

“Towards an Earth–Moon Economy – Developing Off–Planet Resources”

Moon Miners’ Manifesto

& The Moon Society Journal**www.MoonMinersManifesto.info**



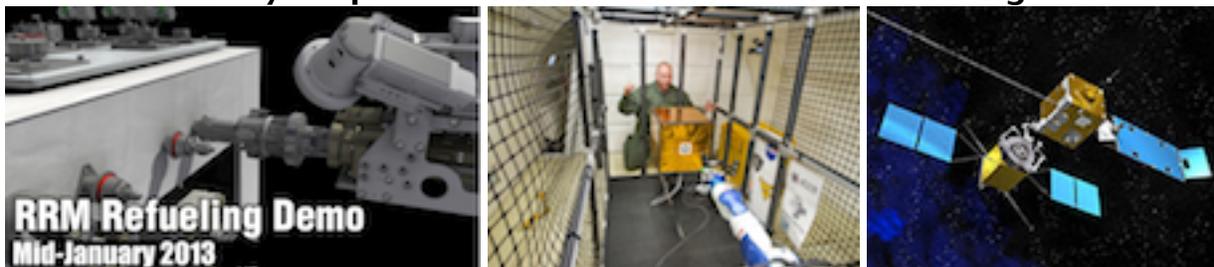

Above: A concept of what comes next in Earth Orbit after ISS: A **Commercial Shipyard–Depot**

Image source: <http://bbs.stardestroyer.net/viewtopic.php?t=143538> – Google Image Search: “Orbital Shipyard”

Feature Articles:

- 2 In Focus: NASA continues to seek Commercial Partners
- 4 The Forgotten Stepping Stone: An Orbiting Depot/Station/Shipyard – Peter Kokh and Dave Dietzler
- 6 Space Industries – Dave Dietzler
- 7 Lunar Materials Production Technologies to Investigate – Dave Dietzler

Baby Steps towards in-orbit Satellite Servicing



L: <http://ssco.gsfc.nasa.gov/> – NASA Satellite Servicing Capabilities Office

M: <https://flightopportunities.nasa.gov/technologies/9/> – Autonomous Robotic Capture

R: http://www.nasa.gov/centers/kennedy/home/satellite_servicing.html
– Kennedy Supporting Effort to Develop Satellite Servicing Capabilities

For past articles, Visit http://www.moonsociety.org/publications/mmm_classics/ or [mmm_themes/](http://www.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://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 for submissions.**
- **Submissions by email** to KokhMMM@aol.com – Email message body text or MS Word, Open Office, Text files, and pdf file attachments or mailed CDs, DVDs, or typed hard copy [short pieces only, less than 1,000 words] to:
Moon Miners' Manifesto, c/o Peter Kokh, 1630 N. 32nd Street, Milwaukee, WI 53208-2040

In Focus NASA Continues to seek Commercial Partners

By Peter Kokh

One of the most significant things President Obama did on being elected in 2008, was to pick former NSS Executive Director Lori Garver to be assistant NASA Administrator. Since then, Lori, who is also a strong “chapter person,” has been working to save NASA money, “so NASA can do more with less” in this period where money is tight, through partnerships with commercial companies. Recently, more and more government agencies, most notably the Department of Defense/DOD – are choosing to “hitch rides” into space for various instruments aboard commercial satellites. The buzz word here is “**hosted payloads.**”

See: <http://www.space.com/18588-military-nasa-commercial-hosted-payloads.html>

We don't know if this practice will catch on in other countries, but it is a very good sign in this country, where quite contrary to long standing American tradition of “Free Enterprise,” NASA has been a shining example of “socialized space.” Yes, we are all proud of what NASA has done. But that pride should not blind us to the fact that these achievements were outside our heritage tradition. Republicans and Democrats alike have supported “socialized space” – most often more interested in the jobs it brought to their districts than in keeping within our free enterprise paradigm. Many of us, in particular the Space Frontier Foundation, but also to a lesser extent the National Space Society (whose ill-chosen name broadcasts a degree of blindness to this issue) have worked hard to

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

get out the message that we can do more with less money spent more appropriately with better results through commercialization.

We have a long way to go yet, down this road, but the signs of progress are encouraging. We've succeeded in retiring the amazing but overly expensive Space Shuttles to museums around the country and in supporting NASA's new effort to partner with commercial providers for access to the International Space Station. And now we have commercial firms in the "module business" such as Bigelow Aerospace and ILC Dover (both into the inflatable module business, each with its own systems and architectures). NASA is also making use of the Google Lunar X-prize program, having contracted with Astrobiotics for a hitchhiker rover capable of going down into a lunar lavatube "skylight" and reporting back on what it finds.

While NASA, in partnership with Lockheed-Martin, is building its own Orion crew capsule for flights to destinations beyond Low Earth Orbit (LEO), Elon Musk's Space-X has ambitions of sending crews to Mars, and we should not be surprised to find NASA someday kissing Lockheed-Martin goodbye and hitching a ride with Space-X.

Governments are by nature extremely inefficient, and money-wasting. Government space programs are too often structured by political decisions. Now in the rest of the world, space is still highly nationalized. But as this young Commercial Space Revolution continues, it is the Nationalized space programs that will be left in the dust. But we hope that ESA will follow NASA's lead in contracting more and more with commercial firms.

What about Space Science Missions?

Here, government funding is totally appropriate and indeed, except where the expected scientific results have commercial implications (finding and assaying space resources economically worth developing) there may be no other way. So we should all continue to support space science missions. We need to know much more about the Moon, about Mars, and about the asteroids, if we are going to effectively open space and become a "multi-world species." The U.S. government "opened" the American West by land grants and other support to railroads. This type of partnership role is most important and it should continue, following that example. So we continue to encourage ever more capable space science missions by NASA and other national space agencies.

National Politics

Many space enthusiasts believe that the Republican Party is more pro-space than the Democratic Party. But you have to look at it Representative by Representative, and Senator by Senator, and President by President. Both parties support free enterprise, but sadly, some on both sides of the aisle, put local politics before the national good. Meanwhile, the Obama Administration seems to be solidly behind Space Commercialization, and we should all be happy about that, even if it means less NASA-contractor business in our own district or state.

Opening the Moon

Look, let's face it. NASA **can** explore the Moon. But it **cannot** open the lunar frontier. Industry and business alone can do that. Only commercial interests can design a moonbase that is open-ended, designed for expansion and replication. Turning the Moon into an eighth human frontier continent is a job for pioneers. Governments can assist as the U.S. government, under successive administrations, facilitated the opening of the American West in the second half of the 19th Century.

The same goes for Mars. Governments will only support a human sortie or two. We must not blind ourselves to that. Yes, in the past, various governments have supported settlement of lands with little or no economic rationale, for military and other strategic but non-economic reasons. Yet unless an indigenous local economy takes over growth and development, invigorated by trade, such national outposts are doomed to be future ghost towns.

All of us, Republicans, Democrats, independents and others need to recognize these facts. We need to push and support space commercialization on a nonpartisan basis.

Orbital Refueling

As to the new SLS rocket NASA says it needs for a mission to the asteroids, we should lobby to have Congress cancel that program and mandate that NASA rely on commercial rockets, including Atlas. Not enough power? Well there is a solution to that too! It is called orbital refueling, and Boeing has plans for that. Orbital refueling capacity is essential if the Space Age is not going to be a short term phenomenon in human history.

The Flexible Path

Many do not like this "lack of direction" – this "indecisiveness" – but speaking for ourselves, this path is "right on." Why? Because the three "competing" paths – Moon, Mars, Asteroids – all require the development of key technologies needed in common for each. And if this Flexible Path does that job, then all of us – Lunans, Martians, Asteroiders – will get to see our dreams begin to come true sooner and more robustly. Moreover, in the end, none of these frontiers can survive without making a go of it economically. And we believe that this degree of minimum prosperity can only be achieved by trade with each other as well as with Earth. Together, these frontiers will prosper, separately, all three can only fail and fold.

This why Al Anzaldúa and I have put out "The Triway Declaration." See MMM #256 – June 2012 or online at: <http://www.thespacereview.com/article/2078/1>

"Live long and prosper, commercially!"

PK

An Orbiting Depot/Station/Shipyard – Resurrecting a Forgotten Stepping Stone

By Peter Kokh and Dave Dietzler

Goals of the space enthusiast community in the Post-Apollo period

Many of us old enough to have lived through the glory days of the Apollo Moon Mission period were devastated when the remaining three Apollo moon landing missions, #18, #19, and #20 were cancelled. Prior to this cancellation, all of the major contractors were working on plans for permanent Lunar Outposts. The disappointment was intense enough to eat the insides of those of us whose hopes that Apollo would be the grand beginning of permanent human presence beyond Earth orbit were dashed.

When Gerard O'Neill published his "High Frontier" vision a few years later in the 1970's many of us took heart. We organized and began to campaign to have the United States adopt Wernher von Braun's plans for an orbiting Space Station that would serve as both a depot to the great beyond, and as a shipyard of sorts.

The Space Station idea had a rough time in Congress, and was on the verge of defeat by one vote when President Bill Clinton found a way to save it: the Space Station, if we brought the Russians aboard as equal partners, would be a great way to keep unemployed Russian scientists and engineers busy doing something constructive, instead of hiring out to other countries with less honorable intentions. Space Station "Freedom" passed by one vote.

The Cost We Paid for this Accommodation

But because the Russian spaceport, Baikonur in the Kazakhstan Republic (formerly part of the Soviet Union: the U.S.S.R.) is at the substantially more northern latitude of 46° North, for the Russians to be able to launch to the Station required that ISS have an orbit around Earth which had that high inclination to the equator.

The price was high:

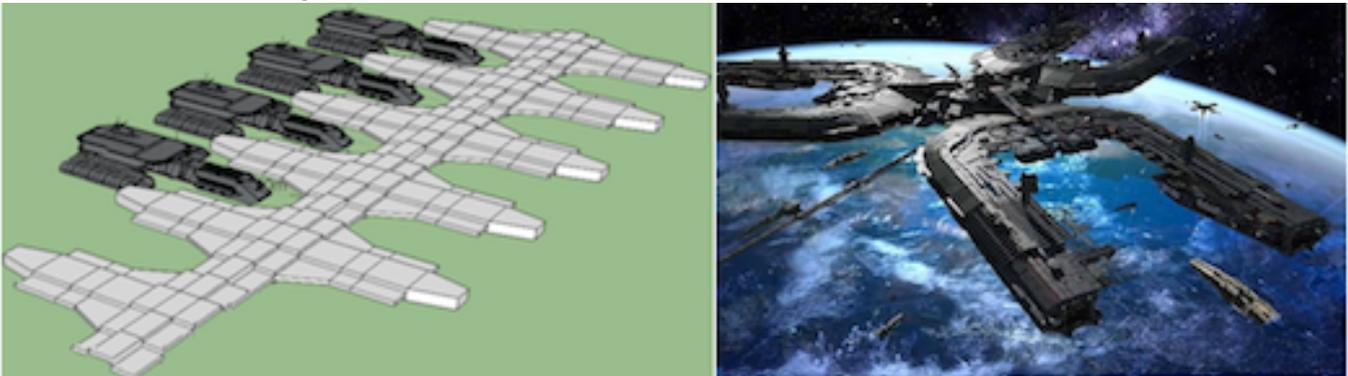
- **High Inclination Orbits are great for studying the Earth below as they pass over most of the populated area of our planet between the Arctic and Antarctic circles.**
- **But that excluded the one top priority space station use for which we campaigned so hard: serving as an assembly point and depot for missions to deep space**

Make no mistake, most space enthusiasts feel that the International Space Station (despite the high cost of the unnecessary deorbiting of Russia's MIR station (which could have been boosted to a safe high orbit as the first International Space Monument) has been a very positive project, keeping manned space in the public limelight, this type of station has nothing to do with von Braun's vision of its purpose and function.

What Space Enthusiasts and their Societies have been doing wrong

We seem to have forgotten von Braun's plans, or to have dismissed them as politically impossible. So we restrict ourselves to supporting proposed human deep space missions and space transportation systems that do not need orbital assembly or an orbital depot. Perhaps our strategy should not be to campaign anew for an Orbital Assembly and Depot for Deep Space Missions, but to reinvent the concept, given a possibly enabling revolution which has been going on for almost a decade: Commercialization

A Commercial Orbiting "Shipyard & Port" for Deep Space Missions, unmanned and manned



Left: adapted from <http://img203.imageshack.us/img203/4258/shipyard.png> Image Search: orbital shipyard
right: http://images2.wikia.nocookie.net/_cb20100704050848/worldsofsdn/images/d/dc/OrbitalYard.jpg
 Okay, these are out of Star Trek or something similar, but you get the idea! It would grow as "business" demanded

It is not politically possible, within the United States or within the World at Large, to float the idea of an "ISS II" in an equatorial orbit. The World Economy is too fragile, and most space-faring nations are doing all they can to keep supporting our existing magnificent station. No, governments are not whom we need to be looking to!

Now two years ago, we would have been laughed at and dismissed, but given the now substantial record of one success after another by Space-X both in building new more economical rockets, and now after two successful cargo missions to the International Space Station, and with the pending successful debut of other commercial space vehicles, we need to be aggressively looking beyond the status quo.

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

1. We need to be lobbying Congress to mandate that NASA **open "ALL" bids to Commercial companies** as well as to the traditional aerospace contractors. There is nothing so effective as competition. It is the Commercial companies who are most motivated to try ingenious new methods and techniques and technologies.
2. A proposal to build **the start of an Orbiting Shipyard** is unlikely to come from NASA, but there is every reason to expect it from a consortium of commercial companies. Why? To put together in orbit all these proposed "commercial space stations" (think Bigelow, think Excalibur Almaz) and orbital hotels (once a route to realization appears, the serious proposals will follow.)
3. Consider: for decades now, we have been imagining an era when orbital space will be populated with space hotels and industrial parks. Who will build them? Where will they be built? The answer is so obvious that it is curious that there have been no proposals. We need a startup, small at first, orbital shipyard.
4. Consider that plans for an integral element of such a shipyard – **an orbital refueling facility** – are already in an advanced stage of planning by Dallas Bienhoff at Boeing.
5. Consider that key components are already in use at ISS: **solar panels** for power and the two **Canadarms** (2nd with Dextre)
6. The first **robonaut** is now at ISS and learning new tricks there. **In order to be financially feasible, any Orbiting Shipyard will have to minimize human staffing and maximize robotic and telerobotic staffing**
7. Consider that **automated docking systems** are now advanced
8. **All the needed technologies are now coming online**, off the pages of pulp and film science fiction.



Starting Small, Expanding as Customer Demand Warrants

Our expectation is that this will start as a refueling station. Why? Because that service will revolutionize how deep space mission spacecraft are designed and built, allow major savings, and increase the volume of such traffic.

Services provided by a Commercial Space Shipyard and Depot from humble start on up

1. **Orbital Shipyard/Space "drydock"**
 - In-space vehicles need places to dock and transfer cargo as well as to refuel.
 - Logistics operations need a specific way to transfer large cargo items from docked vehicle to vehicle
 - The docking and cargo handling capacity and structure is a significant part of any space logistics base
2. **Refueling rockets**
3. **Repair/salvage of derelict satellites** – things that can't be teleoperated from Earth. New satellites that "grapple" derelict satellites and other large artifacts in orbit are on the drawing boards. Efforts to clear space of "debris" will work to provide an orbiting shipyard with needed scraps and salvaged parts.]
[39 derelict satellites: http://en.wikipedia.org/wiki/Category:Derelict_satellites_orbiting_Earth Then
4. **Components Storage:** old upper stages, perhaps just the tanks and return the engines to Earth....and materials from old sats....; solar panels for ion drives, lander fuel tanks become LUNOX tanks
5. **Shipments:** Anything rich in alloy components rare on the Moon, shipped to lunar outposts (transport from Earth to orbit already prepaid) Examples: copper, lead, zinc, gold, silver, etc.
6. **Disassembly, Assembly, Production:**
 - Assemble cargo modules, solar electric ion drive units and landers to the Moon's surface....
 - Convert old upper stage tanks into LUNOX tanks....for storing up LOX from the Moon...Perhaps upper stage LOX tanks will be used for storage and RP1 tanks for habitat..
 - Grind up old upper stages and use Al powder for fuel?
 - Refurbish old solar panels from old sats?
 - Devise a well insulated tank set that detaches from its engines which return to Earth with a heat shield installed and then use the tank for cryo-propellant storage
 - grind up plastic/composite payload fairings, breaking them down into carbon and hydrogen
7. **Other Services**
 - Assembly of modules and stages (allowing multiple small rocket launches vs. one massive one (cost savings)
 - Repair of various systems
 - Servicing of water/air recycling systems

- Storage lockers for items to be shipped to Earth or elsewhere as capacity on visiting spacecraft allows
- Storage lockers for useful parts scavenged from satellites that can't be repaired, and scrap
- Launching of assembled and/or serviced satellites and other structures to their intended orbit or destination
- An adjacent hotel-dorm for workers and visitors with recreation facilities
- Food growth chambers
- Market facilities
- And more

Should we have an Orbiting Shipyard Define & Design Competition?

Moon Miners' Manifesto & Milwaukee Lunar Reclamation Society will consider sponsoring such a competition and offering prizes.

Meanwhile Reader contributions to this brainstorming exercise are most welcome!

- Functions such a facility would serve
- Backbone structure
- What orbit altitude and inclination would best support what functions?
- Architectural concepts and designs allowing growth and expansion as needed, module by module
- Artwork (google images has some suggestions but feel free to start fresh)
- Other Define & Design items you can think of (not specifics that would be part of your proposal!)
-- email to mmm@moonsociety.org kokhmmm@aol.com



By Dave Dietzler

Many of us have grand visions of space tourism with perhaps a million or more people visiting the Moon every year for the price of a medium sized house today. It's more optimistic than post-apocalyptic nightmares. Think of the business opportunities. First there's the launch to LEO business. Then there's the obvious--hotels complete with room service as well as bus tours and space-suited walking tours on the lunar surface, even sub-orbital rocket hops to other places of interest on the Moon. This is all icing on the cake. Beneath it all will be support industries from food production, manufacturing and construction to fuel and raw materials. Most people give little thought to those multibillion dollar offshore oil rigs when they gas up their cars and all the infrastructure needed to get that gasoline to them. The last thing on people's minds when they are partying it up at a resort hotel complex is all the quarrying, brick baking, lumbering and sawing and labor that had to be done to create the place! How did it all get done? It wasn't done by a centrally planned government agency. Business and industry evolved. The same thing will happen in space.

It would be nice if governmental agencies laid down some infrastructure in space in the same way that roads and highways were built. These were built for the entire public. Will the government want to build infrastructure for high priced tourism in space? I don't think the taxpayers will go for it; at least not until anyone can afford to travel in space. What kind of infrastructure is needed? Private rocket bases and spacecraft to LEO are foreseeable and so are LEO hotels consisting of both inflatable and hard modules.

Beyond LEO, the Game Changes

Going beyond LEO means we have to use local resources, "live off the land," and build on the Moon and in outer space, because even at \$50 to \$100 a pound to LEO shipments into space are going to be costly. We need about twice as much mass in the form of propellant than the mass of a spaceship to "loop the Moon" and aerobrake and even more if we want to land on the Moon and return. Will the government set up propellant depots in LEO and at EML1 along with tankers and solar electric tugs and mines and mass drivers on the lunar surface? Somehow industry has to do this. Only by starting off small, accruing profits and reinvesting those profits will any company or group of companies be able to do this. It's gonna take many decades so don't be impatient.

The lunar mines must produce raw materials for construction on and beneath the lunar surface. The only way to keep costs down will be to use robots extensively instead of human labor. Fortunately Earth orbit and the Moon are not so far away that teleoperation is impractical. Once the propellant supply problem is solved by the construction of depots in LEO and at EML1 and mining on the lunar surface with mass drivers or space elevators to get propellant into space, flights to the Moon can begin, but these will only be "loop the Moon" cruises and "hit and run" landings. Millionaires looking for high adventure in space will be customers. Given time the propellant supply

infrastructure can grow to accommodate more and more travelers but some of us want to spend longer periods of time on the Moon and that means there must be shielded habitat and food production.

The first lunar hotels will probably be inflatables covered with regolith with physicochemical water and air recycling systems. Oxygen from regolith will be no problem since that challenge was surmounted for propellant. Stocks of dried food rehydrated with recycled water will be supplanted by crops grown in inflatable modules with robot gardeners. These gardens will be buried for radiation and thermal insulation and filtered sunlight will be piped in from heliostats. The heaviest part of the gardens will be the batteries, fuel cells, fly wheels and solar panels needed to supply light for lunar nightspan. If we really want to grow the lunar tourism business we must make everything on the Moon from solar panels to power storage systems to vehicles and habitat. The ideal location might be a lava tube near one of the poles.

So we need a big hotel and resort on the Moon and that means more mining and production of construction materials and some smart robots. The engineering details will number in the millions but what about the money? Certainly if we build it they will come.

Outsourcing Beyond the Moon

The only elements the Moon is really in short supply of are hydrogen, carbon and nitrogen, but these can be scavenged from regolith and mined from polar ice. When a million tourists a year visit the Moon we will need large space liners or cycling stations and a fair number of them. If we can meet that challenge we can build robotic ships to mine near Earth asteroids and comets. An abundance of light elements and platinum group metals could be had. When it comes to the use of water and plastics on the Moon "reduce, reuse and recycle" will be the rule but with asteroid or comet mining there will be no limits to what can be done on the Moon as long as the cash is flowing in.

Sound like a lot? This is a logical, doable plan. In time it may all unfold in just this way. **DDz**

Lunar Materials Production Technologies to Investigate

By Dave Dietzler

The ground rules are simple: Initial production of materials on the Moon may utilize imported equipment and materials rare on the Moon like carbon crucibles for furnaces and reagents like halogens; however, the goal is to construct equipment with lunar sourced materials and use lunar sourced reagents. These follow no particular order:

1. Solar furnaces with aluminum and/or magnesium sheet metal reflectors. Melting pots of metal, perhaps meteoric iron, lined with refractory ceramic like alumina or magnesia.
2. Electric furnaces with melting pots similar to those used with solar furnaces and iron aluminide or Fe-Al-Cr heating elements.
3. Quenching of molten anorthite glass by radiation in the vacuum while pouring from melting pot [1].
4. Casting of molten materials (iron, basalt, etc.) in the vacuum. Study of evaporation and problems related to that.
5. Mining of solar wind implanted elements.
6. Mining of sulfur by roasting large amounts of regolith at up to 1200 C. Construction of equipment for this from iron produced on the Moon [2].
7. Mining meteoric iron-nickel fines with magnets, grinding and purifying this material magnetically, treatment with CO gas to form carbonyls and distillation to separate iron from nickel [3].
8. Production of high nickel alloy iron and maraging steel.
9. Production of cement by roasting anorthositic highland regolith at 1500 C. in the vacuum and construction of furnace melting pots with alumina ceramic [4].
10. Distillation of FeO, SiO₂ and MgO during cement production. Cast basalt might suffice for distillation equipment construction [5].
11. Hydrogen reduction of FeO released during cement production to iron metal and water and recovery of hydrogen by water electrolysis along with production of oxygen.
12. Separation of SiO₂ and MgO released during cement production by roasting and distillation or electrostatic separation.
13. Magma electrolysis that yields oxygen, ferrosilicon and slag. Construction of magma electrolysis cells with alumina or magnesia linings, regolith insulation, iron-nickel jackets and high temperature and corrosion resistant ceramic electrodes made on the Moon [6].
14. Silicothermic reduction of MgO from cement production and magnesium bearing minerals. FeSi from magma electrolysis used as reductant. Solar or electric furnaces capable of operating at 1200 C. made of high nickel alloy iron perhaps [7].

15. Use of magnesium to reduce alumina to aluminum metal. This might be highly exothermic. Since no material could stand the heat of a thermite reaction a covered crater where a pool of stratified molten regolith and aluminum might work [8].
16. Production of alumina by sulfuric acid leaching of melted and quenched glass of anorthite, cement and slag from magma electrolysis. Construction of vats, pipes and valves for acid leaching with cast basalt and high silicon alloy iron.
17. Sulfuric acid recycling systems made of basalt and high silicon iron.
18. Temperature maintenance systems that enable equipment to survive temperature extremes on the Moon like thermal wadis and solar shades.

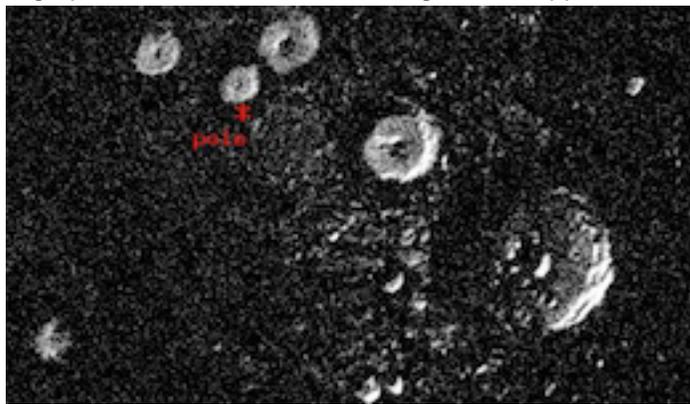
References:

- 1] Melt-Quench-Leech Aluminum Extraction David Burkhead
<http://www.asi.org/adb/02/02/03/aluminum-extraction.html>
- 2] <http://www.nss.org/settlement/moon/library/1980-HandbookOfLunarMaterials.pdf> pg. 115
- 3] Lunar Beneficiation William N. Agosto – <http://www.nss.org/settlement/nasa/spaceresvol3/lunarben1b.htm>
- 4] Cement and Concrete: Gene Corley and Larry A. Haskin
<http://www.nss.org/settlement/nasa/spaceresvol3/cemncon1.htm>
- 5] "Selective Evaporation of Lunar Oxide Components" – Rudolf Keller and David B. Stofesky of EMEC Consultants.
<http://www.permanent.com/space-industry-distillation.html>
- 6] **Magma Electrolysis Electrodes** – <http://www.moonminer.org/10201.html> and **Magma Electrolysis**
<http://www.moonminer.org/9701.html>
- 7] Magnesium: The Overlooked Metal – <http://www.moonminer.org/10501.html>
- 8] **Aluminum Oxide Reduction Methods** – Viktor Austin Olliver
<http://www.asi.org/adb/02/02/03/aluminum-extraction-methods.html>

DDz

Postscript on our article on Mercury in MMM #261

We had reported that the Messenger orbiter confirmed water ice in Mercury's north polar craters, which, Mercury's axis having no appreciable tilt, are always in darkness. The Radio Telescope at Arecibo, Puerto Rico had predicted this nearly fourteen plus years ago based on a radar scan July 25–26, 1999. Here is a map of those radar findings, the bright areas lining up with the craters that Messenger has mapped.



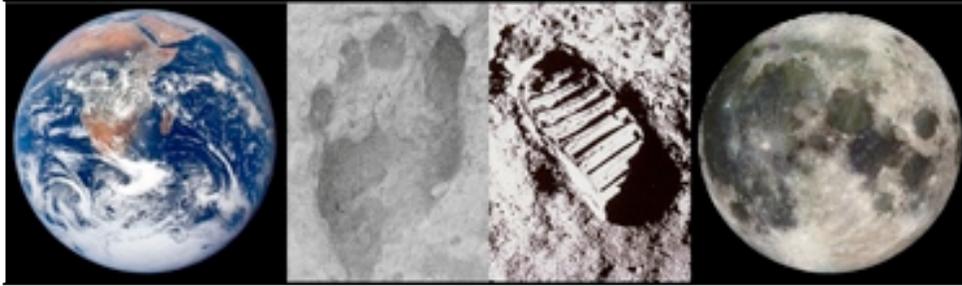
For more, read: <http://www.planetary.org/blogs/emily-lakdawalla/2012/11291206-mercury-polar-ice.html>
Neutron Spectrometer observations suggest the ice is buried about 10 m (4 in) below a surface layer of dust.



MAILBOX: In your lead article in the November 2012 MMM "In Focus – To the stars" you say that we would need to maintain an average speed of 23% of the speed of light to reach Alpha Centauri in 100 years. I calculate an average velocity of only 4.3% of the speed of light (8.6% of the speed of light peak velocity assuming constant acceleration and deceleration) – the calculation is simple – 4.3 light-years/100 years. While this doesn't change the fact that this is way beyond our current technology, its still 5 times easier than your number.

– Scotty Gammenthaler

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

Our Mission is to inspire and involve people everywhere, from all walks of life, to create an expanded Earth-Moon economy that will contribute solutions to the major problems that continue to challenge our home world.

Moon Society Strategy

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

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

From Moon Society President Ken Murphy – The Year Ahead

Things may have seemed quiet here at The Moon Society, but behind the scenes has been a flurry of activity to position us for a strong year in 2013.

On the financial front, The Moon Society is in a stronger position than ever. Our 501c3 status has been clarified with the IRS, and we've registered with one of the leading non-profit websites to build our credibility as a 501c3 doing good work in its community. The books are almost in order, and will be audited once finished. This will serve to establish our legal status and credibility with payment mechanisms like Paypal and Amazon, so that we can start generating funds to undertake more ambitious projects.

On the publishing front, Peter Kokh continues to do yeoman's work in preparing not only MMM, but also the India Quarterly version. This is a big task, and The Moon Society needs to provide Peter with a support team to generate content and provide editing support. Behind the scenes, we've been scrubbing old MMMs to build theme issues on popular topics for e-reader platforms that can be sold through Kindle and other outlets. We will be formally launching these later this year.

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

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

From Moon Society President, continued

On the ISDC front, we're building a really exciting track for this year's conference on the topic of Lunar Lava Tubes. These fascinating phenomena offer not only amazing science opportunities, but also potential future homes to Lunar settlers. The track will also have some overlap with last year's theme of the cislunar economy, providing continuity but also different perspectives.

We need to jumpstart one of our science projects, and we just so happen to have one that's perfect. As a reminder, TMS received a bequest to be used for projects to advance our objectives and two specific projects were identified. First, and more ambitious is a Solar Sail Comm Sat to test their use as part of a Lunar Communications architecture. Your president has also proposed that the project address the concept of pole-sitting, or hovering over the North or South Pole of the Moon.

The second project is to study **communications strategies for robots exploring Lunar Lava Tubes**. Given the theme of this year's ISDC, your president is proposing that we use that to feed into a Kickstarter campaign to raise funds for a field exercise that would send a handful of young scientists to a lava tube to run robots around and determine the best communications strategies for when they're deep underground. Ideally, this would lead to a published paper that would demonstrate The Moon Society as a supporter of quality Lunar science.

It's an ambitious plan, and Kickstarter campaigns don't necessarily succeed. Nevertheless, it's a chance to raise the profile of TMS in a serious way.

The big challenge we face is our website. Board chairman Philip Crume is heading up the team looking at a new web solution for TMS. To help with the project please contact Phillip at pcrume.moonsociety@gmail.com. Leadership absolutely needs the support of membership in this project, as we will be scrubbing and reorganizing the content to make it more accessible and friendlier to new ways to connect to the internet like smartphones.

The scheduled launch for the new website is end-of-June of this year, but hopefully sooner. Leadership has been evaluating hosting and website architecture options, and will soon be in a position to begin migrating content to the new format, and that's where we most need your help. The Moon Society has a unique and comprehensive archive of Moon information replicated nowhere else in the world. We can increase our relevance by making that information more accessible to even casual infoseekers.

Lastly, your leadership has been challenged again this year to publish an article, editorial, or blog about our Moon. Several of your leadership team were successful in this regard last year, hopefully all of them will be this year. You can take up the challenge as well, as part of TMS's goal of better educating the public of the benefits of exploring, developing, and settling our Moon.

So we've got big things in the works here at The Moon Society, and we want to give you, the membership, ways to get directly involved. Some of those ways are by necessity administrative like newsletter or website, but we also want to engage in projects of direct relevance to our goals, like the lava tube field exercise. You can always tell me how you want to get directly engaged at president@moonsociety.org.

The space industry is entering a very exciting stage in its metamorphosis; 2013 is going to be a year full of announcements. Let's all work together to make sure The Moon Society is at the cutting edge of that change. **KM**

Looking Ahead to April Outreach Opportunities

Yuri's Night – Friday, April 12th, 2013 – It is not too early to start planning for this opportunity. That the date falls on a Friday this year, provides the opportunity to plan a Saturday afternoon/evening event instead. Then you have time to pick location and decide on your program.

If your chapter's meeting happens to be on the 2nd Saturday, which this year happens to be the day after Yuri's night, then you are essentially committing to no more than a special meeting, your location already set.

The first step takes no pain. Register your chapter's party at <http://yurisnight.net/#/home>

Earth Day – Monday, April 22nd – If your chapter meeting is set for the 3rd Saturday, which this year falls on the 20th, you could use your regular slot and location to observe Earth Day two days earlier, when you are likelier to attract new people, than on the following Monday. **Suggestions:** <http://www.moonsociety.org/info/events.html>

Remember to plug the "Mother Earth/Father Sky" theme: www.moonsociety.org/images/changing/earth_sky.gif

Astronomy Day – Saturday, April 20th – If your chapter meeting is set for the 3rd Saturday, you could use your regular slot and location to also observe not only Earth Day, but Astronomy Day all together, for a super event. **Suggestions:** <http://www.moonsociety.org/info/events.html>

Top Reasons for Chapter Members to Meet in Person

From Moon Society Chapters Coordinator Peter Kokh

Be forewarned, this list is a stab in the dark to help get brainstorming started that will help your chapter remain strong and productive.

This list is sure to be incomplete, so please do send us your own list, dropping those suggestions I make below that do not seem promising, and adding others that I did not think of.

You will have already noticed that I list many more than just “10.” That’s because the idea is to get feedback from readers in various chapters, as to which they think are the most productive. **Give us “your” top ten!**

• Discussions

- What’s going on in space
- Space mission proposals put forth but not yet budgeted
- Recent space/science fiction/other films in theaters or online
- Promising technologies under development
- Comparing notes on new books, films
- Outreach opportunities (be inventive!)
- Reporting on conventions and conferences recently attended and upcoming
- Taking turns studying a topic and presenting at a future meeting

• Planning

- Group outing to a movie
- Group field trip to some local or regional attraction that showcases relevant technologies needed in space
- Group trip to take in a meeting of another space chapter, astronomy or other science club, etc.
- Information booth or table at
 - A science fiction convention: <http://nsschapters.org/hub/con.htm>
 - A geology convention
 - An astronomy convention: <http://nsschapters.org/hub/events.htm#amastron>
 - An environmental event: <http://nsschapters.org/hub/events.htm#envirol> – <http://observethemoonnight.org>
 - A robotics convention
 - An air show
 - Or _____ (add to this list!)
- Chapter space exhibits to use at sci-fi cons or other public events and in schools or elsewhere
- Contributing judges and prizes for a high school science fair
- Letter writing campaigns to newspapers, magazines, TV stations
- Sidewalk astronomy planning

• Speaking Opportunities: <http://nsschapters.org/hub/con.htm>

- At schools, libraries, meetings of other organizations and clubs
- Meetings of other groups (list venues you have tried or thought of as speaking opportunities)
- Create your own opportunities (find a location: libraries, schools, other), send out invitations, news releases
- Show educational videos: **50 Moon Colony TV Videos:** <http://www.youtube.com/user/mooncolonytv>

• Projects: <http://nsschapters.org/hub/projects.htm>

- Designing and creating chapter exhibits: <http://nsschapters.org/hub/exhibits.htm>
- Keeping a chapter scrapbook: <http://nsschapters.org/hub/scrapbook.htm>
- Liaison with other groups and clubs
- Contributing books to a chapter library

Let us know

- What has worked well for your chapter
- What you tried and will try again with improvements
- What has flopped, with your analysis of why it flopped, and whether you will try again with improvements

NSS San Diego organizes an annual “Retreat” for its leaders: the result is one very productive chapter

✓ check out: <http://sandiegospace.org/?s=retreat> – If your chapter has been stagnant for some time, (as has my own Milwaukee Lunar Reclamation Society) such a “retreat” may be very helpful in planning the upcoming year and getting chapter leaders and members into productive mode. More on this in next month’s MMM.

Members who might want to help put together our **Lava Tube Kickstarter project** later this year are encouraged to check out (and everyone should support!) the NSS Kickstarter project to create a short film explaining and showing why all of this space stuff is so important.

<http://www.kickstarter.com/projects/351762534/our-future-in-space-a-national-space-society-video>

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

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

February

Chapters & Outposts 2013

ORGANIZING “OUTPOSTS”

Bay Area Moon Society, CA Outpost – South San Francisco Bay – <http://www.moonsociety.org/chapters/bams/>

Contact: Henry Cates hcate2@pacbell.net Meeting the 1st Tuesday of the Month at Henry’s home

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

Moon Society Knoxville Outpost – Contact: Jason Tuttle – tuttlepc@gmail.com

Moon Society Milwaukee Outpost (MSMO) – http://www.moonsociety.org/chapters/milwaukee/msmo_aboutus.htm

Contact: Peter Kokh kokhmmm@aol.com – http://www.moonsociety.org/chapters/milwaukee/msmo_output.htm

ORGANIZED CHAPTERS

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

Contact: Robert Perry surfer_bob@charter.net – Meetings 3rd Wed monthly at Buder Branch Library, 4401 S. Hampton, in the basement conference room – Next meetings – MAR 20 – APR 17 – MAY 15

No meeting reports for the December and January meetings.

Moon Society Phoenix Chapter - <http://www.msphx.org> – Contacts: Craig Porter portercd@msn.com Meeting the 3rd Saturdays of the month at Denny's, 4403 South Rural Road, Tempe
Next meetings – MAR 16 – APR 20 – MAY 18 – JUN 15 – JUL 20

January 19th Meeting Notes (from Mike Mackowski) : Our speaker was Dr. Pete Swan talking about space elevators. He focused on recent discoveries and inventions that are bringing the space elevator closer to reality. A member of the NSS, he has participated in many local, national and international activities. He has written two books on the topic and is Vice President of the International Space Elevator Consortium. He is currently pulling together 28 world-renowned authors in multiple disciplines, to produce a report for the International Academy of Astronautics. This study is an, “Assessment of the Technological Feasibility and Challenges of the Space Elevator Concept.” His focused on recent realizations in many fields that will significantly raise the probability of a Space Elevator by 2032.

I was unable to attend the meeting as he is on a trip for work. We are looking for volunteers who would like to serve as officers. Per our MSP by-laws, nominations are due by Jan 15 with elections to be held at the February meeting. Mike Mackowski is willing to continue as treasurer, and also president, if necessary. Others need to step up, and we need a second name to put on a new checking account as it should not just be in Mike’s name.

Meeting Room Crisis: Denny’s is no longer available for our meetings: I called the Denny’s in Tempe to book our next meeting but they are under new management and require a minimum of 15 people or a tab of \$150 to book the rear room. We’ve never even had ten people. I also attended a business meeting of the Phoenix National Space Society today to re-organize after the death of Dave Fisher, who was chapter VP and heading up the group. We discussed future meeting options as the place NSS was meeting was set up via Dave and there is no guarantee that facility (Humanist Center) will still be available to us.

The next meeting (joint Moon Society and NSS) is set for the third Saturday of the month, or Feb 16. Right now time and location and topic for our scheduled February meeting are TBD.

We also need to elect officers at the next meeting, so (as acting chair/president) I need volunteers who must be national members. I am open to suggestions as to how to proceed. Please note I will also be absent (on business travel) for the February 16 joint meeting with NSS planned, 6 pm start at location to be determined. As this will be a joint meeting with NSS, they will likely come up with the programming.

There will be a **Yuri’s Night event on Friday April 12** in conjunction with the Space Access Conference. It will be mostly a social function. The local AIAA section has agreed to sponsor a hospitality room (as in past years) so the Phoenix Moon Society has a great opportunity here to promote the group and provide some programming for the evening. Think about things we could offer to this event. 414-514-5308

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

Contact: Eric Bowen eric@streamlinerschedules.com – Meeting 3rd Mondays, 7 pm in the conference room of the Bay Area Community Center at Clear Lake Park – Odd # months: MAR 18 – MAY 20 – JUL 15 – SEP 16

January 14th Meeting Notes: We held our January meeting on the 14th, the 2nd Monday, as the 3rd Monday is a National holiday “Martin Luther King Jr.” as well as the Presidential inauguration.

Greater Fort Worth Space Chapter Patricia Ferguson tricia3718@gmail.com Online Meetings: No reports

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

GREAT BROWSING LINKS

SPACE STATIONS: ISS, COMMERCIAL

<http://www.space.com/18616-astronauts-one-year-space-mission.html>

<http://www.space.com/18520-space-gas-station-vivisat-satellite.html>

<http://www.sen.com/feature/bigelow-aerospace-and-the-inflatable-space-stations.html>

www.excaliburalmaz.com/0401_Press.html + www.excaliburalmaz.com/pdf/EA_press_release_06-19-2012.pdf

<http://www.space.com/18747-stratolaunch-orbital-sciences-replaces-spacex.html>

<http://www.space.com/18802-deep-space-agency-apollo-astronaut.html>

<http://www.space.com/18588-military-nasa-commercial-hosted-payloads.html>

<http://www.space.com/19236-space-station-inflatable-module-bigelow.html>

Orbital Hotel Design – <http://www.spacefuture.com/habitat/hoteldesign.shtm> NASA is 3-D printing rocket motor parts – a technology that could cut imports to the Moon, Mars

http://www.designnews.com/author.asp?section_id=1392&doc_id=254513&cid=NL_Newsletters+-+DN+Daily&dfpPParams=ind_183,industry_aero,industry_gov,bid_27,aid_254513&dfpLayout=blog

EARTH

<http://www.livescience.com/19466-climate-change-myths-busted.html>

<http://www.livescience.com/19102-amazing-facts-earth.html>

MOON

<http://www.ilcdover.com/Toroidal-Lunar-Habitat/>

<http://www.space.com/18800-golden-spike-private-moon-company.html>

<http://www.space.com/18808-apollo-17-anniversary-harrison-schmitt.html>

<http://www.space.com/18905-moon-spacecraft-dumping-ground-infographic.html>

A Global Lunar Landing Site Study to Provide the Scientific Context for Exploration of the Moon

<http://www.lpi.usra.edu/nlsi/CLSE-landing-site-study/>

Commercial Moon Base? www.spacecalendar.com/may-21-27-2012-vol-31-no-21-hawaii-island-usa/9/

MARS

<http://www.space.com/18980-radiation-manned-exploration-deep-space.html>

<http://www.space.com/18513-curiosity-detects-but-can-t-see-dust-devils-on-mars-video.html>

<http://www.space.com/18769-mars-rover-curiosity-mission-extension.html>

<http://www.space.com/18771-nasa-next-mars-rover-sample-caching.html>

<http://www.space.com/18753-mars-radiation-manned-mission.html>

MERCURY

<http://news.yahoo.com/blogs/sideshow/nasa-says-enough-ice-mercury-encase-washington-dc-194415297.html>

www.space.com/18647-how-big-is-mercury.html – www.space.com/18646-mercury-distance.html

www.space.com/18645-mercury-temperature.html – www.space.com/18644-mercury-atmosphere.html

www.space.com/18643-mercury-composition.html – www.space.com/18641-mercury-formation.html

OTHER PLANETS + MOONS + ASTEROIDS

<http://www.space.com/18875-titan-nile-river-cassini.html>

<http://www.space.com/18584-dwarf-planets-solar-system-infographic.html>

<http://www.space.com/18583-dwarf-planet-makemake-atmosphere.html>

<http://www.space.com/18583-dwarf-planet-makemake-atmosphere.html>

<http://www.space.com/18628-pluto-atmosphere-larger.html>

<http://www.space.com/16538-pluto-moons-explained-infographic.html>

<http://www.space.com/18679-enormous-vortex-on-saturn-snapped-by-spacecraft-video.html>

<http://www.space.com/18508-asteroid-protection-nuclear-bombs.html>

<http://www.space.com/18901-nasa-mission-jupiter-moon-europa.html>

<http://www.space.com/19303-asteroid-deflection-europe-spacecraft.html>

SPACE SETTLEMENTS + ASTRONOMY + ASTROBIOLOGICS

http://alglobus.net/NASAwork/papers/NSSJOURNAL_PathsToSpaceSettlement_2012.pdf

<http://www.space.com/18578-life-alien-planets-dying-stars.html>

<http://www.space.com/18624-alien-life-search-hairspray.html>

www.scientificamerican.com/article.cfm?id=graphic-science-exoplanet-discoveries-date-just-drop-in-bucket-interactive

<http://www.space.com/18659-biggest-black-hole-blast-mystery.html>

www.nydailynews.com/news/national/amazing-1970s-artwork-envisions-colonized-space-article-1.1219511

<http://www.space.com/19241-life-precursor-chemical-found.html>

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

GREAT SPACE VIDEOS

VIDEO TOUR OF ISS by guide Sunita Williams

<http://www.space.com/18598-iss-tour-cupola-weightlifting-and-a-closet-module-video.html>

<http://www.space.com/18597-iss-tour-russian-segment-soyuz-spacecraft-video.html>

<http://www.space.com/18591-iss-tour-labs-exercise-bike-space-suits-video.html>

<http://www.space.com/18590-iss-tour-kitchen-bedrooms-the-latrines-video.html>

<http://www.space.com/18618-rocket-sled-nasa-retro-tech-tests-future-planetary-descents-video.html>

Small Reactor for Deep Space Exploration - <http://www.youtube.com/watch?v=KobRfGqlpGc&feature=youtu.be>

For more, go to <http://www.youtube.com/?tab=wy> and search for "ISS Tour"

VIDEOS ON OTHER SUBJECTS

<http://www.space.com/18599-what-did-curiosity-find-on-mars-video.html>

<http://www.space.com/17919-life-on-titan-saturns-cold-moon-fascinates-scientists-video.html>

<http://www.space.com/18666-captain-kirk-touts-medical-tech-spun-from-nasa-video.html>

<http://www.space.com/18718-polar-ice-melt-causes-sea-level-rise-satellites-find-video.html>

<http://www.space.com/18767-curiosity-s-sister-to-launch-to-mars-in-2020-video.html>

<http://www.space.com/18757-3-d-printers-on-moon-to-print-space-parts-video.html>

<http://www.space.com/18801-private-company-wants-bootprints-on-the-moon-by-2020-video.htm>

<http://www.space.com/18796-back-to-the-moon-for-power-scientist-says-go-video.html>

<http://www.space.com/18792-enceladus-sample-return-mission.html>

<http://www.space.com/17540-how-did-mars-lose-its-atmosphere-maven-aims-to-find-out-video.html>

NASA Johnson Style (Gangnam parody) - <http://www.youtube.com/watch?v=2Sar5WT76kE>

<http://www.space.com/18931-nasa-gangnam-style-music-video-parody-with-a-purpose.html>

<http://www.space.com/18972-five-planets-discovered-one-potentially-habitable.html>

Study of Nearby sun-like star Tau Ceti indicates it may have 5 planets, one in "habitable zone"

<http://www.space.com/18972-five-planets-discovered-one-potentially-habitable.html> (video)

<http://www.space.com/19130-asteroid-vesta-crater-3d-photo.html>

<http://vimeo.com/55073825> - The "Overview Effect" - a must watch video!

<http://www.space.com/15400-asteroid-threat-promise-space-venture-launches-video.html>

IMAGES BEST SEEN IN FULL COLOR

GRAIL Gravity Maps of the Moon: L>R; west nearside, east nearside, farside -

<http://i.space.com/images/i/000/024/223/i02/moon-crust-gravity.jpg>

SPACE + SCIENCE FICTION FILMS

<http://www.space.com/18815-europa-mission-a-go-in-new-sci-fi-film-teaser-trailer.html>

<http://www.universetoday.com/98439/enticing-trailer-for-new-movie-about-a-mission-to-europa/>

[MMM SCIENCE FICTION by George von Mond]

Marshall Mike Moondust and the Sinister Selenian Subterfuge

Chapter V:

Mike was beginning to wonder if the nurses were in on the conspiracy to kill him. Every day brought a new exquisite form of pain as the hospital staff knitted his ravaged body back together. Nurse Ratched especially seemed to delight in his pain. He was going to show her!

Marshall Murphy dropped in periodically to brief Mike on the results from the forensics labs. It turns out that the section of wire that Mike had returned showed signs of unusual wear, but only in the region of the section that failed. The work on the rocket motors was going slower, as there wasn't a whole lot of evidence to work with in the investigation. Still, concerns had been raised that there shouldn't have been any debris in that region that could take out a Merlin.

Being confined to a bed, when not in the misery of rehab, left Mike with ample time to review the records he'd collected at Archaea Mines. They were certainly going through a lot of equipment, but what was notable was how little of it was coming back to the scrapyards. Sure, small stuff gets smelted in the Solar furnaces and fed into advanced 3-

D printers (replicators, thought Mike, they should just give up and call them replicators), but where was the big stuff going?

He hadn't recalled any piles of equipment lying around, and orbital imagery didn't show anything. He decided to take a closer look at the region. An early survey had noted an unusual age in samples from that region, but the data was buried in the voluminous data product of scientific efforts to date impacts looking for periodicity in the impact record. It wasn't what they were looking for, and so it took a private company digging through the records looking for prospects to prise out that bit of value. And what value it was ñ well over four billion years of SWIEs getting punched into the soil. The company wasn't just mining the gases for use in cislunar space; it was selling samples like crazy to scientists all over Earth.

A knock on the door interrupted Mike's musings. He looked up to see his CO entering the room. "What's up, Marshall?" he asked cheerily.

"Good news, Mike. The nurses say your recovery is proceeding nicely, and you should be out and about in about another month. Something tells me they're enjoying your rehab just a bit too much," Marshall Murphy replied as he tossed a bookchip on Mike's bed with a smile on his face.

"Lust in the Moondust?" asked Mike curiously.

"I guess you could call it fan fiction," noted John. "The placement of scars in, shall we say, less obvious places makes it pretty clear that the hero is modeled on you. We're trying to figure out which particular nurse is behind it, but we won't stop them unless you ask us to do so."

"Hmmm," mused Mike, "perhaps I should read it first!"

"I do recommend it. Or rather, Mrs. Murphy recommends it," replied John. "As does Cynthiana down in analysis, Michelle in communications, Mei Ling in tracking," he continued, "although for some reason Deputy Diane just blushed and quickly excused herself" he left hanging in the air.

"I haven't seen her," replied Mike. "Did she stop by at all?"

"Pretty much every day while you were out," answered his CO, "and she's pretty much been a workaholic since you pulled through it. I had to send her to the Antipodal Array just to get her out of my hair, and they're already begging to send her back."

"I thought I saw her once," said Mike slowly, "although in my delirium I couldn't be sure if I was alive or dead or if it was the spirit of the Moon keeping me from death."

"There might be something to that," replied John.

Another knock came on the door and a nurse poked her head in. "Time for physical therapy, John" she said with a cheery smile.

"Ugh," said Mike, "another day in the torture chamber. Please give my regards to everyone at the office"

"Will do," said Marshall Murphy on his way out, "enjoy the book!"

Medicine had made great leaps on the Moon, in a manner of speaking. The human body only puts as much energy into its upkeep as it needs, and if it's not constantly fighting Earth's gravity it doesn't need as much bone and muscle. So Lunar scientists had focused on keeping its citizens as close to Earth-normal as possible. Early carousels and gyms were replaced by more sophisticated and focused means of stressing bones and muscles, and it was to these machines that Mike had to submit his body if he hoped to return to peak physical condition, at least by Lunar standards.

Today was the motorized traction table, usually referred to as "The Rack." Ostensibly, this one created some kind of accelerated stressing of the bones and muscles to stimulate them, but Mike was convinced that Nurse Ratched was just a sadist and the machine was from her personal collection, an opinion reinforced as she firmly strapped him onto the table and set it into motion. She drew the curtains around the table and left Mike to his misery.

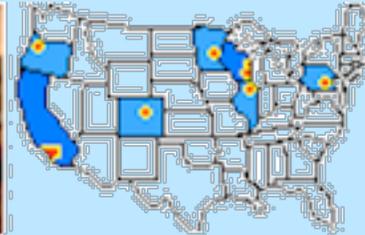
The program was set to a slow acceleration for fifteen minutes, so Mike let his thoughts drift. Shortly, though, he heard a click of a door opening, and soon thereafter he noted a distinct acceleration in the traction cycle, quickly sending spears of agony through his muscles. He struggled viciously against the straps as the increasing vigor of the table threatened to tear him apart!

MISSED PREVIOUS INSTALLMENTS? The whole series is now online, up to the current issue at:

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

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

NSS Chapters that share Moon Miners' Manifesto



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

WISCONSIN



MLRS – Milwaukee Lunar Reclamation Society

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

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

2013 LRS OFFICERS & (•) **BOARD MEMBERS** Contact Information

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

Meeting place changes for some dates: For some dates this year only, our regular meeting place (Mayfair Mall Garden Suites East G110) will be unavailable. So on February 9, March 9, October 12, and November 9 we will meet down the hall in room G150. This is because of a temporary problem, and will not be the case in following years.

It's official! MLRS has reincorporated as a Wisconsin 501c3 non profit organization. Thanks to James Schroeter.

Early notice Special April Meeting; our regular 2nd Sat. meeting date falls on April 13th, the afternoon after the official celebration of Yuri's Night (52nd anniversary of first human in orbit) so we will throw a party to celebrate that night the next afternoon. As Charlotte and Gene will be at an astronomy convention, this may be a small event.

WISCONSIN



SSS – Sheboygan Space Society

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

c/o Will Foerster 920-894-2376 (h) – astrowill@charter.net

SSS Sec. Harald Schenk hschenk@charter.net

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

Meetings are at The Stoelting House, 309 Indian Hill, Kiel WI 53042 - 3rd Thurs even # months

NEXT MEETINGS: FEB 21 - APR 18 - JUN 20 - AUG 15 - OCT 17 - DEC 14 (SAT in Milwaukee)

CALIFORNIA



SSDS – San Diego Space Society

8690 Aero Drive, Suite 115, #77, San Diego, CA 92123 – <http://sandiegospace.org>

Bulletin! After five years operating as a chapter of the National Space Society, the San Diego Space Society is undergoing a reorganization and will be rebooted as **San Diego Space** in early 2013. The endeavor is being undertaken to create the first regional nonprofit space agency for San Diego and southern California.

An all new web site along with a bold new logo is being developed and will be launched soon.

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

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: Lisa Kaspin odyssey_editor@yahoo.com
<http://www.oasis-nss.org/wordpress/> - oasis@oasis-nss.org – Odyssey Newsletter www.oasis-nss.org/articles.html

Incoming Officers: Pres. Lisa Kaspin; VP Gareth Powell; Tres. Karin Ward; Secr. Robert Gounley; Web. Tina Beychok;

Regular Meeting 3 pm 3rd SAT monthly FEB 16 – MAR 16 – APR 20 – MAY 18 – JUN 15 – JUL 20
February 21st Dinner Meeting, celebrating SS Endeavor's new home at the Samuel Oschin Air & Space Center.
 Event at the **Proud Bird Restaurant, LAX**, 11022 Aviation Blvd, Los Angeles, 5:30 pm – 6:30 pm Event
 Check-in, Reception with Cash Bar, 6:30 pm – 7:30 pm Dinner, 7:30 pm – 9:00 pm Presentations.

NEWS: OASIS has added a new term the Space Movement Lexicon: “**Vampire Space Programs**” – various space projects and programs that had once been considered or even budgeted, but then cancelled. **MMM will do its best to popularize the term** so that those new to the space movement will realize all that has already been proposed and considered but has not seen the light of day for reasons either legitimate or illegitimate.

COLORADO



DSS: Denver Space Society fka Front Range L5
1 Cerry Hills Farm Drive, Englewood, CO 80133

Eric Boethin 303-781-0800 eric@boethin.com – Monthly Meetings 6:00 PM on 1st Thursdays
 Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, First Floor Civic Center
 NEXT MEETINGS: MAR 7 – APR 4 – MAY 2 – JUN 6 – JUL ? – AUG 1 – SEP 5 – OCT 3 – NOV 7 – DEC 5

ILLINOIS



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

During a recent teleconference with respect TO speaking opportunities at the Winnetka (North Shore suburban) public library, we settled on the following confirmed dates: June 23, September 15, November 10

MINNESOTA



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

At the MN SFS business meeting on Monday, January 14, 2013 at the Craig Rostal residence we made plans for the Science Fiction conventions this year: **Marscon**, **Minicon** in the Spring, as well as for **CONvergence** this summer, and for our other spring and summer events.

OREGON



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

(LBRT – Oregon Moonbase) moonbase@comcast.net

Meetings 3rd Sat. each month at 2 p.m. - Bourne Plaza, 1441 SE 122nd, Portland, downstairs
Regular Meeting 3 pm 3rd SAT monthly – FEB 16 – MAR 16 – APR 20 – MAY 18 – JUN 15 – JUL 20

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

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>

Meeting Times and Location: Our February meeting is on the 9th (snow date the 16th) at the Liberty One Food Court from one to three p.m. We have not set our March and April meetings, but, April will most likely be at the New Jersey State Museum on April 20. This will be the Super Science Weekend event.

December 15th Meeting Report: Since Earl arrived late to the meeting some reports will be limited:

Dorothy brought news of the Intrepid Museum being closed for the near future due to hurricane Sandy. Repairs are ongoing. The Shuttle was not harmed. She also reported on an upcoming (Marc, 2013) exhibit of space jewelry at The Forbes Museum. This used to have permanent exhibits. The material will be from the Georgian Period (18th century) through today with the Materials used going from the mundane (from Earth) to literally from outer space. To visit this place they say to call on the day of the intended visit to be sure that it will be open. It is in New York at 65 Fifth Avenue. Lots of other neat New York science locations.

Larry discussed our website activity and mentioned solar activity as well. His main report was on getting some new Facebook friends thanks to “friending” Charles Radley. Mr. Radley has a number of friends interested in space exploration, and, they are “friending” us as well! All this because Larry set up our Facebook page! He has also put the image of our business card on our site so that interested parties (and our members who do personal outreach, like Mitch and Hank especially) can download the printable version of the card. And lastly: Larry and Dorothy have put in the groups request for a table at the 2013 Super Science Festival in Trenton! Go Dotty and Larry!

Hank, and a guest, Jim Tigar, discussed the ins and outs of PSFS group and the activities related to the Philcon sci-fi convention and about accounting/finances. Since this was about another group we decided to go on to other topics but Jim did contribute quite a bit on space activities as well as this Philcon related topic.

Dennis Pearson reported that NSS headquarters is asking for someone to distribute press releases in our region. He has asked Mitch Gordon, NSSPASA Vice President, to take the lead on this due to his personal interest in, and activities involving, public relations and outreach. A very good match. Dennis also discussed the Golden Spike Company, which, is working on Moon trips as a private operation! The cost is as impressive as the goal: \$1.4 Billion Dollars. An exclamation point would be redundant. This is from an NSS press release.

Mitch told us of the Gallery public outreach event he, and Wallace, where to do at a prominent center city location, The rail center at Market Street East, which was cancelled due to a hurricane (not Sandy) on the appointed day. He is working with the mass transit agency in our area (SEPTA) to reschedule. It may happen near the end of December (hello shoppers!). And from the Fall Ad Astra: The Road Map to Space Settlement for those who have yet to join NSS. And yet more: Mitch is awaiting word on the Science Festival event (he is our contact) in the spring. The follow on to that event is our outreach, requested by the event coordinators, is our Astronomy Day outreach.

Earl brought material that was tabled until this posted report with one exception: I asked for, and received, volunteer help for judging at the Carver Science Fair(s) in February and March. I also passed out several publications for quick perusal by the group: Discover Magazine had an excellent article on what it took to get the Kepler Mission to happen. It was like the work of Capability Brown, famous English landscape designer, for William Borucki to get his dream into the sky. A very detailed, but not rigorous, interview with him by Andrew Grant, associate editor of the magazine. The piece is in the December issue and starts on page 42. Amateur planet finding is also emphasized and there is other great material in this publication. From Nuts and Volts: in the Tecknowledge section is a short report on Curiosity with this link: mars.nasa.gov/explore/freedrive. With it you can drive in Gale Crater! You must install the Unity web player for this to work (requires a “newer operating system”). Jeff Eckert, who writes this column, also selected a report on the fundamentals of the Universe: Dark Energy Survey Underway at Cerro Tololo Observatory in Chile. And also a quick story on implantable, dissolvable, medical systems. This technology, based on fabrication of sensors and interface electronics, has been discussed in a number of magazines in the last two months. It might allow direct sensing of conditions in the brain, for example, by systems that would be placed in contact with the region to be examined, or, a drug delivery system where the components of the delivery system would dissolve in the body after delivering regulated doses of medications as needed (think space explorers exposed to unexpected doses of radiation or sudden traumas). This topic also appeared in a recent issue of Today's Medical Devices.

And one more techie item: In a special issue devoted to 3D printers (from the publishers of Make Magazine, Winter 2013), appears “Desert Manufacturing” where Markus Kayser has built a 3D printer that uses a large Fresnel lens and some solar panels, and a computer system running C.A.D. and positioning software, to build ob-

jects using Solar Sinstering. He has made bowls and a tile out of desert sand with this equipment. The object to be made is described in a C.A.D. file on an S.D. card. See: markuskayser.com/work/solarsinster.

We had an extended discussion with frequent inputs by Jim Tigar on private space transportation and exploration activities like those that Dr. Peter Diamandis is involved in. -- Submitted by Earl Bennett.

January 19th Meeting Notes: We had a lot of pre meeting talk with Rich Bowers on various topics that included the proposal to put for a one way expedition to Mars! At the time we had few details and speculated on who might go (or be sent to "Australia" as used to happen). The 2023 expedition launch date seems close for such an ambitious project, but if the Russians launch it they will probably have a number of volunteers. We shall see. And space related politics of course.

Larry reported on our web visits, and, the possibility of a guest visiting our meeting from his Facebook Friends. From viewing his website he is a real space enthusiast. Emory Stagmer was invited to our meeting but was unable to attend. His site, which includes videos of his group in Maryland. The site is Untied Music (.com) and looks interesting. Larry also pointed a few other activists that are looking at us thanks to his Friending of Charles Radley. Dotty and Larry also brought confirmation of permission to do outreach at the Super Science event in April.

Since Hank was unavailable at this meeting I will report that Dotty and Larry will go to the Lunacon science fiction event, which has invited Mitch and Earl as guests for the science facts (and futurism and philosophy for Mitch) and associate member Wallace will be going to Boscon for that convention.

Dotty brought material from a number of sources ranging from the films at The Franklin Institute, With Space Junk" at the I-Max being the most recent offering , with "Wildest Weather in the Solar System" at The Fels Planetarium, to the Asteroid and Comet Watch from NASA (that included the news that Apophis will miss us in 2036), and, from the Columbia Journalism Review for Jan./Feb., Cosmos will be redone with Neil De Grasse Tyson performing the role Carl Sagan made famous.

Mitch told us that the paperwork for the Science Festival has been announced and we should get the application for participation. April 20 is the date and we will do both this, and, the Astronomy Day event connected to this event. He brought Edgar Mitchell's book "The Way of the Explorer" on the effect of being in space on your perception of the universe. He also brought: The Futurist for Jan./Feb. with an editorial response he wrote, and " Going Deep" on human space flight beyond Earth orbit (Ad Astra for winter 2012/2013) to L-2 and NEAR asteroids. Private enterprise again, page 22. And Mitch is working on a public outreach event in the Transportation Hub underground near the Gallery.

Janice brought material from Science on Curiosity's' search for live via Methane detection. She explained that methane needs to be renewed in the Martian environment and that biologic process is a leading candidate for the source on Mars. There was also a short report on the ALMA millimeter antenna array becoming fully operational, and her own work on an experimental growth system for vegetables on the I.S.S.!

Dennis Pearson came in late, but, he brought news of the February close approach of an asteroid and some of the recent political events ("fiscal cliff" negotiations) that may affect NASA and other space operations activities. Earl gave quick talks on: "Tractor Beams" for particle sampling with the Martian atmosphere (and a picture of Curiosity") as an example. There were several examples, but, all of which used laser beams in various configurations to move bacterium to dust grain size material to the sample analysis chamber. January issue in Techknewlegy. There were several interesting reports in Medical Design Briefs, from the publishers of NASA Tech Briefs, but this time we go from space to Mission Accomplished. The Mission is transferring tech developed for a space application, in this case for examining x-ray emissions from the Sun, to improving the quality of medical x-rays by reducing scattering effects on the beam that has passed through the patient. This sharpens the details. Page 33 of the January issue. See the publication for this and much more (on line available to qualified individuals). Science for December 29, 2012 has a great number of good reports, including the end of the GRAIL mission to map the Moons gravitational characteristics, and sufficient material to make finding it at the Library or online worth while. Extra solar super Earth, science stories of the year, etc! And: AMSAT has resumed regular publishing! They have done some reorganization and were featuring the ongoing work on the FunCube series of satellites that are currently being readied for launch. Most of the work is being done in England and Scotland, with Clyde Aerospace doing the development and assembly of the satellite, with launch occurring of the complete craft, called The Ukube-1, on or about March 2013 from Baikonur in Kazakhstan. Communication will be on ham radio frequencies and will include a microwave (2401 mhz) down link for high data rate transmissions. This craft is designed to be a technology demonstrator platform. November, December issue.

Finally, for the George Washington Carver Science Fair: Dennis, Earl and Mike Fisher have volunteered as judges for our groups awards in space related science and technology in February and March.

Submitted by Earl Bennett.

Consider joining the National Space Society's Kickstarter Project to create a blockbuster Video
<http://www.kickstarter.com/projects/351762534/our-future-in-space-a-national-space-society-video>

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

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 #262 February 2013

- 1. In Focus: NASA continues to seek Commercial Partners
- 4. The Forgotten Stepping Stone: An Orbiting Depot/Station/Shipyard – Peter Kokh & Dave Dietzler
- 6. Space Industries – Dave Dietzler
- 7. Lunar Materials Production Technologies to Investigate – Dave Dietzler

Moon Society Journal Section

- 9. The Year Ahead – Ken Murphy
- 10. April Outreach Opportunities
- 11. Reasons for chapter people to meet in person
- 12. Chapter & Outpost News
- 13. Browsing Links – Video Links
- 14. 14. Video Links; Fiction: Marshall Mike Moondust and the Sinister Selenian Subterfuge
- 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
- LUNAR RECLAMATION SOC. (NSS-Milwaukee) • \$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 • \$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

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