environment/wp/2016/06/27/its-official-humans-are-making-the-earth-much-greener/)  
[www.yahoo.com/news/massive-lava-lamp-blobs-deep-inside-earth-scientists-133739047.html](http://www.yahoo.com/news/massive-lava-lamp-blobs-deep-inside-earth-scientists-133739047.html)  
[www.space.com/33379-supernova-explosions-earth-life-mass-extinction.html](http://www.space.com/33379-supernova-explosions-earth-life-mass-extinction.html)  
[www.solardaily.com/reports/Unearthing\\_the\\_true\\_cost\\_of\\_fossil\\_fuels\\_and\\_the\\_true\\_value\\_of\\_photovoltaics\\_99.html](http://www.solardaily.com/reports/Unearthing_the_true_cost_of_fossil_fuels_and_the_true_value_of_photovoltaics_99.html)

**MOON**

<http://phys.org/news/2016-06-private-venture-moon-mission.html>  
<http://phys.org/news/2016-06-private-venture-moon-mission.html>  
[www.space-travel.com/reports/Airbus\\_Defence\\_and\\_Space\\_to\\_guide\\_lunar\\_lander\\_to\\_the\\_Moon\\_999.html](http://www.space-travel.com/reports/Airbus_Defence_and_Space_to_guide_lunar_lander_to_the_Moon_999.html)  
[www.space.com/32964-china-moon-far-side-mission-science-goals.html](http://www.space.com/32964-china-moon-far-side-mission-science-goals.html)  
[www.space.com/33185-earth-quasi-moon-asteroid-2016-ho3.html](http://www.space.com/33185-earth-quasi-moon-asteroid-2016-ho3.html)  
[http://www.space-travel.com/reports/Taiwan\\_to\\_make\\_lunar\\_lander\\_for\\_NASA\\_moon-mining\\_mission\\_999.html](http://www.space-travel.com/reports/Taiwan_to_make_lunar_lander_for_NASA_moon-mining_mission_999.html)  
[www.space-travel.com/reports/While\\_Politicians\\_Fight\\_Russian\\_and\\_US\\_Engineers\\_Plan\\_Manned\\_Moon\\_Mission\\_999.html](http://www.space-travel.com/reports/While_Politicians_Fight_Russian_and_US_Engineers_Plan_Manned_Moon_Mission_999.html)

**MARS**

[www.marsdaily.com/reports/NASA\\_Mars\\_Orbiters\\_Reveal\\_Seasonal\\_Dust\\_Storm\\_Pattern\\_999.html](http://www.marsdaily.com/reports/NASA_Mars_Orbiters_Reveal_Seasonal_Dust_Storm_Pattern_999.html)  
[www.marsdaily.com/reports/Mars\\_colonists\\_to\\_undergo\\_five\\_days\\_of\\_tests\\_999.html](http://www.marsdaily.com/reports/Mars_colonists_to_undergo_five_days_of_tests_999.html)  
<http://phys.org/news/2016-06-dutch-crops-grown-mars-soil.html>  
<http://www.space.com/33335-huge-moons-may-have-hit-mars.html>  
<http://phys.org/news/2016-07-giant-impact-mystery-mars-moons.html>  
[www.marsdaily.com/reports/Mars\\_Canyons\\_Study\\_Adds\\_Clues\\_about\\_Possible\\_Water\\_999.html](http://www.marsdaily.com/reports/Mars_Canyons_Study_Adds_Clues_about_Possible_Water_999.html)  
[www.marsdaily.com/reports/NASA\\_Selects\\_Five\\_Mars\\_Orbiter\\_Concept\\_Studies\\_999.html](http://www.marsdaily.com/reports/NASA_Selects_Five_Mars_Orbiter_Concept_Studies_999.html)  
[www.marsdaily.com/reports/NASA\\_Selects\\_Five\\_Mars\\_Orbiter\\_Concept\\_Studies\\_999.html](http://www.marsdaily.com/reports/NASA_Selects_Five_Mars_Orbiter_Concept_Studies_999.html)  
<http://phys.org/news/2016-07-deeper-mars.html>  
<http://phys.org/news/2016-07-mars-gullies-liquid.html>

**ASTEROIDS + COMETS**

[www.space.com/33185-earth-quasi-moon-asteroid-2016-ho3.html](http://www.space.com/33185-earth-quasi-moon-asteroid-2016-ho3.html)  
[www.space.com/33048-spinning-comets-can-break-apart-reform.html](http://www.space.com/33048-spinning-comets-can-break-apart-reform.html)  
[www.space.com/33043-planetary-resources-ceres-earth-observation-project.html](http://www.space.com/33043-planetary-resources-ceres-earth-observation-project.html)  
[www.space.com/33310-biggest-mysteries-dwarf-planet-ceres.html](http://www.space.com/33310-biggest-mysteries-dwarf-planet-ceres.html)  
<http://phys.org/news/2016-07-dawn-ceres-craters-ice-accumulate.html>

<http://phys.org/news/2016-07-nasa-surface-asteroid.html>  
<http://phys.org/news/2016-07-goodbye-philae-earth-severs-link.html>  
<http://phys.org/news/2016-07-comets-born.html>

### OTHER PLANETS + MOONS

[www.space.com/33058-jupiter-clouds-ammonia-swirls-radio-telescope-map.html](http://www.space.com/33058-jupiter-clouds-ammonia-swirls-radio-telescope-map.html)  
[www.space.com/15498-europa-sdcmp.html](http://www.space.com/15498-europa-sdcmp.html)  
[www.space.com/16440-ganymede-facts-about-jupiters-largest-moon.html](http://www.space.com/16440-ganymede-facts-about-jupiters-largest-moon.html)  
[www.scientificamerican.com/article/excitement-builds-for-the-possibility-of-life-on-enceladus/](http://www.scientificamerican.com/article/excitement-builds-for-the-possibility-of-life-on-enceladus/)  
[www.space.com/33294-enceladus-may-resemble-earth-lost-city.html](http://www.space.com/33294-enceladus-may-resemble-earth-lost-city.html)  
[www.space.com/32848-pluto-moon-hydra-water-ice.html](http://www.space.com/32848-pluto-moon-hydra-water-ice.html)  
[www.space.com/33256-pluto-may-harbor-liquid-ocean.html](http://www.space.com/33256-pluto-may-harbor-liquid-ocean.html)  
[www.space.com/33223-charon-and-ceres-contain-pencil-graphite.html?cmpid=NL\\_SP\\_weekly\\_2016-6-22](http://www.space.com/33223-charon-and-ceres-contain-pencil-graphite.html?cmpid=NL_SP_weekly_2016-6-22)  
[\(on Pluto\)](http://phys.org/news/2016-06-bolsters-case-present-day-subsurface-ocean.html)  
[www.space.com/20812-saturn-moons.html](http://www.space.com/20812-saturn-moons.html)  
[www.space.com/33412-nasa-aerobot-drone-saturn-moon-titan.html](http://www.space.com/33412-nasa-aerobot-drone-saturn-moon-titan.html)  
[www.spacedaily.com/reports/Chemical\\_trail\\_on\\_Titan\\_may\\_be\\_key\\_to\\_prebiotic\\_conditions\\_999.html](http://www.spacedaily.com/reports/Chemical_trail_on_Titan_may_be_key_to_prebiotic_conditions_999.html)  
[www.space.com/22201-uranus-moons.html](http://www.space.com/22201-uranus-moons.html)  
[www.space.com/22222-neptunes-moons.html](http://www.space.com/22222-neptunes-moons.html)  
[www.space.com/22223-triton-moon.html](http://www.space.com/22223-triton-moon.html)  
[www.space.com/33332-new-horizons-pluto-probe-mission-extension.html](http://www.space.com/33332-new-horizons-pluto-probe-mission-extension.html)  
[www.spacedaily.com/reports/Chemical\\_trail\\_on\\_Titan\\_may\\_be\\_key\\_to\\_prebiotic\\_conditions\\_999.html](http://www.spacedaily.com/reports/Chemical_trail_on_Titan_may_be_key_to_prebiotic_conditions_999.html)  
[www.space.com/22201-uranus-moons.html](http://www.space.com/22201-uranus-moons.html)  
[www.space.com/33387-dwarf-planet-discovery-2015-rr245.html](http://www.space.com/33387-dwarf-planet-discovery-2015-rr245.html)  
<http://phys.org/news/2016-07-lies-beneath-venus-surface-revealed.html>  
[www.spacedaily.com/reports/BepiColombo\\_Mission\\_to\\_Mercury\\_on\\_Track\\_for\\_April\\_2018\\_Launch\\_999.html](http://www.spacedaily.com/reports/BepiColombo_Mission_to_Mercury_on_Track_for_April_2018_Launch_999.html)  
[www.space.com/33551-jupiter-heats-up-great-red-spot.html](http://www.space.com/33551-jupiter-heats-up-great-red-spot.html)  
[phys.org/news/2016-07-jupiter-great-red-planet-upper.html](http://phys.org/news/2016-07-jupiter-great-red-planet-upper.html)

### ASTRONOMY + ASTROBIOTICS

[www.space.com/33138-light-pollution-world-sky-atlas.html](http://www.space.com/33138-light-pollution-world-sky-atlas.html)  
<http://phys.org/news/2016-06-alien-life-exoplanets-dies-young.html>  
<http://phys.org/news/2016-06-cloudy-days-exoplanets-atmospheric.html>  
[www.space.com/33203-aliens-extraterrestrial-life-1500-years-for-contact.html](http://www.space.com/33203-aliens-extraterrestrial-life-1500-years-for-contact.html)  
<http://phys.org/news/2016-06-strong-electric-planets-oceans-atmospheres.html>  
[www.space.com/33176-gravitational-waves-from-second-black-hole-collision.html](http://www.space.com/33176-gravitational-waves-from-second-black-hole-collision.html)  
<http://phys.org/news/2016-06-network-theory-mystery-stellar-mass.html>  
<http://phys.org/news/2016-06-simulations-milky-red-giants.html>  
<http://phys.org/news/2016-06-successful-galactic-center-gravity.html>  
[www.space.com/33061-universe-expanding-faster-than-thought-hubble.html](http://www.space.com/33061-universe-expanding-faster-than-thought-hubble.html)  
<http://phys.org/news/2016-06-clumpsof-matterformed-universe-future.html>  
<http://phys.org/news/2016-06-dormant-black-hole-star-x-ray.html>  
<http://phys.org/news/2016-06-successful-galactic-center-gravity.html>  
<http://phys.org/news/2016-06-team-universe-crowded-black-holes.html>  
<http://phys.org/news/2016-06-strong-electric-planets-oceans-atmospheres.html>  
<http://www.space.com/33306-how-does-the-universe-expand-faster-than-light.html>  
<http://phys.org/news/2016-07-astronomers-evidence-clouds-spectrum-coldest.html>  
<http://phys.org/news/2016-07-scientists-radio-emission-nearby-brown.html>  
<http://phys.org/news/2016-07-equation-quantify-life-planets.html>  
[www.space.com/33424-seti-seeks-ideas-to-hunt-strange-alien-lifeforms.html](http://www.space.com/33424-seti-seeks-ideas-to-hunt-strange-alien-lifeforms.html)  
<http://phys.org/news/2016-07-astronomers-dizzying-milky-galaxy-halo.html>  
<http://phys.org/news/2016-07-star-birth-early-clues-life.html>  
<http://phys.org/news/2016-07-nasa-planet-hunter-closer-home.html>  
<http://phys.org/news/2016-07-role-magnetic-fields-star-formation.html>

CubeSats Coming of Age on the Lunar Frontier

# 6<sup>th</sup> International Workshop on LunarCubes

September 28-29, 2016 - Bellevue, WA

Lunar Workshops 2016      September 26 - October 2, 2016

Page <http://lunar-cubes.com>

**Seattle, WA is the place and it's all about space at LunarScene 2016!**

We've combined our highly regarded technical workshops on Lunar Surface Applications and LunarCubes with our Space Entrepreneur workshop and Hack the Moon hackathon for one spectacular, 10 day event.

**Join us September 26 – October 2, 2016 for the Lunar Workshop Of The Year – LunarScene 2016.**

Sept. 26–27, 2016 – 6<sup>th</sup> International Workshop on Lunar Surface Applications

Sept. 28–29, 2016 – 6<sup>th</sup> International Workshop on LunarCubes

September 30, 2016 – Entrepreneur Day

October 1–2, 2016 – Hack the Moon

Proceedings and presentations will be made available online after the event for participants.

Registration – <http://lunar-cubes.com/registration>

**Presentation Requirements:**

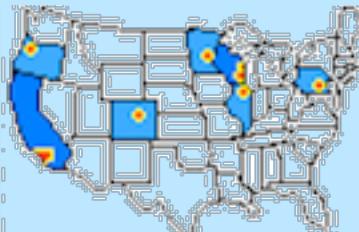
Please submit an abstract prior to August 16, 2016. please email [Faith.Urban@LunarInitiatives.com](mailto:Faith.Urban@LunarInitiatives.com)

<http://gator3238.hostgator.com/~speedhos/lunarcubes.com/abstract-upload.html>

<http://gator3238.hostgator.com/~speedhos/lunarcubes.com/presentation-upload.html> HOTEL:

Red Lion Hotel Bellevue 11211 Main Street, Bellevue, WA 98004, Phone: (425) 455-5240. Fax: (425) 455-065

### 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 – <http://legacy.moonsociety.org/chapters/milwaukee/>  
<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](mailto:kokhmmm@aol.com) VICE-PRESIDENT Doug Armstrong  
 NSS (414) 273-1126 – SECRETARY – Charlotte Dupree NSS (262) 675-0941 [gdupree@charter.net](mailto:gdupree@charter.net)

• James Schroeter (414) 333-3679 – [james\\_schroeter@yahoo.com](mailto:james_schroeter@yahoo.com) TREASURER/Database • Robert Bialecki (414)  
 372-9613 – [bobriverwest@yahoo.com](mailto:bobriverwest@yahoo.com) (• Current Members of the MLRS Board of Directors)

**Meetings:** Mayfair Mall lower level room G150 for all meetings except December, in G110:

DEC 12 – **2016 Schedule** MAY14 – JUN 11 – SEP 10 – OCT 8 – NOV 12

*Past articles* [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)  
*Or arranged by themes:* [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

WISCONSIN



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

[www.sheboyganspacesociety.org](http://www.sheboyganspacesociety.org) c/o Will Foerster 920-894-1344 (h) [astrowill@frontier.com](mailto:astrowill@frontier.com)

SSS Sec./Tres. c/o B.Pat Knier [dcnpatknier@gmail.org](mailto:dcnpatknier@gmail.org)

DUES: "SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

**2016 MEETINGS:** Meetings are held – **3rd Thur even # months:** Dec Call for location (920) 894-1344

"

CALIFORNIA



**OASIS: Organization for the Advancement of Space Industrialization & Settlement**  
**Greater Los Angeles Chapter of NSS – PO Box 1231, Redondo Beach, CA 902**

Events Hotline/Answering Machine: 310-364-2290 – Odyssey Ed: Kat Tanaka [odyssey\\_editor@yahoo.com](mailto:odyssey_editor@yahoo.com)  
[oasis@oasis-nss.org](mailto:oasis@oasis-nss.org) – Odyssey Newsletter [www.oasis-nss.org/articles.html](http://www.oasis-nss.org/articles.html) Regular Meeting 3 pm 3<sup>rd</sup> SAT monthly – **2016 Schedule** 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/>

**James W. Barnard** 303-781-0800 [trailrdr@ecentral.com](mailto:trailrdr@ecentral.com) – Monthly Meetings every **3rd Thursdays, 7 pm**  
Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, 1st Flr Civic Center  
**2016:** May 19, Jun 16, Jul 21, Aug 18, Sep 15, Oct 20, Nov 17, Dec 15

ILLINOIS



[LDAhean@aol.com](mailto:LDAhean@aol.com)

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

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 Schedule** Jun 2 – Jul 7 – Aug 4 – Sep 1 – Oct 7 – Nov 4 – Dec 1

OREGON



**Oregon L5 Society** – <http://www.OregonL5.org>  
PO Box 86, Oregon City, OR 97045

(LBRT – Oregon Moonbase) [moonbase@comcast.net](mailto:moonbase@comcast.net) – Charles Radley: [cfrjlr@gmail.com](mailto:cfrjlr@gmail.com)

Meetings the **3rd Sat** of the Month at 2:00 PM – **2016 Schedule** May 20 – Jun 18 – Sep 17 – Oct 15 – Nov 19 – Dec 17

*Past articles* [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)  
*Or arranged by themes:* [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

PENNSYLVANIA



## NSS-PASA: NSS Philadelphia Area Space Alliance

928 Clinton Street, Philadelphia, PA, 19107 <http://chapters.nss.org/pa/philly>c/o Earl Bennett, [Earlisat@verizon.net](mailto:Earlisat@verizon.net) – 856/261-8032 (h), 215/698-26**Meetings 3rd Thursday monthly 2016;****The NSSPASA Report for June, 2016**

**Meeting times and locations:** In July and August will be at the Liberty One Food Court on The tenth and the sixth respectively. This will be from one to three p.m. . We are planning to be part of the 2016 Super Science Space event later in August. This was formerly a part of the New Jersey State Museums Super Science Saturday in the spring ,but, the activities were broken into several specialty events (crafts, history space exploration, etc.). We have no activities scheduled for July (nothing for Landing Day), and August has not been nailed down. Individual members and friends will visit the Maker Fair that happens at The Queens Hall of Science in September.

Larry (our webmaster for 16 years!\_ gave the first report on web activities and his desire for assistance with the web work. He has been Some of the things brought up included Moon Miners having the wrong website for us (we are moving to an NSS supplied site: <http://chapters.nss.org/pa/philly>) which could get you old data. Larry has urged us to have the old site information removed from sites that still use it for a reference. On happier news: Larry reports that the QR code on the back of the card he redesigned works fine: he was talking to someone (at Balticon?) and they tried connectintg to our site via the code and was successful. More on that later.

Dorothy brought a number of things from the museums in the mid Atlantic region including: on the Intrepid you can have "The Star Fleet Academy Experience" opening July nineth. It will be a huge exhibit, 12000 square feet, and will be divided into a number of areas including medicine, engineering, navigation and more. The exhibit runs from July 9 to October 31. This special exhibit includes timed tickets and advanced registration for tours is recommended. Go to the website for much more on the Starship Intrepid! There will also be a space and science festival from July 14 to the 17<sup>th</sup> on the ship. And at the American Museum of Natural History: The Rose center component of the Museum will have "Dark Universe", the movie, and how the film was made. The voice of the film is Neil de Grasse Tyson. The center also has on exhibit one of the masks that are used to control the light travelling through the Webb space telescope. Note that the Webb is on the cover of the June NASA Tech Briefs.

On the event mentioned earlier: Dotty and Larry, along with Earl and Michelle and Hank and Wallace all went to Balticon science fiction convention and had varying reactions to it: Dorothy did her Sunday service and was pleased with the attendance and the attitude the people had who came. The service was based on the Quaker Meeting style. On the other events at the Balticon: Dotty thought that it was good but a bit of a mad house at this new location. Some of the problem was simply a lot of talks that conflicted. This was not due to a huge quantity of interesting talks, but rather groupings that conflicted (the offsetting of when talks happened was part of the problem). We attended several talks together including a stand out, by John Ashmead, on Quantum Dots and their Application. Michelle and Earl thoroughly enjoyed this topic and his style. Some talks were outside of space exploration but enjoyable: Genetics in bird speciation was one of these. We also attended a talk on L-5 colonies, but, we were not engaged enough to stay. Johns' talk was the alternative.Wallace talked of the special Guests of Honor of the Past. I should mention that George R.R. Martin was the present Guest of Honor. It was a great event!

Hank reported that two people will be doing science programming and Hank will be assisting. We (Mitch and Earl ) have been contacted by The Philcon Committee already and plant to submit panel and talk ideas. Hank will be going to a Con at the Sci Fi Museum in Washington D.C. on the 4<sup>th</sup> of July weekend. He will be busy this summer going to Lunacon (in August in Riersertown Md.) and Shore Leave. And we talked about hotels again. We should know in the next few months if the NASFIC science fiction event will be coming here.

Janice brought in a report on perseverance: a scientists search for a cosmic ray particle made up of a particular isotope of Iron (56). In seventeen years he found fifteen of them. These are from a supernova in our vicinity. From Science, May 6<sup>th</sup> . Doing basic research doesn't always mean using the latest instruments and getting results relatively quickly. Parenthetically: Earl has read a report on the source of particles detected from interstellar space in which there are two possible sources along a 1 degree wide band that is along the Earths orbit. That report included the reasoning for at least two effects that could cause the lack of definitive location of which of two possible sources are responsible for the observed material. This is from Freeman Dyson's talk "Looking for Life in Unlikely Places" in the book "Interstellar Travel and Multi-Generation Space Ships" edited by Yoji Kondo et al.

Mitch gave an extended report that included our readiness to send our payment to Moon Miners, the June observational opportunity for Mars (best proximity and illumination in years) and his work on the upcomming anniversary of the publication of the book "The High Frontier" by Gerrard K. O'Neill. This publication is why many of us began thinking that we could be the people doing those things that formerly were only being done by a tiny group of former military pilots and specialists or in shows with actors doing things that were off in the (relatively) distant future. Dr. O'Neill's book talked of the steps that are necessary, in broad outline, to actually live as

Past articles [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)

Or arranged by themes: [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)

permanent residents on/in a habitat including gathering the material and paying to put all of the elements together. This is where many of us first saw the idea of using off Earth resource, and specifically the Moon, as the major source for materials, and, getting them where we would use them without launching tens of thousands of rockets from lunar mining sites (using the electromagnetic device called the Mass Driver, or, the gas cannon that is seldom mentioned after its' introduction in a NASA report). Mitch is in correspondence with Derrick Pitts, Chief Astronomer, of the Franklin Institute on an event in 2017 of the fortieth anniversary of the publication. Mitch is also working on at least one panel for the Fall Philcon. In addition he reported on an article titled: Can We Protect Mars Explorers From Deadly Cosmic Radiation? . The answer points out that there are a limited number of effective measures ( using materials from Earth I think) with low mass shielding, but, it also points toward pharmacological and biological solutions . Some of these have been worked on for decades due to worries about the effects of possible nuclear strikes or accidental releases radioactive materials. These would also apply to other exposures until we have cheap materials launched from the Moon or drawn from asteroidal sources. He also reported on "the Book of Answers" from Fog City Press with a chapter on nano scale medication to be injected before entering space.

Rich Bowers, our oldest member and our founder, points out that a report he has read (on line?) claims that immortal humans could be created. Rich points out that space habitats and exploration would be the best way for those people to contribute to our species and would also reduce the chances of a tyrannical society that could be very difficult to reform ("liberalize"). There have been a number of science fiction stories exploring what would happen with various forms of quasi or effective immortality. From Robert Heinlein and Lazarus long to The Young Immortals of G. avid Nordley we have various thoughts on what they might do among us or achieve for humanity.

Earl reported in a number of areas and we had contributions from attending members in several areas: there have been a number of launches of both Space X and Blue Origin main stages with most being successes. Just as Robert Heinlein and a number of writers have described these vehicles go up and come down vertically. Several of these have gone to space, sub orbital, and came back for refurbishing and re-launch. As the old saying goes "when already?" for the first to orbit, with crew, and back. The preliminaries, putting payloads into orbit and returning for a quick turn around will take some years, but, sub-orbital and orbital flights should happen before the Mars exploration parties leave. One possible near term use would be to place some of the Lunar X-Prize vehicles and their orbital injection stage. In somewhat farther out news: In Analog for July/ Augusts Alternate View column by John Cramer is more on Tabby's Star and the possibilities of better gravitational wave detection and a Higgs family member. Tabby's star has more peculiarities than large light extinctions (compared to most other transient light dips). When the long term light curves for the star were examined it was found that there is a trend toward lower detected emissions over time. Look for Tabitha Boyajians' group at Yale for the latest result and links to related material. The LIGO detection has been refined and is now (at the time of Johns report) thought to have been the merger between a 29 solar masses and a 36 solar masses black hole. This created a 62 solar masses black hole and the waves detected across 1.5 billion light years. He reports that the detected strain variations (the signal) was on the order of ten to the minus 21 . And the sensitivity is going to be improved, and, other detectors will be brought on line. As mentioned last month, from Analog and other sources, there are plans for space based detector(s) as well. And the "Gos Companion" particle? Check with the C.E.R.N. site and others for more on this work, and see the reference list on page 80 of the column. On the cover of the June, 2016, NASA Tech Briefs is an image of the Webb Space Telescope, which should go up in a few years, which is related to a special section on NASAs advanced coatings work at the Goddard Space Flight Center. The report begins on page twelve and features some of the people who have done the work, including Grace Miller, who has worked as a coatings engineer back to the 1960s with NASA. She is world renowned in her field (she is shown with members of the thermal coatings group). The current engine of choice for much discussion is the Ion Engine. In this issue is a report on a version of the device that uses Iodine as the working fluid (fuel) instead of the more typical Xenon.

This device is one of a family of engines called "Hall Effect Thrusters" that combine the use of electro static and magnetic fields (applying the Hall effect) to control the energy and direction of the emitted ionized material. This version has several points that the authors think recommend it. Two of them are: the configuration allows a reduction of damage to the engines components by the stream of ions that can hit the internal structure as they travel through the engine to be accelerated by the fields, and second, the need to handle cryogenic material, Xenon or other gases, is eliminated as Iodine requires no such cooling. This reduces the mass required for containing the fuel (no pressure vessel required). This report, starting on page 53 of the June issue, was done for NASAs' Marshall Space Flight Center by James Szabo, Bruce Pote, and, Vlad Hraby of Busek Co. Inc. . Further work needs to be done and NASA is looking for partners to continue development. I should note here that a number of efforts for the space program are handled by this method of public and private contractor partnering. Also: the next article is on controlling a problem with nuclear thermal rocket degradation being done for Marshall Space Flight Center.

There is a huge amount of interesting work being done but I will finish with two items from different NASA publications: from Sensor Technology (special issue): "Making Sense From Sensors" on the topic of sensor fusion. The article points out that we have more and more sensors and a number of interfaces for them. We measure a number of quantities directly, or as related effects, and can combine them to get an overview of some state that we are looking at. As an example we can look at the results of various devices hooked up to, internal to, or remotely

sensing, a patient (or space traveler?) and presenting them in an easy to interpret way to medical personnel. This is collected as "telemetry" data that you may have seen in a hospital. It also applies to most of our technical equipment as well as our bodies now. By Diya Soubra for Arm Cortex-M Processors, ARM, Inc. . And from the May Medical Design Briefs: Researchers tame aerogel by freezing it from a group at The University of Buffalo. This is describing a technique to make 3D objects from Graphene in suspension, initially by pouring it into freezing molds, or by mixing it with a thickening agent, such as a polymer, and printing the structure with a 3D printer. The researchers working on a third method, in the Buffalo and at Harbin Institute of Technology in China and Kansas State University here, that uses a modified 3D printer and frozen water to create desirable structures without some of the problems that can be caused by subsequent processing in the other techniques. All of this effort is because Graphene has a number of desirable properties for Earth and space applications: conductivity much higher than copper, both thermally and electrically, and is stronger than steel ( by 300 times), and, can be made into a very light, strong structure/ system. The technique involves layers of the Graphene material and layers of ice assembled on a -25 degree substrate. The assembly is created, then dipped in liquid nitrogen and subsequently freeze dried. See the report and the background on Graphene and its' potential ( and the work needed to get some of it).

#### . The NSSPASA Report for July 2016

**Meeting times and locations:** Our next meeting will be August 6th, and we will be doing an event on August 20<sup>th</sup> at The New Jersey State Museum. In September we will meet on the 10<sup>th</sup> at Liberty One in the Food Court.

**Meeting Notes:** we had a well attended meeting with much diversion into the history of the Weimar Republic and the conditions that gave us the rocket team and the Third Reich. This started due to a recent cover of "The Economist" with the robot from "Metropolis" on the cover. Our group has a number of history buffs and they can sometimes be distracting. As can those interested in other activities.

**Larry's report:** our website and Facebook are getting decent views and the site looks good. With our new cards you can reach our site using a smart phone to scan the "QR" code on the new card. Larry and I discussed what to do with our old cards and came up with a solution that I will share: Larry can print a copy of the QR code on adhesive backed labels and thus salvage the "old fashioned" cards with a link to our new version of our website. Very good Larry! He also brought in an example of the JAVA script that he uses to build elements of our web presence. He wants to encourage members to learn to maintain and improve our presence on the web. This is probably something that many chapters of the various space exploration organizations should look into. At this point there are a large number of people with some experience with coding and some may like to help your organization with their activities on the web. One group Earl is affiliated with, Amsat, issued a call for assistance in various technical areas including web support. Canvas your people and you may get what you need. Also: Larry has asked me to contact Ron La Joie to confirm our new (NSS provided) website.

**Dorothy** brought several things including a summer fun activity: The Aviation Hall of Fame and Museum of New Jersey at Teterboro Airport. Open Tuesday to Sunday from 10 to 4 p.m.. And on special days, four times a year, "Open Cockpit" happens. Kids and family members can sit in the cockpits of a number of planes. And in December Santa Claus flies in on board a helicopter. See the website: njahof.org . Also: Robot Revolution is coming to The Franklin Institute. This will be there from October, 2016 to April 2<sup>nd</sup> 2017. See the museums website for prices and other activity at The Institute (fi.edu).

**Hank Smith** announced that he is not part of Science Programming at Philcon this year. He attended the Escape Velocity convention in Maryland, and, he went to Shore Leave on the 15<sup>th</sup> and 16<sup>th</sup>. He has clarified his World Con connection: he has a supporting membership for the event, which allows him voting privileges, but is not an attending membership.

**Dennis Pearson** went to the ISDC! He thought Puerto Rico was fun and he got to go see the Arecibo Radar Astronomy site (from inside the equipment room at the focus). At the ISDC one of the speakers, President Gleason of Orbital Sciences, said that there is a problem with the non competitive environment that space business presently is in. parenthetically: this looks to be changing in the near future: we had, in July, a successful launch, return, and relaunch to the I.S.S. . The "take it or leave it" nature of the previous period looks to be going away. And Sheppard could be available too, and how many others? Dennis also noted that one of the local Science Fair winners from the Allentown area, where he was instrumental in setting up an award, in the national finals.

**Mitch** reported that the head of E.S.A. says Mars is not going to be landed on till at least 2031. Also: Elon Musk is planning to send 3D printers and other equipment to Mars to begin manufacturing items explorers and inhabitants as early as 2018. The astronauts would get there in 2030. And Juno has arrived! The probe to study Jupiter's atmosphere, magnetic fields, and, radiation environment arrived during the 4<sup>th</sup> of July period and has a twenty month mission before being dropped into Jupiter to avoid possible contamination of Europa (studies of future orbital intersections indicated this possibility). The orbit of the craft is pole to pole rather than equatorial in order to collect data over the whole planets atmospheric zones rather than a band around the equator. Some features at the poles also caused this path selection. And another purpose of this crafts operation is to help get data on the formation of the planets and where they originally were in the early solar system. See the NASA website for more on Juno. And Mitch commented on the ISDC and it's location in Puerto Rico. In Ad Astra for Spring with the great shot from space of the island at night, and, the issues other articles including "Humans Orbiting Mars, by John Logsdon and Casey Dreier, and "How to Think about Going to Mars" by Dale Skran. See the reports and look

*Past articles [http://legacy.moonsociety.org/publications/mmm\\_classics/](http://legacy.moonsociety.org/publications/mmm_classics/)*

*Or arranged by themes: [http://legacy.moonsociety.org/publications/mmm\\_themes/](http://legacy.moonsociety.org/publications/mmm_themes/)*

at the timelines ( and the graphics for possible staging activities for the eventual arrival).

Because we are in a presidential election year there was much talk on whether anyone had heard a concrete declaration of intentions toward space exploration from any of the candidates. We had not heard this as such. Rich Bowers brought this up along with some history of European societies in times of enormous changes. This was a bit of distraction from our reports closer to space exploration , but, we did get something from that period: the Rocket Team was formed and active in Germany while the politics around them gave the world the second world war. All of this discussion was brought on by a copy of The Economist, an English financial publication, with the iconic robot from the film Metropolis on the cover. The related article was "The Rise of the Robots". The magazine was brought in by Steven, a theologian and history buff, who promotes the non military exploration and habitation of space at events. Earl will get issue information on the issue if interest requires it.

Earl rechecked his postings from the New Jersey State Museum and found that NSSPASA is to exhibit at the Space Exploration and Habitation event at the museum on August 20<sup>th</sup> . This should happen before this is published as hard copy. We have been part of the museums activities for about twenty five years now and began when it was a mid winter event. We bring various displays and hand outs on numerous topics to get the public interested and supportive of space exploration and the many areas of science and technology that would make it possible for them, and the children, to be part of these historical activities. Because of the mixed audience you have to be serious and a showman to get the audience members to listen to what we hope to create for that future civilization: an educated, motivated, creative population supporting investment of time and resources in the expansion of humanity beyond the Earth. I am trying to put together some propulsion oriented displays with the Photonic Sails ("Light Sails") moving up on the list of possible exhibits. The Starshot program, with its' emphasis on this kind of propulsion, is the reason for this. On that subject: there has been a little more material released on the project and the organization backing it:

The Breakthrough Prize Foundation. This group has a number of projects going including a SETI program. In order to plan better, and to secure scientific knowledge about planets around other stars, work will go forward on upgrading and adding to the instruments, both ground based and in space, searching for Earth like planets around other stars and the Alpha Centauri system in particular. The main program is also noted in this website and how there may be the launch of a "carrier" craft to bring a large number of probes up to orbit before deployment in orbit and subsequent laser array acceleration (the name in the paper is "Light Beamer"). They have begun to outline areas where added research is needed and they will probably need help in the areas mentioned. Working scientists may like to check out: breakthroughinitiatives.org. Note: I tried to print out five pages of the websites documents only a few printed. This may be due to my older system. Also: in a special addition to the normal quality material in NASA Tech Briefs there was a Photonics Tech Briefs with several articles on technology being developed for space exploration: "NASA's Infrared Sensors Spots Near Earth Asteroids" with an interview with Amy Mainzer who is a research scientist and is the NEOCam Principal Investigator at J.P.L. . The NEOCam is located at the L-1 point in the Earth-Moon and Sun system. The main reason this new camera can detect these objects is because the sensor, using Mercury Cadmium Telluride as the individual pixels, has been tuned ,compositionally, for the wavelengths emitted by the NEAs. This is around 300 kelvin. Another point is that this sensor assembly (which includes a readout chip called HAWAII) can operate in the 35 to40 degree Kelvin range, thus relaxing the cooling levels necessary to make such things work. Neat pictures. See the Photonics and Imaging Technology for July, 2016, and: [www.jpl.nasa.gov/asteroidwatch](http://www.jpl.nasa.gov/asteroidwatch) .

Lots more in this and the main Tech Briefs publication There is also medically material in the Medical Design Briefs issue. In the R&D Roundup section is a brief summary of techniques used to find flaws in Titanium components. The main emphasis is medical components, but, this kind of technology could be used in aerospace and other critical manufacturing areas. There is much more in this issue on advances in surgical techniques and applied research: there is another brief report on the creation of miniature artificial lungs for example. July, 2016 issue. And from Amsat: progress is being made on the study of the integration of a ham communication system with a large , commercial, payload. The study is to determine if the integration is possible and costs quite a bit of money (over \$100k). In other parts of the overall report, delivered at the Dayton Hamvention, there was a lot on the many CubeSats in orbit and planned including several with experiments contributed by a number of Universities and other groups. One of the highlights of this report, in the May/June Amsat journal, is the plans going forward for a new amateur satellite using microwave techniques: The "Nickel and Dime" system, meaning operation at five gigahertz and ten gigahertz, for the uplink to the satellite and downlink, respectively. Great issue. And one more tech item: on an NHK show recently a research was shown developing a new way to build wings, and other moving medium devices, that was built using knowledge gained from studying the flight of Dragonflies. The demonstration of the effect of using the technique was interesting for Earth bound uses now and on other worlds later: a wind turbine was shown comparing a conventional blade design and the bio-mimicing design. The bio-mimic started producing energy at significantly lower wind speeds than the conventional design. If this could be applied to a Mars aircraft we could see a savings in required energy, and thus power system mass, for aero explorers.

Note: Dorothy will publish her latest "Dimensions" by the time this is published. This includes her and Larry's touring.

Submitted by Earl Bennett, President, NSSPASA, KD2CYA

**Moon Miners' MANIFESTO**  
**Milwaukee Lunar Reclamation Society, Inc.**  
**PO Box 2102, Milwaukee, WI 53201-2102**



**PRSR STD  
U.S. POSTAGE  
PAID  
MANASOTA FL  
PERMIT No. 802**

Please renew promptly so as not to miss an issue  
 Address Service Requested  
 -->> Mail Carrier, Time Sensitive Material

## INDEX to MMM #297 August 2016

- In Focus: Between "suburban" Earthside & the Moon: Geosynchronous Orbit Activities could be Earth's Economy
3. Building-out GEO with Materials from where on the Moon? Two Options, Peter Kokh.
  4. Making Heavy Equipment on the Moon, Dave Dietzler
  6. A Brief Assessment of Regolith Processing Systems, Dave Dietzler
  7. Space Solar vs. Elon Musk's Rooftop Solar, Dave Dietzler
  8. Book Review: A Case for the Moon by Robert Walker

---

### Moon Society Journal Section

9. An Update on current Moon Society Projects
  10. How to throw a Star Party
  11. Moon Society Chapter ^ Outpost News
- 

12-13. Browsing Links

14 International Workshop #6 on Lunar Cubes; NSS-MMM Chapter News

---

**CHAPTER MEMBER DUES -- MMM Subscriptions:** Send proper dues to address in chapter section

**CHICAGO SPACE FRONTIER L5** • \$15 annual dues

**MILWAUKEE LUNAR RECLAMATION SOC.** • \$15 low "one rate" to address above

**MINNESOTA SPACE FRONTIER SOCIETY** • \$25 Regular Dues

**OREGON L5 SOCIETY** • \$25 for all members

**O.A.S.I.S. L5 (Los Angeles)** • \$28 regular dues with MMM

**PHILADELPHIA AREA SPACE ALLIANCE**

- Annual dues with MMM \$25, due March or \$6 per quarter before the next March

**SHEBOYGAN SPACE SOCIETY (WI)** • \$15 regular, • \$10 student/teacher/friend • \$1/extra family member

**Individual Subscriptions outside participating chapter areas:** • \$15 USA • \$25 Canada;

- US \$55 Surface Mail Outside North America – Payable to “MLRS”, PO Box 2102, Milwaukee, WI 53201