

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

Moon Miners' Manifesto

& The Moon Society Journal

www.MMM-MoonMinersManifesto.com



Soon many people will be able to fly to the edge of space. As prices drop, this will be but the beginning. Day flights and night flights, aurora flights, full moon flights; milky way flights. Further down the road are flights via the edge of space to especially attractive intercontinental destinations: Hong Kong, CapeTown, Rio de Janeiro, Dubai etc.

Feature Articles

1 In Focus: Creating a Manufacturing "Beachhead" on the Moon, Peter Kokh

5 Growing "Start-up" Industries on the Moon, Dave Dietzler

6 "Backing up" our Civilization, Peter Kokh



Left: Station at L1 ----- Right: archives of human civilization in a lunar lavatube

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://www.MoonSociety.org/publications/mmm_classics/
 - **MMM THEME Issues:** 14 collections of articles according to themes: [.../publications/mmm_themes/](http://www.moonsociety.org/publications/mmm_themes/)
 - **MMM Glossary:** new terms, old terms/new meanings: www.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 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://www.moonsociety.org/chapters/milwaukee/>
 - **The National Space Society** is a grassroots pro-space member-ship organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.
National Space Society 1155 15th Street NW, Suite 500 Washington, DC 20005 (202) 429-1600 – www.NSS.org
 - **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon.” – Contact info p. 9.
 - **NSS chapters** and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.
 - **Publication Deadline:** Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, Sooner is better! – **No compensation is paid.**
 - **Submissions by email** to KokhMMM@aol.com – Email message body text or MS Word, 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 Creating a Manufacturing “Beachhead” on the Moon There's more to it than most of us suspect

By Peter Kokh

“A **beachhead** is a temporary line created when a [military](http://en.wikipedia.org/wiki/Beachhead) unit reaches a beach by sea and begins to defend the area while other reinforcements help out until a unit large enough to begin advancing has arrived.”
<http://en.wikipedia.org/wiki/Beachhead>

We can apply it by analogy to a first resource-advantaged site on the Moon.

Before we humans descend upon the Moon in numbers, we need to have ready made shelter against the cosmic elements, in particular, against various forms of radiation, that can damage living tissue, and shorten the lifespans of human crews and settlers. And to do this, we need to be able to pre-manufacture materials with which to create shelters within which to live and operate. It has been clear for some time now, that it would be wise to send robotic crews “to do the dirty work” starting basic manufacturing operations, and building safe living spaces for human crews to follow. We will always need robots to do work that requires being out-vac, exposed on the surface for long periods. Robots may drive the overland bus and truck routes for example, and do the prospecting.

We have already talked about this several times in past issues. In MMM #242, three years ago (already!) on the front page, we introduced readers to NASA-JSC's "Project M" – putting telepresence-operated "robonauts" on the Moon to pave the way for humans. Do watch this video: www.youtube.com/watch?v=kFPNcWN7QnM I have watched it many times and it still gives me a thrill.



It is possible but unlikely, that we will have fully autonomous robots to do what needs to be done before humans arrive to find ready made and properly equipped quarters. If the robots need teleoperation only once in a while, teleoperators on Earth can possibly make due with the 3 second time delay involved. If they need more constant guidance, a forward outpost at the Earth-Moon L1 or L2 Lagrange points may be needed.

While "maintaining" those two positions will require some fuel, there would be no advantage at all to teleoperating from either of the two flank positions, L4 and L5 as while these positions are stable, no position-keeping needed, they are as far from the Moon's surface as Earth itself.

Shielding needed at L1 and/or L2 Lagrange points

The problem is that at these points, well outside of the Van Allen Belts which protect Earth, low Earth orbits and Geosynchronous orbits, in comparison with lunar surface sites, crews will be exposed to radiation from the entire sky, not just the half of it that they would be exposed to if they were on the lunar surface. Now Apollo astronauts on the last three missions spent more time on the surface, up to 3 full days, with little ill effect. But changing crews twice a week, or even weekly, even monthly, would be exorbitantly expensive.

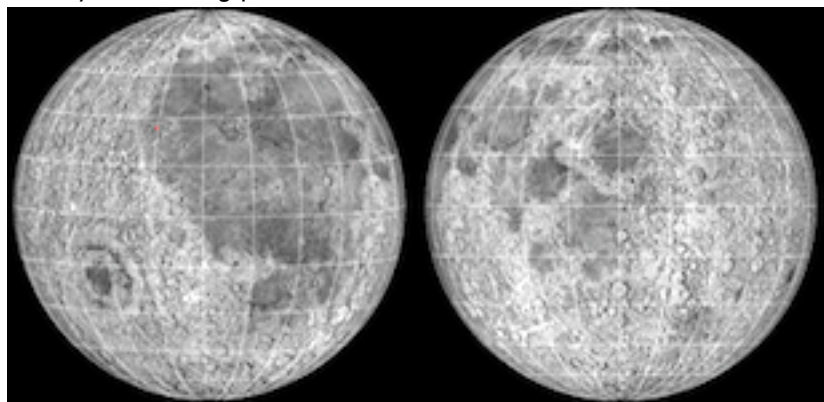


L1 Station with Bigelow modules: Juxtaposition of images by the author

If we do need a small crew at one of the Lagrange points, we will need to provide shielding. The simplest way of doing that could be to house them in a Bigelow 330 module with its one foot thick Vectran walls made of light chemical elements. Tests show that polyethylene is a much better radiation absorbent than any kind of metal. More importantly, its light density and overall weight makes it less expensive to ship from Earth. And while that shielding may be enough in Earth orbits within the Van Allen Belt, it might very well be insufficient beyond those belts at the various Earth-Moon Lagrange Points. The two Bigelow Genesis modules tested are in low Earth orbits as will be the similar-sized Bigelow module NASA will attach to the International Space Station for further tests.

Perhaps the National Space Society, the Moon Society, and the Mars Society should push NASA to budget a radiation exposure test for a B330 module.

Putting it at either L4 or L5, just for the test, would be ideal, as from either “perch,” a telescopic camera on board could relay to observers on Earth, a view of one of the Moon’s “flanks” that we can never see from Earth’s surface thus gaining publicity and stirring public interest in the Moon. But that is a lesser consideration.



Left: a computer generated image of the Moon centered on 60°W as seen from L4

Right: the corresponding image of the Moon centered on 60°E as seen from L5

If tests showed that the B330’s foot thick vectran hull provided insufficient long term shielding, then versions with appropriately thicker hulls could be produced for use at an L1 or L2 teleoperations station. But if first tests show that this hull, designed more for puncture resistance than for radiation resistance, does not offer the needed deep space radiation protection, then it is back to the drawing boards.

We need to know, and we need to know without further delay.

Back to teleoperating robots etc. on the Moon’s (or Mars’) surface from an outpost in orbit.

Down on the Moon’s surface, the robonaut crew could prepare the site, and set up simple “manufacturing” equipment to making basic shielding materials like easily stacked “lego blocks” made of compressed and sintered moondust. Perhaps they could even operate contour crafting equipment, the big brother of 3D Printing to make hangars that could be shielded with moondust to provide unpressurized shielded open space under which to park and connect various habitat and activity modules.

SEE “**Lunar Base Preconstruction: A Public Demonstration of the use of Moondust to make Building Materials**” MMM #232, February 2010 – reprinted in **MMM Theme Issue: Lunar Architecture and Construction**.

http://www.moonsociety.org/publications/mmm_themes/mmmt_construction.pdf

Long term they could be tasked with setting up manufacturing operations using on site materials and elements, dubbed “in situ” (Latin for “on site”) – a term used by “professionals.” to impress people.)

Humans need arrive only when basic manufacturing operations and stockpiles of products made by them were already in place. They could then get down to business doing things robots, teleoperated or autonomous, could not do as well as humans on location. Some of these construction products could be shipped off the Moon for use elsewhere, for example to build large structures in Geosynchronous orbit.

It will take only a fraction, 1/23rd, of the rocket fuel to ship a given mass from the Moon’s surface all the way “down the gravity hill” to GEO as it will take to ship an equivalent mass from Earth’s surface “up the gravity hill” to GEO. In this sense there is still a real “uphill” and “downhill” in space. MMM had coined the words “upports” and “downports” more than two decades ago. It is this leverage that will open the Moon to mining and manufacturing, and to settlements for those involved.

It is this vast gravity uphill and downhill difference that makes lunar materials the key to realizing the full economic potential of Geosynchronous Orbit, for use in solar power satellites and in giant platforms hosting hundreds of satellite packages in each of the 180 available slots 2° apart. GEO satellites are already responsible for over \$300 billion of gross product a year.

Human Mars missions are at stake too

If the Bigelow hull provides insufficient radiation protection, the sooner we find that out and design and test something superior, the better. Not only do we need safe transit for humans to Mars, we also need protection for humans in Mars orbit, even low Mars orbits, as Mars, unlike Earth, is not blessed with anything like our own Van Allen Belts. **If we want to teleoperate robots and robotic probes and construction equipment on Mars surface, beefing up the Bigelow/Transhab hull system is a top priority.** ##

Growing "Start-up" Industries on the Moon

By Dave Dietzler

Barring the creation of nanobots by brilliant post-singularity Artificial Intelligence in the middle of the 21st century that can use solar energy and feed on lunar regolith to grow Moon bases the way tiny seeds produce giant oak trees, we mere mortals must devise common sense ways of using local resources on the Moon to build habitat and industry there. Since the technological singularity is predicted to render humans obsolete by the year 2100, it seems pointless to speculate about the future at all; but let's do it anyway.

Companies like SpaceX and Orbital Sciences are working on low cost access to Earth orbit. Others want to capture asteroids and haul them back to Earth orbit. If these people triumph our way to the Moon is cleared, but it still seems likely that we will use lunar resources to grow industry on the Moon for economic reasons.

We must get a foothold on the Moon first with teleoperated robots controlled by Earthside crews. Despite the almost 3 second lag time this is possible. Our first order of business will be the mining of volatiles from mare regolith. This will involve shoveling up millions of tons of regolith and heating it to release H, H₂O, CO, CO₂, CH₄, N₂, He₄ and He₃....if we can build machines with corrosion resistant furnaces made of titanium alloy perhaps we can run at 900 C.+ to roast out sulfur some of which will react with water to form sulphuric acid. We could also roast out some sodium and potassium.

While the polar ices of the Moon are very tempting there are challenges involving energy for machines that must work in dark craters as cold or colder than on distant Pluto. Perhaps nuclear power can surmount these challenges and rebellious entrepreneurs will thwart the politically correct phobia of nuclear anything by launching from a private island out to sea or from Russia.

If we can mine those polar ices we will also need to transport them to lunar mine sites...so things are not so simple. Once we get the ice or the SWIVs mined up we need to separate the substances with heavy equipment and store them in insulated tanks. So we are looking at substantial tonnages of machinery just to get these basic substances that will be essential for life support and possibly for rocket propellant.

What if we try a different tack? What if we try to make some of this equipment on the Moon with readily available materials? We could land machines that can magnetically separate meteoric iron-nickel fines from regolith, run them through centrifugal grinders and a second magnetic separation, and produce almost pure iron-nickel. These machines would have to sift through millions of tons of regolith to get decent amounts of metal, but consider this--a square kilometer (100 hectares or about 250 acres) mined to a depth of one half meter yields about a million tons of regolith. If we are looking at only 0.1% metal recovery from this we get one thousand tons of metal. That's quite a bit!

This metal will be rather soft with a Moh's hardness of about 5. We might want to convert some of it to steel. Iron-nickel rods packed in carbon powder and heated to about 1100 C. for several days will form good steel. One ton of carbon could make 200 tons of 0.5% carbon steel that will have extra toughness due to the nickel content. The key to this will be large 3D printers.

There are 3D printers in existence now that can print in a build envelope 4' x 4' x 19' and in the future there will be bigger ones. If we can land a really rugged machine or set of machines and some solar panels we can set up shop. Since iron melts at about 1500 C. and 3D printers can even work with titanium, m.p. 1900 C., it should be possible to take the meteoric FeNi fines and print out rods. Since anorthite melts at 1500 C. we could print out a carburizing box or boxes for making steel.

By locating on a mare "coast" we will have access to mare basalt as well as highland anorthite. Heating elements will also be required for the carburizing boxes and we will land some carbon to get started. Once we have steel we will need to powder it perhaps with centrifugal electric spark discharge machines then run it through the 3D printers to make various steel parts for building mining rovers, piping, storage tanks, etc. Thus we will need assembly robots also. All this could be done by teleoperated robots to avoid footing the cost of habitat and supplies for humans and the cost of returning humans to Earth. Humans are still in the picture. We are just paving the way ahead for them with machines.

If we can land some partially finished mining machines and other robots and complete them with lunar made steel parts, then we will be ahead of the curve. It's all about saving weight.

There are other raw materials available on the Moon besides iron-nickel fines and anorthite. Basalt is abundant and it melts at only 1250 C. so 3D printers could crank out basalt items. Things might go faster if we print up some iron molds for casting basalt bricks, blocks, tiles, etc. We could print up an iron basalt melting furnace or furnaces too. Whether these would be heated with solar rays focused by an aluminized plastic "umbrella" or electric heat is another matter.

A centrifugal casting machine for making basalt pipes and conduits could also be printed up from iron and steel. Cement can be made by roasting anorthite at over 1500 C. to drive off FeO, MgO and SiO₂. Iron furnaces with cooling passages and space radiators could be printed up and assembled for producing cement.

Needless to say, all those iron items would cost a large fortune to rocket up from Earth! If the oxides of iron, magnesium and silicon from the cement furnaces can be captured we have feedstock for metallic iron by hydrogen reduction of FeO, magnesia firebrick that might be reduced with silicon to magnesium metal for structures and an explosive, and silica for glass.

At this point we are looking at the partial production of mining machines of various sorts, assembly robots, SWIVs and/or polar ice separation equipment, basalt items of all sorts, furnaces, anorthite items, and cement. With SWIVs and/or ice we can make hydraulic cement that can be sprayed inside of inflatable forms to make concrete modules for living, farming and working. Since aluminum and magnesium have such low vapor pressures we will need to cast and machine them or run them thru 3D printers inside of pressurized modules.

Autoclaved Aerated Concrete, AAC, is another interesting material. It requires cement, sand, water and a small amount of aluminum that could be derived from cannibalized landers. An autoclave would also be needed. Perhaps we could print one up with lunar materials.

The 3D printers that are capable of producing various items amassing hundreds of times their own weight won't stop at iron, steel, basalt and anorthite. We will want some titanium. The lunar titanium-rich mineral ilmenite is found in the mare areas. This is one reason basing on a mare coast is desirable.

This does not mean that we don't want a polar ice mining base; that would be very useful especially if loads of water could be conveyed by tanker robot rovers from the north polar region to the mare coastal base we envision growing into a large industrial settlement. With lunar carbon from ice or SWIVs and iron from meteoric fines and cement production we could make plenty of steel of any desired grade. A fluidized bed reactor made of lunar steel could be printed and welded up for reducing ilmenite with hot hydrogen. More equipment including FFC cells made of a combination of lunar and imported parts would be needed to produce titanium.

Without going into more detail, let it suffice to say that we will get production of all lunar available materials going in full swing and this includes hydrogen, water, oxygen, carbon, nitrogen, helium, iron, nickel, steel, basalt, anorthite, glass, magnesium, aluminum and titanium perhaps calcium, manganese and chromium to in due time. A combination of 3D printing and traditional processes like sand casting, drilling, machining, etc. will make it possible to replicate the 3D printers.

A look forward

Once we are cranking out lunar materials and things like mining machines, furnaces, molds, tools, habitat and everyday items from basalt teapots to basalt countertops, etc. are produced on the Moon along with more 3D printers there is nothing stopping the lunar settlement from exponential growth. Humans will be introduced somewhere along the way, if only as tourists.

Farm modules filled with basalt planting boxes and steamed regolith (zeolites) for a planting medium will be seeded and tended by the robots in anticipation of human visitors. If humans are necessary before CELSS (Closed Environment Life Support Systems) and food production are up and running they will eat dehydrated imported food with recycled water.

When thousands of tourists, scientists and Moon miners move in we will need lots of habitat modules made on the Moon as well as food grown on the Moon. The settlement will send out tendrils--dirt roads and eventually railways to other locations on the Moon where bases will be built for mining local deposits of pyroclastic glass, KREEP, ilmenite, etc.

Distant bases will also be built in locations of scenic beauty. Ideal locations for mass drivers will be selected and mass drivers with aluminum or calcium metal coils will launch materials into space for everything from solar power satellites, large telecommunication platforms, the construction of giant optical space telescopes for studying extrasolar planets, space stations and space colonies, fleets of ships and cycling stations to other planets in the solar system, large robotic ships for asteroid mining, defense systems, and whatever else you can think of.

Dave Dietzler

“Backing Up” our “Civilization”

By Peter Kokh

Backing up Knowledge

Many, if not most of us, have learned the hard way, how important it is to backup our computer files. One unpredictable hard drive crash, or even a misplaced key stroke, could wipe out everything into which we have put so many hours of work, if we had not found a way to duplicate our files in safer modes.

And it is not only electronic mishaps to fear. Apple, for example, has the notorious mercenary habit of coming out with new software that will not read old files. (There ought to be a law against that!)

We can store files on Google, and/or in electronic “clouds.” But a serious enough solar electronic storm could erase all that. Before the computer age, we had books. Yes, books can burn, or rot, but the chances of that are slim compared to the chances of electronic disasters. And you did not have to keep paying rent to libraries to keep books on their shelves. Our new information system is strictly for profit. Fail to renew a domain name, on top

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

of a computer crash, and valuable files are lost. More, because we have to pay for storage, many older files are removed from the web as no longer up to date. Try to look something up from a few years back? Good luck!

Backing up artifacts

Museums, thank heavens, have not yet gone “electronic” or virtual. We need to have a serious national and global conversation of providing the same preservation automatically in case of super solar flares that could erase all electronic files.

Living Species

Biologists are still discovering previously unknown or uncatalogued species found in remote areas, such as forests, swamps, ocean beds and other places not yet fully explored. Meanwhile, many species are becoming extinct through the spread of civilization into their areas. Forests have been shrinking. Efforts to catalog living species before they are creatures of the past should have greater priority, and by that, we mean greater funding.

Climate change, whether manmade, natural, or more likely some combination of both, is drastically affecting some biomes. A recent survey showed that trees and plants once common in the area surrounding Winnipeg, Manitoba, have, in the past thirty years, been replaced by plants and trees common around Minneapolis, 500 kilometers (300 miles) to the south. This year, melting ice on Baffin Island in the Canadian Arctic have exposed dead moss beds that have been buried under ice for 44,000 years.

Unfortunately, decisions made for political reasons put little priority on funding the cataloging of flora and fauna and organisms in general that are threatened. We think of “our kids” when it comes to money, but not when it comes to passing on the heritage of nature, which leads one to wonder if our “children” have anything to do with stances on either.

Longer Range Threats

In addition to possible super solar flares, the likes of which have not been felt, or noticed, in historical times, there are other risks: “Super volcanos” being much more likely than super flares or super asteroid strikes. Yellowstone, to judge from past eruptions 700,000 years apart, is overdue. The last eruption left meters of ash covering nearly two thirds of the United States. One within the past 100,000 years in Sumatra, may have reduced Earth’s population at the time to a fraction of what it had been.

And, yes, should a civilization erasing non-detourable asteroid come our way: we owe to our ancestors, and to our offspring, to “back up our civilization” off planet.”

Safety for specimens, artifacts, and records

No place on Earth provides a safe depository long range. Earth’s active geology wipes out mountain ranges, valleys, coastlines, and caves. Sure some places may be safe for a hundred thousand years or more, but we want to talk about long term: millions of years, hundreds of millions of years, even longer. We are not thinking now of preservation for far future human generations, although we should, but of “backing up our civilization” so that should, someday, a star-faring civilization come this way, long after our civilization and its ruins have turned to dust, can discover who we were, how we lived, what we were about. Where could we put archives of all kinds so that they could survive our civilization and possibly be discovered by others?

Lavatubes on the Moon, and Mars

The Moon is geologically dead. The mare areas (dark level plains) on the Moon were formed between 3.5 and 3.8 billion years ago by spreading low-viscosity lava flowing in rivers that crusted over, forming tubes. The tubes still intact have survived that long, formed in an age when life on Earth may still have been one-celled. Here in carefully chosen tubes, unlikely to be compromised over hundreds, even billions of years, we could put the Grand Archives of All Humanity and Earth Life: records of our civilization and cultures; artifacts, preserved biological specimens, or models thereof.

Read “**Archive Luna**” pp. 19–20 in MMM Classics #11

Should “anyone” come this way, perhaps long after all trace of our civilization had disappeared on our ever changing planet, it is in lunar lavatubes that they would look. Would we leave clues as to which tube to explore? Clues that would survive the ravages of time? Beacons activated by vehicle approach? Could we rig something that would work long after we are gone? It’s worth thinking about.



What about similar archives for the eons in lavatubes on Mars? Mars may not be as geologically dead as the Moon, but why not? Should the Sun have swollen and gotten hotter, making Earth and its Moon more challenging

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or [mmm_themes/](#)

places to visit, a “backup” on Mars might be a good idea. Carrying this idea even further, Voyager 1 photographed lava plains on Neptune’s largest moon, Triton. There may well be ancient lavatubes on that moon. There are no known plans to visit the Neptune system in the near future.

Flipping the Coin

Yes, some civilization could send scouts our way some time in the distant future (if they had not already done so long ago). The longer the stretch of time we consider, the less unlikely the visit.

But our Sun is young compared to the Galaxy at large: 4.5 billion compared to 8–12 billion years. **Civilizations elsewhere could have preceded ours and even visited our system while life on Earth was still in a more primitive stage.** If so, where might they have left a calling card? **There is one clear answer: in a lunar lavatube that we would not get around to exploring until we were mature enough to handle and digest what we found.**

Looking at it from another angle

Personally, I am not a believer in FTL, Faster Than Light travel. I see it as a contradiction in terms. But there are other ways to travel between the stars. “Generation Ships” can take their time. After countless generations of living their whole lives in such an “ark” no matter how large, any descendant is not going to want to disembark onto an open to the heavens world that from their ingrained point of view is “inside out” with ever disappearing horizons. They would have “an inside out form of vertigo.”

Now seed ships, carrying genetic material only, to be combined (sperm and eggs into embryos) and raised and then educated by nanny-robots once the ship finds an inhabitable world not already home to a sentient species – now, that’s something else. No living humans would be lost among the stars en route.

Be that as it may, let’s suppose some distant day that a ship of humans arrives in the Alpha Centauri System, a system a billion and a half years older than ours, and find a planet that evidently had life, and from the evidence of non-perishable items in junk piles, had intelligent life. But those people, whoever they were, did not leave records or any other evidence about themselves, their history, their culture, their achievements. Would’t it be nice if they had a moon like ours or some other world in their system that had places like lavatubes that would not be eradicated by weather or geology, and where they had left records there about themselves, their biology, history, and culture?

Do onto others what you would have them do onto you, goes the old adage. We should create records and other evidence about ourselves, our world, our culture, our civilization. We have the ideal place, nearby and immune to the ravages of time: lavatubes on the Moon.

Backing up our Civilization

By this we are talking about a number of things: near term things we are failing to do now, with our switch to “rented” electronic storage, not yet developing storage media immune to solar storms, much less economics, etc. But we need to leave a record not only of our science, our art, our culture, our beliefs, but also of the biologically rich and diverse environment that supports us. Even if the Moon had nothing of resources worth taping, even if it did not offer us a perch from which to expand further into space, we ought to be going to the Moon for something in the long term, more important: “backing up our Civilization,” our culture, our history, and the Living Complex of plant, animal, microbial life in which we live. Is there enough space in those tubes? There must be many thousands of kilometers of intact tubes, a hundred or more meters wide. And more in lava flow layers below. Yes, there is plenty of room.

**If for no other reason than to “Back up” our Civilization,
We must go into space, and to the Moon in particular.
We must become a space-faring species.**

For a speculative-fictional version of this idea, read the author’s

“It Came From the Bowels of the Moon”

http://www.moonsociety.org/humor/afd_news.html

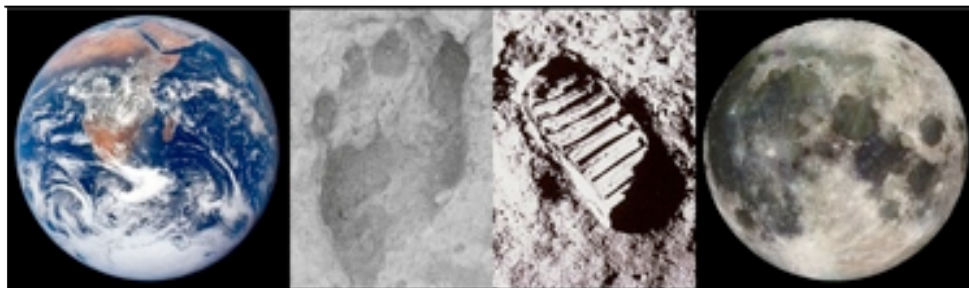
(scroll down the page)

This piece was formatted to be printed on two sides of one sheet of paper,
hence its “crammed” appearance.

It was submitted at a 2007 Milwaukee “Horror-con:” **It Came from the Bowels of Lake Michigan!**

And as a hedge, we should duplicate these archives in a secure lavatube complex on Mars. PK

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” – www.moonsociety.org/spreadtheword/whowhat.html

We envision a future in which the free enterprise human economy has expanded to include settlements on the Moon and elsewhere, contributing products and services that will foster a better life for all humanity on Earth and beyond, inspiring our youth, and fostering hope in an open-ended positive future for humankind.

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

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

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

From Moon Society President Ken Murphy

Recently I was discussing this year's Moon Track with The Moon Society's Ambassador-at-Large Dave Dunlop. We've had two excellent ISDCs in a row, with our Cislunar Economy track in 2012 and Lunar Lava Tubes/ Cislunar Economy two-day extravaganza in 2013. Recent discussions amongst the leadership have made it clear that while the immediate direction of The Moon Society is unclear as we adapt to sociocultural and economic changes working their way through the world, we have nevertheless tapped a very important idea – that of an Earth–Moon, or cislunar, economy.

We also discussed the original push into space back in 1957 as part of the International Geophysical Year, which marshaled the scientific forces of the world to build a much better understanding of the Earth as a system.

The next logical extension of that is a focus on the Earth and Moon as a system. The recent slew of scientific missions to the Moon after the long post-Apollo dearth has been leading to many unbelievable revelations about our celestial companion. It's starting to get wider press that some of the water on the Moon may be from Earth! Delivered in trace amounts each month as the Moon passes through the Earth's magnetotail, it has had aeons to accumulate even in the harsh lunar environment. There are no doubt many more such mysteries waiting to be unveiled.

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

President's "rant" continued.

In that context then, the idea of a sort of Geo-Selene program to study the Earth and Moon—as a system— is compelling. There are initiatives around to have a Lunar Decade or that sort of thing, but really a much more valuable context is that of the Moon as a companion to Earth in our cosmic dance around the Sun. We'll be exploring this concept more in our ISDC track this year.

In the interim, head on over to The Space Review and check out my article on "Celebrating Space", highlighting the many opportunities there are throughout the year to share the importance of space exploration with our local communities. After all, everyone loves a party, especially a space party. I've been bugging our membership for years to get involved and make Moon education happen in our local communities; let's make 2014 the year that interest in our Moon takes off! – <http://www.thespacereview.com/article/2440/1> KM

Cooperative Ventures for Chapters with non-Space Organizations

- Astronomy clubs
- Geology clubs
- Speleology clubs (caves, lavatubes)
- Interior gardening (green walls, more)
- Garden-based crafts (how settlers can use such crafts to personalize lunar/Martian homesteads)
- Natural fabrics and dyes
- School art programs
- Architecture: options suitable for living on Moon or Mars; underground, bermed, etc.
- If you can think of other club "alliances" please share that with us:
chapters-coordinator@moonsociety.org

Chapters can take advantage of unique local resources, space-related or not

If your chapter does not have anything directly space-relevant, try leveraging things that are indirectly relevant.

Example: Our **St Louis** Chapter has a unique local resource: a Living Walls company: we have been talking about the role of Living Walls in Lunar and Martian homes, public walkways, and elsewhere and the contribution they can make to sustaining and expanding a settlement biosphere. <http://www.thelivingwallco.com>

Example: In **Milwaukee** the Mitchell Park Domes <http://county.milwaukee.gov/MitchellParkConservation10116.htm> that showcase plants and trees that grow in the northern states (Temperate Dome), in deserts and other arid places (Desert Dome) and in warm moist areas (Tropical Dome). In the Desert Dome one can imagine oneself in a settlement on Mars. And there are now three **Urban Ecology Centers** in Milwaukee, on the East (main), North, and South sides. At Mitchell International Airport there is the Museum of Flight. Not to forget the annual **Airventure** week long airshow in Oshkosh, 80 miles north (a very expensive event for exhibitors, indoors or even outdoors.) Make identification of such helpful local resources an activity for your next chapter meeting. Then send us the list you have compiled. chapters-coordinator@moonsociety.org

No Moon Society Chapter? If your city has an NSS or Mars Society chapter, join it!

You are more likely to find someone interested in the Moon in any space chapter than at random in the public. The point is that it is hard to find people interested in group activities of any kind. If you find another space interest group or club join it.

- Report on Moon-relevant news and activities, and point out tie ins.
- Give a talk about technologies needed in common to open all sectors of space: the Moon; the Asteroids; Mars.
Cite: "The Triway to Space" paper by Al Anzaldúa and Peter Kokh:
– <http://www.thespacereview.com/article/2078/1>
– <http://www.moonsociety.org/presentations/ppt/Triway1.ppt>
– <http://www.moonsociety.org/presentations/pdf/Triway1.pdf>
- In time your interest and contributions might give rise to a "joint" chapter. And at least you will have the company of others interested in space. NSS chapters in particular are multi-destination friendly. If you have a Mars Society chapter you can work on areas, projects, research that is relevant to both. You can work on Moon-Mars trade opportunities, etc. People who are willing to settle anywhere off-Earth will have that in common.

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

How do we Engage Young People? – Targeting Generation “X” – Some Ideas

We can continue to be conservative, and become extinct, or? Some ideas to toss around:

- Use Smart Phones, not Computers – **can we develop “apps”** for MMM? For the Moon Society?
- STEM (Science, Technology, Electronics, Math: **targeted projects, contests, competitions**, etc.
- An **online Flip-Magazine** that can be “read” on a smart phone or tablet? (best of TTSIQ)
- **Free electronic memberships**, projects, contests, competitions, for students adverse to old folks organizations
- **Free registrations at ISDCs etc.** (could be limited in number, e.g. to first 300 registering online)
- Sponsored **field trips**

Why? We are on a sinking ship whether we want to recognize that or not.

- ✓ **We are not in a budget crisis:** We can afford at least a temporary low budget registration for people under 20, and perhaps discounted memberships even under thirty
- ✓ We can afford a **“no cost e-membership class” for teachers and students** – as important as revenue is, it is far less important than reaching out to more people
- ✓ What can we do to reach **young people in their preferred media:** Facebook, Twitter, Smart phone Apps
- ✓ **We could form an App Committee** to look at existing space apps and brainstorm what we can put out that is Moon and Cislunar Economy focused, settlement focused
- * **Announce all new “Free Publications” – TTSIQ, Theme issues** – a link to these under Publications. (I? can do that on the media – announce these in every Ad Astra, TTS
- ✓ We might **negotiate with NSS for a number of ISDC registrations** that we can give away free or at really low levels to promising and/or interested students, “to get them hooked” These are people who otherwise would not come, and so no revenue is lost. NSS might follow suite
NSS might decide to follow suite

Other Ideas

- ✓ **Field trips** in chapter hinterlands
- ✓ **Talks in schools, scout units,**
- ✓ Special underage notification list
- ✓ **QR code stamp, sticker in books? in donated books? in online publications**
- ✓ **“Member” “Fan”**
- ✓ **a program for “Followers/Fans?”**
- ✓ **Twitter accounts for each publication: MMM, TTSIQ, Ad Astra?**

Your ideas? Send to chapters-coordinator@moonsociety.org

February

Chapters & Outposts 2014

OUTPOSTS (2 or more local members in search of more)

Bay Area Moon Society, CA Outpost – **South San Francisco Bay** Contact: Henry Cates hcate2@pacbell.net **Moon Society Nashville Outpost** – Contact: Chuck Schlemm – cschlemm@comcast.net

MOON SOCIETY CHAPTERS

Moon Society St. Louis Chapter – <http://www.moonsociety.org/chapters/stlouis/>

Contact: Robert Perry surfer_bob@charter.net – Meetings 2nd Wed monthly at Buder Branch Library, 4401 S. Hampton, in the basement conference room – Next meetings – **MAR 12 – APR 9 – MAY 14**

Decmber report: Paul Baldwin, Jim Merriman, Bob Perry, and Amy White, members of the St. Louis chapter of the Moon Society and the NSS Chapter, the St. Louis Space Frontier, had an **informational booth** at the Ferguson, Missouri Central Elementary School's High Achievement For All (HAFA) Science Night on Dec. 3, 5:30 PM–7:00 PM.

January Report: Nicholas Kirschman, Christine Nobe, Bob Perry, and Amy White of The St. Louis Space Frontier had a two table display at the Saint Louis Science Center's "First Friday" event along with displays by people from Arch Reactor, The St. Louis Astronomical Society, the Washington University Science Fiction Branch Library, Kawakon (fans of Japanese science fiction and fantasy anime – their convention will be the first weekend in February) and a few other groups in other parts of the building complex. Then with those events finished and the holliday rush, the bad weather, and the typical seasonal colds and flus, neither group had a regular meeting in December.

The two groups had a **joint meeting on the evening of Thursday, January 16th** at Fallon's Bar and Grill, with Paul A. Baldwin, Stephen Block, Barry Branham, Larry Krup, Sally Kula, Jim Merriman, Philip Newell, Bob Perry, and Amy White attending. We started at about 6:30 with meals and Paul's presentation on the ISS. The main topic of the business meeting was how to host a regional NSS conference in the fall.

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

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

Greater Fort Worth Space Chapter c/o Patricia Ferguson tricia3718@gmail.com

JOINT MOON SOCIETY – NSS CHAPTERS

NSS/Moon Society Phoenix Chapter – <http://nssphoenix.wordpress.com/> – c/o Mike Mackowski

Meeting 3rd Saturdays at HSGP Community Center, Mesa, 627 W. Rio Salado Parkway.– **MAR 15, APR 19, MAY 17**

The January 18th meeting of the Phoenix chapters of the National Space Society and the Moon Society was at 11 am at usual at the Humanist Society in Tempe. Our speaker was Al Anzaldua from Tucson, and talked about "Cislunar Telerobotics: Key to Building Solar System Infrastructure." Al has done a lot of research on future scenarios for utilizing the Moon's resources for supporting manned outposts and for supplying propellant for various deep space and cis-lunar activities. He gave a very thorough presentation on this topic, focusing on how to generate a balance between manned and robotic vehicles. Latency, or the time delay between the operator and tele-operated machine, is a critical factor in this balance. For example, operating machines on the lunar surface remotely from Earth's surface has an unacceptably long delay. If the remote operators were in a high lunar orbit, or perhaps the Earth-Moon L1 point, the latency is much less of a problem.

His talk made the case that recent advances in telerobotics will bring human cognition (telepresence) to a variety of cis-lunar venues and in this way facilitate the building of solar system infrastructure. Government with private companies will utilize telerobotics to remove, rehabilitate, and repurpose space debris, thus expanding the cis-lunar econosphere. Eventually telerobotics will be used to explore and exploit the Moon from Earth-Moon L1/L2 as well as explore Mars from Phobos and Deimos, facilitating the eventual presence of permanent human-run bases. Telerobotics will also enhance on-orbit construction, processing, and manufacturing. Even on extraterrestrial planetary surfaces, human telepresence will be employed where a hazards, distance, or expense preclude human physical presence. (Telerobotics is already being used on Earth in mining, surgery, and mining operations.) Wise use of telerobotics to help build solar system infrastructure will in the long run facilitate permanent human presence, first on bases, and eventually in settlements throughout the solar system.

Pat Lonchar, our chapter treasurer, made a video recording of the presentation and it is posted at these YouTube links: Part 1 – http://youtu.be/_ceLlalcKvE Part 2 – <http://youtu.be/PCKXMnzxE00>

Part 3 – http://youtu.be/_lRrMm0U64c Part 4 – <http://youtu.be/zuHydnhvjPI>

After the meeting, several members attended a planning meeting at a nearby restaurant. There, chapter president Mike Mackowski led a discussion of future meeting topics, possible field trips, social functions, and other outreach opportunities. Look for a follow up report on the club's website. Members may also want to check my latest blog post () with a summary of last year's activities.

Tucson L5 Space Society – <http://www.tucsonspacesociety.org/> Now serving Moon Society Members

Contact: Al Anzaldua – Meets monthly, every 2nd Saturday, 6:30 PM **FEB 8 – MAR 8 – APR 12 – MAY 10**

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

Contact: Eric Bowen eric@streamlinerschedules.com – Meeting 7 pm in the conference room of the Bay Area Community Center at Clear Lake Park – Even # months: (((Marianne.dyson@nss.org)))

Milwaukee Lunar Reclamation Society (NSS/Moon Society) – (Publishers of Moon Miners' Manifesto)

<http://www.moonsociety.org/chapters/milwaukee/> Contact: Peter Kokh kokhmmm@aol.com

Mayfair Mall lower level Garden Suites East Room G110 – 2nd Saturdays 1–4pm **FEB 8 – MAR 8 – APR 12 – MAY 10**

The date of our April 12th meeting coincides with Yuri's Night, which we have not previously observed. We are considering some options. Stay tuned.

Moon Society members who live in other areas are encouraged to check to see if there is a National Space Society chapter nearby. If two or more Moon Society members join an NSS Chapter, that Chapter could be listed as a joint chapter (if the so wish). Here is where to check: http://chapters.nss.org/a/lists/#US_Chapters



Marshall Mike Moondust and the Sinister Selenian Subterfuge

[MMM Fiction by George von Mond]

MISSED PREVIOUS INSTALLMENTS? The whole series is now online, Chapters I–XIII (1–13):

<http://www.moonsociety.org/publications/fiction/MMSSS.pdf>

Chapter XIV

Marshall Mike Moondust peered carefully around the corner and down the hall towards the Ops Center. He had to speak with Director Kelvin, but the invaders were focused on the same destination. Mike carefully pulled his flechette gun from a hidden pouch and fingered the controls. It fired glass arrows that tended to shatter inside their targets, shredding tissue and giving surgeons fits. The interlopers were almost to a man from Earth, and Mike knew he could use that to his advantage. Taking a last deep breath he broke cover and rushed into the corridor.

Using a move perfected by most Lunar teenagers and inspired by the old art of parkour on Earth, Mike headed up the far wall and actually took several steps on the ceiling before heading down the other wall, firing at the suddenly exposed targets stunned by his acrobatic feats. Those not wounded quickly ducked further back in their entrenchments, giving Mike time to punch the controls and slip into the Ops Center. A chorus of clicks and clacks met him as the door slid shut behind him.

"Marshall, what a pleasant surprise" said a voice as Mike stared at the sea of weapons pointed in his direction.

"Director Kelvin, how'd you know?" replied Mike. "And by the way, we need to talk about the various firearms I'm seeing pointed in my direction which I really don't need to be seeing right now."

"Let it slide, Mike. We'd be hosed by now if we didn't have them. What's going on, anyway?"

"It's a coup by Earth interests," replied Mike. "They're moving on the major cities right now using an army of salvaged mining equipment. They could do a great deal of damage to the facilities, and I have to get a warning to them."

"You're out of luck there," replied Kelvin. "The first thing they did was take out the comm arrays. We can't reach the polesitter right above us."

"Not directly," answered Mike, "but do you know Morse Code? The satellite also keeps a visual watch of the area. We're going to use the parabolic mirror on top of the power tower to flash the satellite."

"I hope that works. Coulson, get on the tower controls and make it happen. Where's comms? O'Leary! You know Morse Code, right? Work with Coulson on this and make it a priority."

Mike moved towards a panel of video displays. He could see several intruders moving away from the Ops Center, dragging their companions wounded by the sharpshooting. On another panel he saw transport vehicles being smashed, and on another he saw vehicles starting to move away from the base.

"They're pulling out," he announced. "They think we're out of commission for the duration and are heading off to join the main force. We're running out of time to warn the cities. I need transport. Is there anything other than what was destroyed on the landing pads?"

"I have a private shuttle," replied Kelvin. "It's kept in a separate hangar and should be unharmed. This way..." he finished as the two headed out a nearby door.

They headed back to the cafeteria, where the initial panic seemed to be fading to an ongoing anxiety. Mike found Katie stooped over a wounded worker. "Katie, we're headed to Tychoville to alert the authorities to the threat. Are there any wounded who need urgent care?"

"These two really need to be treated at a hospital," she answered. "One has internal bleeding we can't treat, the other has a head wound that frankly frightens me. I can try to stabilize them for a short flight."

"Come with us," suggested Mike. "The hospital at Tychoville is probably going to need some help soon. You've got things under control here; let's head to the next danger zone."

"Mike, you always knew how to sweet talk a girl. Does Diane know you're still alive? I didn't appreciate having to deal with her inconsolability after your funeral, you bastard. She's never going to forgive you when she does find out. Frankly, you don't deserve a Tess Trueheart like her. She oughta..."

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

"Please, Katie, can we focus on the task at hand? We need to get these two casualties to the Director's private shuttle. Do we have stretchers?" asked Mike.

Soon, they were all packed in aboard the Director's private shuttle. The hangar doors opened to show the base devastated by the depredations of the marauders. Like the barbarians of old Earth they had stormed through, destroying anything they found. It would take a long time to recover, but the water found here at the Ice Hole of the Moon was too important to the cislunar, and even translunar economies to be abandoned.

"I'm getting too old for this," mumbled the Director. "I need to let someone younger and more energetic clean up this mess."

"Don't worry, Director," Interjected Mike. "We've got the talent to ensure your legacy endures."

The shuttle took off and headed north to Tychoville on a low ballistic arc. Once in the air, Mike got on the comms. "Tychoville Central, this unscheduled shuttle on incoming vector 185. Do you read?"

"We read you unscheduled shuttle. What is your status?"

"I need to speak with the Lunar Guard immediately. Code Zeta-14-Cynthius. Your city will be under attack in about an hour. Over."

"Is this some kind of joke? Who ever heard of such a thing? This is the Moon, not Earth!"

"Tychoville Central, this is Marshall Mike Moondust. I need to speak with the Lunar Guard immediately. Page them with code Zeta-14-Cynthius. This is urgent!"

"What? Marshall Moondust is dead. I was at the funeral myself. Wait...hold on. The Lunar Guard is responding. I am patching you through," responded the controller.

"This is Marshall James Clavius. Given what I'm seeing on my screen this is the deceased Marshall Moondust on the horn?"

"Affirmative," replied Mike. "My assignment has precipitated an attack on the cities of the Moon by an army of Earthers with lots of heavy equipment. They are moving towards Tychoville and other unknown southern facilities working their way north. I give you one hour ETA. They'll smash comms first, then attack the city. I'd start sending the women and children north immediately. I know you don't have any defensive measures, but you'll have to think of something."

"I'm on it, Mike," answered Marshall Clavius. "We've cleared a spot for you. Docking Bay 94. See you soon."

"Roger, Jim. We've got some work ahead of us." -----

What does Marshall Moondust have in store for the brigands of the Sinister Selenian Subterfuge?
Find out in the next installment! (Chapter XV, MMM #273 - March 2014)

GREAT BROWSING LINKS

SPACE STATIONS + COMMERCIAL SPACE

<http://www.space.com/23230-spacex-falcon9-reusable-rocket-milestone.html>

www.orlandosentinel.com/news/politics/os-space-station-extension-20140107_0_3847257.story

ASTRONAUTS + SPACE TECHNOLOGY + TOURISM

<http://www.space.com/23866-axe-apollo-space-academy-spaceflight-winners.html>

<http://www.tasnimnews.com/English/Home/Single/210226> - bottle rockets to planets

www.nasa.gov/press/2013/december/nasa-developing-legs-for-space-stations-robonaut-2/#

<http://www.bigelowaerospace.com/CVSScrewmembers.php>

http://www.esa.int/Our_Activities/Human_Spaceflight/Astronauts/An_astronaut_s_rhythm

<http://www.space.com/24301-astronaut-skinsuit-soothes-space-backaches.html>

www.theverge.com/2013/10/22/4866026/paragon-world-view-space-tourism-balloon-trip-announced

EARTH

<http://www.space.com/24433-nasa-earth-observation-missions-2014.htm>

MOON

<http://rt.com/news/nasa-grow-plants-moon-420/>

www.space-travel.com/reports/Japanese_firm_describes_proposed_power_belt_for_the_moon_999.html

<http://moonandback.com/2013/11/25/penn-states-google-lunar-xprize-team-lunar-lion-sets-launch/>

<http://www.space.com/24068-destination-moon-petition-congress.html>

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

http://www.nasa.gov/lunarcatalyst_9

<http://www.space.com/24436-private-moon-lander-ideas-wanted.html>

MARS

<http://www.space.com/23882-mars-life-lake-curiosity-rover.html>

<http://www.space.com/23875-mars-radiation-life-manned-mission.html>

<http://news.yahoo.com/ancient-mars-may-habitable-hundreds-millions-years-192336149.html>

<http://www.space.com/24112-private-mars-colony-1058-martian-volunteers.html>

ASTEROIDS + COMETS

www.space.com/23795-comet-ison-s-ghost-seen-by-two-spacecraft-videomet_ison_ghost_stereo_soho.html

OTHER PLANETS + MOONS

Mercury volcano active a billion years? <http://www.tasnimnews.com/English/Home/Single/210226>

http://www.spacedaily.com/reports/Sounding_Rocket_to_Peek_at_Atmosphere_of_Venus_999.html

http://www.spacedaily.com/reports/Model_Suggests_Ocean_Currents_Shape_Europas_Icy_Shell_in_Ways_Critical_for_Potential_Habitats_999.html

<http://www.space.com/23947-tour-the-strange-lakes-of-saturn-s-moon-titan-video.html>

<http://www.jpl.nasa.gov/news/news.php?release=2014-020&1> [water detected on Ceres]

VIDEOS

<http://astrobob.areavoices.com/2013/12/02/new-view-of-u-s-at-night-could-someone-please-dim-the-lights/>

<http://www.space.com/23840-alien-life-search-technology-congress.html>

<http://www.space.com/23861-sun-flips-its-poles-psychedelic-time-lapse-animation.html> – Every 11 years, the magnetic polarity of the Sun reverses. 16 years of high resolution magnetic field line data are animated in magnetic lines. Neon green = positive, purple = negative. (looped 4X)

<http://www.space.com/23885-curiosity-mars-radiation-not-too-high-for-humans-but-video.html>

<http://moonandback.com/2013/11/25/lunar-lion-to-the-moon/>

<http://www.space.com/23901-space-station-robonaut-to-get-legs-video.html>

www.slate.com/blogs/bad_astronomy/2013/12/20/earthrise_recreating_an_iconic_moment_in_space_history.html

“ISDC 2014 – “A Space Renaissance”

Los Angeles, CA – May 14–19, 2014

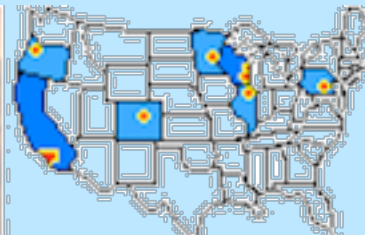
<http://isdc.nss.org/2014/> – Sheraton Gateway Hotel at LAX Airport



<http://www.starwoodhotels.com/sheraton/property/overview/index.html?propertyID=344>

Visitor's Guide to Los Angeles – <http://lacity.org/visitors/index.htm>

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>

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

WISCONSIN

**MLRS – Milwaukee Lunar Reclamation Society**

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

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

PRESIDENT / MMM EDITOR • Peter Kokh NSS 414-342-0705 - kokhmmm@aol.com

VICE-PRESIDENT Doug Armstrong NSS (414) 273-1126

SECRETARY – Charlotte Dupree NSS (262) 675-0941 grdupree@charter.net

• James Schroeter (414) 333-3679 – james_schroeter@yahoo.com

TREASURER/Database – • Robert Bialecki (414) 372-9613 – bobriverwest@yahoo.com

(• Current Members of the MLRS Board of Directors)

Meetings: Mayfair Mall lower level Garden Suites East Room G110 – 2nd Saturdays 1-4 MAR 8 – APR 12 – MAY 10

The date of our April 12th meeting coincides with Yuri's Night. We are considering some options. Stay tuned.

WISCONSIN

**SSS – Sheboygan Space Society**

728 Center St. Kiel, WI 54042-1034 – www.sheboyganspacesociety.org

c/o Will Foerster 920-894-1344 (h) astrowill@frontier.com

SSS Sec./Treas. c/o B. Pat Knier dcnpatknier@gmail.org

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

Meetings are 7-9 pm on the 3rd Thursday evenings in even # months at:

(F) The Foerster Home, 728 Center St. Kiel, WI 53042

(Z) The Zielieke Home, N5427, Grandview Rd, Fond du Lac, WI 54935

NEXT MEETINGS: FEB 20 (F) - APR 17 (Z) - JUN 19 (F) - AUG 21 (Z) - OCT 16 (F) - DEC 13 (SAT in Milwaukee)

CALIFORNIA

**OASIS: Organization for the Advancement of Space Industrialization & Settlement**

Greater Los Angeles Chapter of the National Space Society

PO Box 1231, Redondo Beach, CA 90278

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

<http://www.oasis-nss.org/wordpress/> - oasis@oasis-nss.org – Odyssey Newsletter www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd SAT monthly – APR 20 – MAY 18 – JUN 15 – JUL 20

SAT FEB 15 3 pm OASIS Board Meeting: @ Craig & Karin Ward: 1914 Condon Ave, Redondo Beach

SAT FEB 22 3:30 pm Dr. John Callas: "A Decade on Mars: The Mars Rover Exploration Program"

Long Beach City College Planetarium: 4901 Carson Street, Long Beach

SAT MAR 15 3 pm OASIS Board Meeting:

WED-MON May 14-19 – ISDC 2014 hosted by OASIS at Sheraton Gateway Hotel at LAX Airport

COLORADO

**DSS: Denver Space Society fka Front Range L5**

1 Cherry Hills Farm Drive, Englewood, CO 80133

Eric Boethin 303-781-0800 eric@boethin.com – Monthly Meetings 6:00 PM on 3rd Thursdays, 7 pm

Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, First Floor Civic Center

NEXT MEETINGS: FEB 20 – MAR 20 – APR 16

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

ILLINOIS



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**

OREGON



**ORL5 – Oregon L5 Society – <http://www.OregonL5.org>
PO Box 86, Oregon City, OR 97045**

(LBRT – Oregon Moonbase) moonbase@comcast.net – Charles Radley, President –

Meetings 3rd Sat. each month at 2 p.m. - Bourne Plaza, 1441 SE 122nd, Portland, downstairs

Regular Meeting 3 pm 3rd SAT monthly – APR 20 – MAY 18 – JUN 15 – JUL 20

Oregon L5 Society and PNW AIAA Joint Event “Commercial Mining with a Lunar Elevator” By Charles F. Radley
Wednesday, February 12, 2014 | 6:00 pm, “Midland Library | 805 SE 122nd Ave, Portland, Oregon 97233

Charles writes: “The Earth's Moon is a treasure trove of mineral resources, such as precious metals, rare earth elements, Helium-3 and oxygen for propellants. However, the cost of landing on the Moon is currently very high. Using modern fibers we can build a lunar elevator which reduces the cost of lunar landing sixfold. Furthermore, it makes the cost of collecting material from the Moon and sending it to Earth essentially free. The lunar elevator will pay for itself after nineteen payload cycles. The lunar elevator represents a game changing technology which will open up the Moon to commercial mining.”

Bob McGown writes “I've headed up a chapter of the Mars society here in Oregon. It has been inactive for since 2008. We have been having regular Mars society meetings. Our new meeting location is at the Firland Apartments community Room, 8012 SE Raymond Street in Portland, the third Monday, 7:00 PM with the Rose City Astronomers Cosmology SIG Meetings – February 17th, March 17th, April 21st.

PENNSYLVANIA



**NSS-PASA: NSS Philadelphia Area Space Alliance – 928 Clinton Street, Philadelphia, PA, 19107
c/o Earl Bennett, Earlisat@verizon.net - 856/261-8032 (h), 215/698-2600 (w)**

<http://pasa01.tripod.com/> - <http://phillypasa.blogspot.com>

The NSS-PASA Report for December 2013

Meeting times and locations: our next meeting will be in the Liberty One food court on January 11(snow date the 18th) In February we will meet on the 8th (snow date the 9th) at the food court again. We meet on the sixteenth street (west) side of the building. Other activities are planned for the George Washington Carver Science Fair near the end of the month. There will also be related activity in early March.

The Jade Rabbit has landed! China has put a rover on the Moon. By the time this is published the rover should have survived several dayspan and nightspan cycles. This is very significant as most systems that have been put on the Moon have not been powered equipment that was expected to survive and operate after nightspan. As of December 30 the pictures on Space.com were from the December 14 landing and roll-off.

Larry gave us the web report and sun spot report. On the website the Charity Blossom button is now active and we can be donated. On the Sun Spot front Larry reports that the maximum should occur in April (2014). He also mentioned using a “tiny U.R.L.” to reach our site. Googling does not guarantee arriving at the current version of the site. Our site is: <http://pasa01.tripod.com>.

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

Dotty gave us the travel itinerary for the holidays, but, there was not much happening. However: there is an in depth tour of the Enterprise on the Intrepid in New York harbor. There is also The Dark Universe exhibit (with Neil De Grasse Tyson participating) at the American Museum of Natural History and The Hall of Science in Queens has a display about the Curiosity Rover. For more on travel and Dottie's activities Google Dotty's Dimensions.

Hank reported on PSFS, and Philcon information in particular, and the continued use of the Crowne Plaza in Cherry hill N.J.. Even though people have complained about the location the Philcon Committee has booked the site again for 2014 as it will be available at the traditional (75 years) time of year. We had quite a lot of talk on this subject, but, we go where the event is and can't shift the location. The possibility of Philcon setting up a shuttle from Philadelphia was brought up but may be too costly. On the good news side: the convention may have broken even or made some money!

Our meeting was held on December 14, 2013. Mitch and Earl both brought this news to the meeting with Mitch giving the news and Space .com as reference. He also brought one of the great 1960s designers, Paolo Solari, drawings on space habitats. It looks very different from those of the Princetonians under Dr. O'Neill. The main drawing was called Asternomo and was to house ~30,000 inhabitants. For those who may not know of Solari you may have heard of Arcologies, literally a city in a building, that Solari felt could solve many of the worlds problems with population, habitat preservation, energy use and a host of related problems. This was one of the dreams of the sixties, like the space habitat he envisioned, that remains a dream. Mitch also asked if there was any chapter of the Moon Society that had, or knew of, a generic 3D model of a space habitat that we could buy (I will add: build). He also brought, from the June 2014 Popular Science, "Space School" which is about training for space flight that can be done at a facility just outside of Philadelphia in Southampton Pa.. This is the Nastar Training Facility where you can undergo the training to become a space traveler. You are first checked out to see if you can take the training also. Neat first page picture! And finally: Mitch brought Ad Astra (winter) with an article on using lunar water as a fuel source for reducing the cost of exploration and colonization of the Moon and beyond.

We had a virtual visit by Dennis Pearson, via phone, and have his nominating petition for membership to the NSS Board of Directors going the rounds of local NSS members.

Earl brought material on SETI from the March 2014 (!) Analog magazine. The article, by Mark H. Shellans, has the rather long and descriptive title "The Probability and Nature of an Interstellar Information Trading Community". For those who have read Vernor Vinges "A Fire Upon The Deep" you have seen the mature version of this idea. The difference here is that the report gives specifics on how we might join the system. It also explains why we might not have been able to pick up the communications with all of our first efforts. Included is a chart of nearby star systems that we could check with the system that the author has described. Within 20 light years of us there are 83 star systems (see <http://www.atlasoftheuniverse.com/20lys.html> for the illustrations source). I highly recommend this issue of Analog for this technical article and John G. Cramer's " Entanglement, Spooks, and Superluminal Signals" in the Alternate View column of the magazine (Dr. Cramer is a Physicist). From Medical Design for December 2013 is NASA's PUMA Provides Valuable Patient Data with the use of an instrument developed for astronaut and pilot health monitoring. The acronym stands for Portable Unit for Metabolic Analysis and can be used in "applications beyond space". Since it measures a bodies metabolic functions it can be used for a variety of medical and athletic training performance applications. Variations in oxygen consumption, CO2 release, moisture levels in the exhaled air and a number of other characteristics can be measured that are important to doctors working with spacefarers and patients (and the general populous). This work was done by Daniel Dietrich at NASA's Glenn Research Center in, Cleveland, Ohio. See medicaldesign.com for the article.

And; Ison is gone, long live Ison! It was a great boost for public discussion of space and why we need to become a space faring civilization, but, another comet that may be a great lesson in this area may have missed: while listening to A.B.C. (The Australian Broadcasting Corporation) I heard of a comet performing a close approach, with a one in five hundred or one thousand chance of impact, to Mars. The show was a repeat of a spring broadcast, but, the event was to happen sometime next year. One of the points mentioned was that the Mars Rovers would have a grandstand seat for this close approach! Think of that. Our first comet observations from the surface of another world. The impact, if it happens might tell us a lot about material transfer via comet and, for as long as the rovers last, the transient atmospheric conditions that will result. And finally, from NASA Tech Briefs: there is a report on building an electromagnetic launcher on the International Space Station: International Space Station Based Electromagnetic Launcher for Space Science Payloads, by Ross M. Jones at Caltechs J.P.L. in Pasadena, California. The author mentions several possible designs, including the Mass Driver and Rail Gun, and, the use of the device for sending probes to Earth as well as to the Moon and further out. The use of these devices has been discussed for several score years now and lots of studies have been done. So: When will somebody, or another countries government, put such a system in place? This is similar to what has been done with Solar Sails and Tethers: lots of talk and studies with very little "tin bending". Simulations are nice but they only launch simulated cargos.

Buisness note: at our January meeting we will work on the tax year 2013 paperwork started.

The NSS-PASA Report for January 2014

Meeting times and location: For February and March we will meet at the Liberty One Food Court from one to three p.m. as usual. February **on the eighth** (snow day the ninth), and March the eighth (snow day the ninth again). We will be judging at the Carver Science Fair in February and early March. Mitch is planning for another public outreach in this period also.

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

Larry gave the first report and brought the 2013 website activity. He also told us that a "tiny url" could get to our site: tinyurl.com/nnsevlo. Also: Charity Blossom can take donations now and Larry put in the first one. We have to contact them to confirm our status as a non-profit. Larry also mentioned the early January Coronal Mass Ejection and the resultant Auroral display that came down as far as New Jersey as a result. As part of the report on that he handed us a graphic called "How the Sun Works".

Dorothy brought news of activity at the Franklin Institute which was mostly on movies this time: I-Max Theater: "Space Junk," at the Franklin Theater, "Unraveling the Cosmos" in 3D, and, at the Fels Planetarium: "To Space and Back" It was narrated by James May ("Top Gear" host) and was produced by The Institute. She and I also talked on the Lunacon convention in April and an invitation I have received to attend or be a speaker or panel member. I cannot attend this year but will try for 2015. Dorothy and Larry are attending.

Mitch brought material from Time magazine for January 2014 on "The Private Space Race" which included reports on Space X, Virgin Galactic, Orbital Sciences, and, Sierra Nevada Corporation. As a side note: an Orbital Science cargo craft delivered material to the ISS (crew Christmas presents.) in January (From Dennis Pearson). Thanks to his center city location he had a front row seat for a local tradition, The Mummers Day Parade, and he got great pictures of a mummers group in Space Suits! Also: the newest version of the Orient Express (hypersonic commercial aircraft) was featured in the September 2013 Popular Science. The key to this working will be a new hybrid engine being designed for the plane. Back to Time again: "Finding a Second Earth" on the search for exoplanets and the work of researcher Lisa Kaltenegger, who is at Harvard, in cooperation with the Max Planck Institute. The research instrument for this work is the Transient Exoplanet Survey Satellite.

Hank talked on the new PSFS President, Gary Feldbaum, who has also served as Philcon chairman for three years. He has had some problems with the PSFS website and has found that the Firefox browser works best when accessing it.

Dennis Pearson brought the news, noted previously, of the Orbital Sciences ISS supply mission. In this case, the supplies included Christmas presents, which had been delayed, having been previously bumped for repair material on the previous supply mission (a cooling system had broken down near Christmas and had to be fixed). The Orbital Science launch was from Wallops Island which is a real candidate for a regional space port. Dennis also brought a project he is working on for our input and to explain his ideas. He is planning to build an "interior view" display of various parts of the Bernal Sphere habitat with sub modules inset (inside lighting scones) into the larger interior view assembly. On the X-Prize front: Dennis has given the Rover team at Penn State University permission to land on the acreage he has on the Moon!

Earl brought a large amount of material but also discussed the possibility of a number of chapter members building various possible habitats for locations on planets and moons, and in space, at the discretion of the builders. Rich Bowers had come up with the early version of the habitat form that Dennis is working on, but, he could build his own version as well. And Mitch, who is trained in city planning (he has a degree in this field), could try several ideas he has brought to the meetings. I have found that the January 2014 NASA Tech Briefs has something I will try: a habitat, for use on the Moon, that looks remarkably like a Mars Society Analog structure, is shown in "Habitat Demonstration Unit (HUD) Vertical Cylinder Habitat" from a team at the Johnson Space Center. This is on page 38 of the issue. There is mention of a transport device to be used to move the structure (among other uses): The All-Terrain Hex Limbed Extra Terrestrial Explorer (ATHLETE) and other tools. A VISOR that can translate various imaging sensor data into a sonic equivalent, to: Enabling Microliquid Chromatography by Microbead Packing of Microchannels (for an assaying device with medical and bio-sensing applications in a small package).

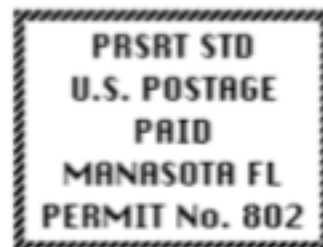
There is a lot of good material in two other NASA publications: In Defense Tech Briefs is: "The Influence of Material Processing on the Performance of Composite Structures" (which are used in many space and special Earth based objects) by the C.E.O and staff at e-Xstream engineering (shown as published). From Medical Design Briefs: an article on a material family that can be used for assisting in the repair, and regrowth of blood vessels and other elements of the circulatory system: "Shaping the Next Generation of Cardiovascular devices Through Biomedical Textile Engineering. The author is Todd Blair of Biomedical Structures. For long term habitation the ability to rehabilitate injured spacefarers will be critical.

And finally: from the Amsat Journal for November/December: for public education: "Cubesat De-orbits in Hampton Roads" on an education outreach by Richard Siff, W4BUE. The device shown is part of a ham club STEM program in the Chesapeake public schools. On satellite launches with STEM and ham projects on board: "November 21 DNEPER Launch Amateur Satellite Summary". There is a chart of the craft launched on the Russian booster, along with the Dubaisat 2 primary cargo. Several of the satellites are also pictured in the article and the scientific and ham uses they are to perform. Several have additional material associated with them in the form of data interpretation software for space craft data (temperature charting, solar flux and solar panel output levels) as well as the experiments that were created by a mix of University and student groups. In this and other articles referenced go to the organization that the references were drawn from for much more. Amsat is indirectly involved in manned space flight in that a number of the astronauts on the I.S.S. are involved in ham radio and some are members of Amsat. It has been supporting a number of projects lately that are for public education outreach and includes training of volunteers who could give technical talks to high school and college students. As the NSS says Ad Astra Per Aspera (To the stars through difficulties).

Submitted by Earl Bennett of NSSPASA.

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

Address Service Requested
 Mail Carrier, Time Sensitive Material <--



Please renew promptly so as not to miss an issue

INDEX to MMM #272 February 2014

Feature Articles

- 1 In Focus: Creating a Manufacturing "Beachhead" on the Moon, Peter Kokh
- 5 Growing Start-up Industries on the Moon, Dave Dietzler
- 6 "Backing up" our Civilization, Peter Kokh

Moon Society Journal Section

- | | |
|--------------------------------|----------------------------------|
| 9. President's Rant | 10. Chapter Activity Suggestions |
| 11-12. Chapter & Outpost News | |
| 13. Moonscapes Science Fiction | 14. Browsing Links |
| 15. Video Links | 16. 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 "LRS", PO Box 2102, Milwaukee, WI 53201