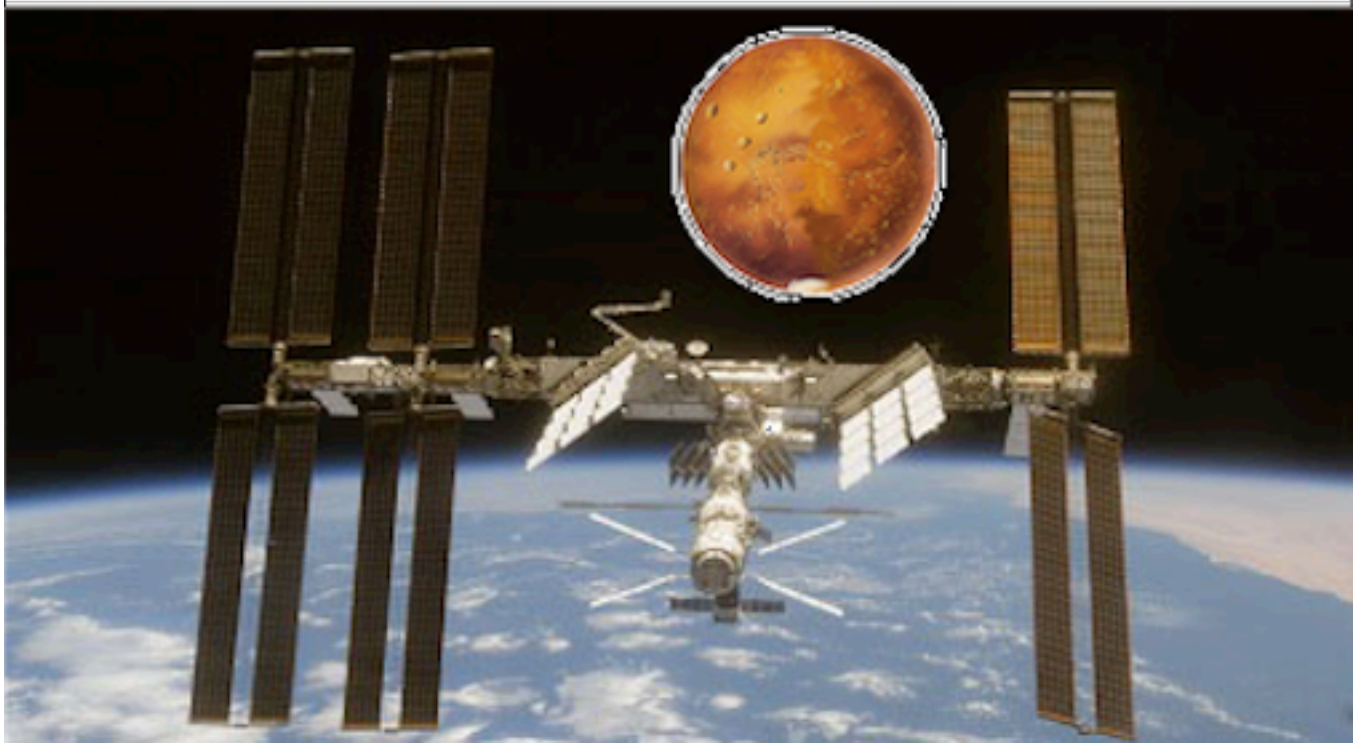
"Towards an Earth-Moon Economy - Developing Off-Planet Resources"

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com



The International Space Station and Mars: How can ISS Simulations Help?

Feature Articles:

2 In Focus: The "Triway" to Space By Peter Kokh and Al Alzandua and Al Alzandua

3 Antarctic Cottage Industries based on "Found" Objects and Materials By Peter Kokh

5 Setting up Shop on the Moon: First Landing Tasks by Dave Dietzler

7 ISS-Mars Simulations - a long way to go By Peter Kokh

Photo: Mt. Erebus volcano, Ross Island, Antarctica

Unmined materials: rock on talus slopes or in river beds, driftwood washed ashore, lose basalt rock on volcano slopes, scrap metal from shipwrecks and elsewhere.

For the small population in Antarctic stations, such sources may be enough out of which to make useful items as well as art work to give an Antarctic flavor to local homes and other spaces, without violating the "no mining" agreement in the Madrid agreement, not up for review until 2041. Such demonstrations could serve as an argument to allow carefully controlled mining operations for local use and trade. pp. 3-4

About Moon Miners' Manifesto

• **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 22 PDF format volumes, for free downloading from this location: **http://www.MoonSociety.org/publications/mmm_classics/**

• **MMM Glossary: new terms, old terms with new meanings:**
http://www.moonsociety.org/publications/m3glossary.html

• **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.

• **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, read **Ad Astra** magazine mailed to **National Space Society** members. There is a daily RSS feed space news section on http://www.moonsociety.org

• **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 - http://www.NSS.org

• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.

• **NSS chapter**s 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 The "Triway" to Space

By Peter Kokh and Al Alzandua (Moon Society Board Candidate)

For several months, Al and I have been working on a paper about destinations for Human Space Exploration. This project started when Al approached me, saying that he was impressed by our Triway Presentation.
http://www.moonsociety.org/presentations/ppt/ or http://www.moonsociety.org/presentations/pdf/

We decided to turn this into a paper for publication and widespread dissemination among the various space enthusiast groups. When we had something with which we were both happy, we presented it for review to David Brandt-Erichsen (former L5 Society leader) and to Moon Society Board member Ben Nault (both of Tucson, where Al also lives) both of whom made some helpful suggestions.

This paper has now been published by Space Review, and has received very positive reviews.

http://www.thespacereview.com/article/2078/1

We intend to seek publication it in as many other publications as possible.

The gist of the article is this: The Moon, Mars, and Asteroids are all important destinations, all three aimed at preservation of Humanity and of our home planet Earth. Rather than focus on rivalry and winning a pointless battle - we need to do all three - we should concentrate on development of the technologies needed in common for all three initiatives. This creates a united front that can convince Congress and the Administration that "we space enthusiasts "do have our act together." Without these technologies, we can do neither of the three. **PK/AA**

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

Postscript to last month's focus on Antarctica

Antarctic Cottage Industries based on "Found" Objects and Materials

By Peter Kokh

"**What is not expressly forbidden, is allowed**." - age old legal maxim

"**Mining**" implies "excavation" of some kind to provide access to minerals or materials below the surface. This includes "strip mining" or removing of a shallow surface layer to reveal mineral or substance (e.g. coal) just below.

What it does not imply is "**collecting**" or "**gathering**" material lying loose on the surface. Collecting meteorites from the surface of Antarctic glaciers is not mining. Neither would be collecting driftwood form other continents tossed up on Antarctic shores by waves and storms. Nor would be salvaging shipwrecks and plane wrecks, or "dumpster diving" the trash piles outside Antarctic stations.

Neither would be collecting crystal rocks lying on the slopes of Mt. Erebus, the continent's only active volcano, on Ross Island overlooking McMurdo Station. It is 3,794 m, 12,447 ft. high.

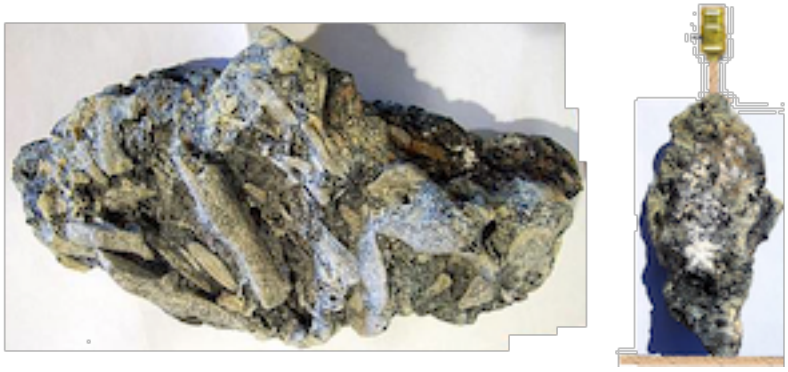
http://skywalker.cochise.edu/wellerr/students/erebus/project.htm

"**Mt. Erebus crystals** are also known as anorthoclase feldspar, a type of feldspar that consists of aluminum silicate. ... Rich in sodium, potassium and silicate, there is only one other place on the planet where these crystals can be found, Mt. Kenya, Africa. Crystals grow in the magma beneath Erebus and get spit out of the mountain inside glassy volcanic bombs. The glass quickly weathers away leaving the mountainside covered in crystals. "While not an extraordinary mineral, these are extraordinarily large." "These crystals are embedded in these bombs and vary in size and shape, but all are of astonishing size for feldspar."

These crystals are coveted by almost everyone at McMurdo Station." Gathering these crystals has obviously been tolerated for some time, beginning with Shakleton's 2009 expedition which found "lumps of lava, large feldspar crystals, from one to three inches in length, and fragments of pumice; both feldspar' and pumice were in many cases coated with sulfur."

What can be made from these crystal bearing rocks?

Nothing sparks the artist's or craftsman's imagination so much as free material. These crystal bearing volcanic "bombs" come in many sizes and shapes. The writer himself is a long time scavenger of found and tossed out objects out of which to make something useful. Among my creations are a number of lamps whose bases are found items with minimum modification.



A cottage industry of lamps made from suitable sized Mt Erebus crystals, along with other items made from these found objects could soon give a uniquely Antarctic "feel" to private and public areas of McMurdo Station - and other stations around the continent. Paperweights, ashtrays, bookends. Even countertops.

Anyone who has ever visited Arizona, New Mexico, and other areas of the US southwest is familiar with the special feel created by SouthWest art from Navaho rugs, to adobe construction, and on and on.

Driftwood

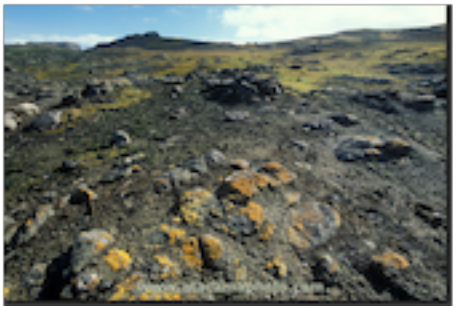
Most Antarctic stations are along the coast and on off-shore islands. Wood harvested by storms from shores of South America, Africa, Australia, etc. may occasionally be washed up on Antarctic shores. Many an artist-craftsman has transformed this free material into something useful, or at least decorative.

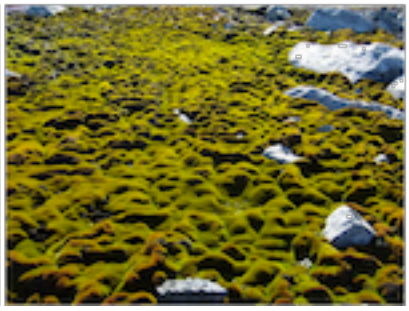
Shipwrecks and Plane wrecks.

Shipwrecks, when accessible can be sources of useful objects and materials. Add the artist/craftsman magic touch and imagination, and the possibilities are too numerous to list. Wrecked aircraft can yield a lot of scrap metal, as well as some intact items (seats? windows? etc.). The re-use possibilities are endless!

Other possibilities: landscaping, gardening, agriculture

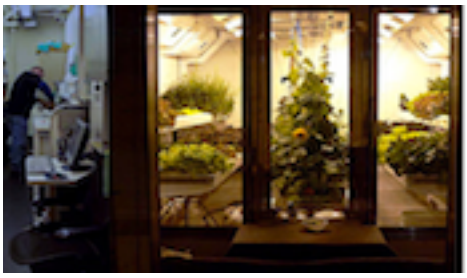
Except along the western shores of the Antarctic Peninsula, there is no plant life in Antarctica. The climate will not support it. What there is, however, moss and lichens, are not to be discounted.





Now imagine a large glassed-in vestibule to an Antarctic Station in which a moderated climate is sustained, warm enough and wet enough to allow a transplanted bed of coastal moss and lichens to thrive, but no warmer, no wetter. It would provide shelter from more severe conditions "outside" and provide a uniquely Antarctic welcome and reassurance. If small planters of moss and/or lichens could survive indoors in private or public areas, such "house plants" might be preferred by some to "exotic" plants from "back home.

At the Amundsen-Scott station at the south pole, there is a much-cherished Food Growth Chamber designed, built, and maintained by the University of Arizona (Tucson) CEAC (Controlled Environment Agriculture Center) - http://ag.arizona.edu/ceac/ - which we have reported on before. The facility has an antechamber in which station personnel can come and relax, surrounded by living plants. Not only does this facility provide fresh salad stuffs daily, but it provides a significant morale boost. Could not similar aptly sized facilities be provided and maintained by entrepreneurs rather than by hired personnel? Outdoors, there is only sterility.




Cottage Industries: from Pastime to Profession

Personnel "allowed" in Antarctica, discounting tourists and visitors, are those hired to assist scientists and researchers and to maintain Antarctic facilities. There would seem to be no place for "entrepreneurs" of any kind. Certainly, there is no place for people who do not earn their right to stay. And clearly, there is no social welfare system on the continent. "Out of work?" - return home, to where you came from!

But it is conceivable that some artist craftsmen could earn the Antarctic equivalent of "full time" income making income and at the same time making it unnecessary to import stock items that their products can supplant. But where would they live? Some stations may have spare space, or unused buildings. If not, maybe if what the artist-craftsman produces is of sufficient value, they could order prefab homes or quarters on mortgage terms. It does not seem likely that even a station as large as McMurdo might someday have an artist-craftsman "suburb" anytime soon. But it would be a start towards a small but growing Antarctic "citizenry."

Fast forward to Moon and Mars: "earning the right to stay"

Might personnel hired for temporary service at an outpost on Moon and Mars, earn his/her right to stay by providing enterpreneurial service of this or any other kind that helps the outpost grow and thrive? This could be how permanent settlement starts. Beyond arts and crafts produced furniture and furnishings that made it unnecessary to import equivalent items from Earth, entrepreneurs could undoubtedly find many other ways to make themselves useful. It may pay to import the tools and supplies they need to keep improving and adding to the services they offer. And if they stay behind, that saves cost of a return home.

The various national space agencies or collaborations of them, may never recruit "settlers." It is then up to those hired to work at Lunar and Martian outposts to earn that right in their spare time.

Could this be how settlement starts? Those with side-talents hired to work at Antarctic stations could pave the way and establish a paradigm for the introduction of a "resident population." All great things can be traced to humble beginnings! **PK**

Setting up Shop on the Moon: First Landing Tasks

By Dave Dietzler

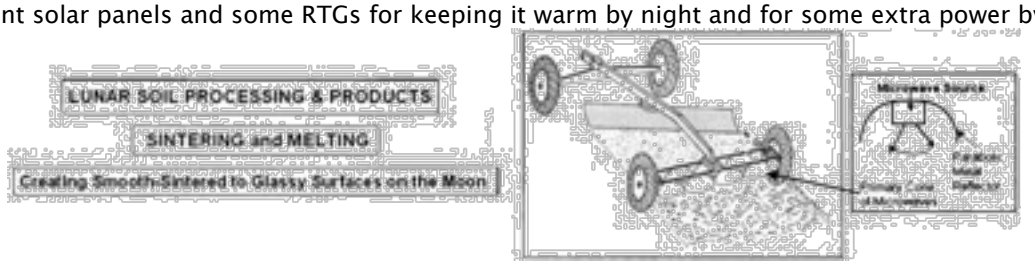
Before Landing

The first lunar base will probably be a small research outpost in the north polar region. Large, mostly self sufficient, industrial settlements will come later. The North polar region is chosen because of its proximity to ice filled craters and the maria of the Moon, particularly Mare Frigoris which connects to most of the nearside maria. As pointed out by Peter Kokh:

- We have to know how pure or mixed the ice or frozen soil is, how hard it is to mine or heat up
- How hard it is to make equipment that will work continuously at these cryo temperatures
- How we get power to the mining equipment
- How we get the water or ice slurry to the surface

For a Polar Base

1. **Land a solar or nuclear or solar augmented nuclear wheeled robot** that can sinter up a landing pad and some roadways with microwaves....by solar augmented nuclear i mean big high efficiency gallium based 30% efficient solar panels and some RTGs for keeping it warm by night and for some extra power by day. (below)



2. **Deploy an inflatable warehouse tent** so we can store items that might be damaged by excess heat and cold like food cargos and sensitive electronix and medicines and even perhaps tanks of liquid gases....while the metal stuff can all go on a sintered pad for a metal yard....
3. **There should be a second robot in case the first robot fails** and both robots should be able to haul cargos from pad to warehouse.... the landers will have wheels on their legs so we can tow them off the landing pad to allow for more landers to come in....
4. **Then we land ice mining robots** that go down into a crater and roast out ice vapors and liquefy them then go store them in used landers' tanks so the bots and landers will need liquid transfer capability.
5. **Then land electrolysis systems to produce hydrogen and oxygen.** It might be preferable to use nuclear steam rockets...for that matter if all the landers are water propellant filled with NTR motors we can start refilling and reusing them instead of sending more landers to the Moon and use them to shuttle back and forth between the north polar site and the L1 station to bring in cargos arriving at L1 by NEP tugs from LEO. Try www.neofuel.com/

   Melting ice, electrolyzing it to hydrogen and oxygen, liquefying H2 and O2 and pumping it will require large amounts of electrical power. It takes a minimum of 65.3wh to split one mole (18grams) of water at 25 C. When burned with oxygen, one mole of H2 releases 79.3wh of energy. The extra 14wh comes from heat absorbed from surroundings during electrolysis. In reality, when comparing the amount of electrical energy input to the amount of energy available from the hydrogen output, commercial electrolysis is only 50% to 80% efficient. So we are talking 99.1wh to 158.6wh to split one mole of water and produce one mole of H2 and a half mole of O2. Let's assume that lunar electrolysis systems are 80% efficient. We will need 99.1 kilowatts to split 18kg. of water every hour. That's not a very high production rate if we want to use polar ice for rocket propellant. Let's say we have 991 kWe worth of solar panels. Then we could split 180 kg. of water every hour and produce 18 tons of hydrogen and oxygen, enough for a small lander, in 100 hours. We'd need about 5 metric tons of solar panels rated at 200 w/kg to split this much water every hour during full dayspan insolation of the panels. This does not include the energy required to melt the ice, pump the water, compress and liquefy the H2 and O2, then pump the LH2 and LOX into a lander. It takes about a third as much energy as a given mass of hydrogen contains to liquefy it. We might be able to take advantage of the super cold conditions in shadowed craters or use shielded space radiators to liquefy hydrogen and oxygen without as great a cost in energy. We will need many tons of solar panels. The thing to do would be to produce solar panels on the Moon, therefore:
6. **Land the necessary chemicals and equipment for producing solar panels** f from lunar silicon, aluminum, phosphorus and glass. Dr. Geoffrey Landiss has written about doing this using a fluorine based process that could produce 1 MWe worth of solar panels yearly. See:
   http://www.asi.org/adb/02/08/solar-cell-production.html and
   http://www.asi.org/adb/02/13/02/silicon-production.html

Dr. Peter Schubert has proposed a system that does not require imported chemicals but uses extreme heat and electromagnetic separation, similar in principle to mass spectrometery, to produce solar panels. **The devices are composed of some exotic materials not available on the Moon so it will not be possible to replicate them there but they are lightweight and highly productive.** His 6 ton system could produce 64 metric tons of doped silicon per year given sunlight 70% of the time at a near polar location along with other elements needed to make solar panels including Al, P and glass for anti-reflection coating. The system uses 139 kWe and could produce 15.9 MWe worth of solar panels yearly with silicon at a thickness of 350 microns, 15% efficiency and 1350 watts solar insolation [1]. This is excellent leverage. If we landed 60 tons of his machines we could produce 159 MWe worth of solar panels in a year and 1.59 GWe in ten years, not considering degradation by radiation in space. This would certainly be sufficient for an industrial settlement.

Power requirements for a small manned base will be several hundred kilowatts at least. With SLA solar panels of 200 w/kg we will need a metric ton to generate 200 kilowatts. These are only rough figures to give you an impression of what we are up against. If we are to extract large amounts of metals we will need many megawatts of power. **The first small robotic/manned base will probably stick with water and solar panel production for a number of years before tackling bigger jobs.**

It seems we need some nuclear power in space for:

- NEP for transfer from LEO to L1 since solar panels will be degraded by passage thru the VABs
- A small nuclear power plant for night span power would probably amass lesss than the necessary mass of solar panels and batteries, flywheels, or fuel cells to get through the nightspan and the reactor would supply waste heat as well as electricity to keep things from freezing up
- Nuclear powered ice mining robots that can withstand the supercold by staying warm with waste heat from onboard nuclear power sources
- RTGs on robots that must get thru the nightspan over and over again for years on end
- Landers or "Moon Shuttles" with NTR that can fuel up on water and transfer cargos from L1 to the lunar surface
- Many people talk about lunar U and Th but even in the KREEP there is only 4 ppm U and 10 ppm Th though some deposits may have 50 ppm Th and that just isn't much... it will take a lot of development before we can tap lunar nuclear fuels...Launching nuclear power sources, even small ones, into LEO might create a political outcry. Perhaps we can avoid this by containing nuclear power sources in re-entry safe casks and sea launching out in the Pacific Ocean.

For a Mare/Highland Coastal Base

Steps 1, 2, 3 and 6 are repeated. We won't be mining ice but we will want to go after solar wind implanted volatiles, meteoric iron fines and other resources. The Mark 3 helium 3 miner proposed by researchers at the University of Wisconsin would use 12.3 MW of concentrated solar energy to heat regolith [2]. This might be done better with electricity and microwaves. We will need to produce plenty of solar panels.

Until we have many megawatts of power we won't be doing much materials processing. The volatiles miners will use large amounts of power, tens of megawatts, and the iron fines miners less. We will want vehicles that can transport ice derived water from the polar base to the (highland/maria) coastal base so we will choose a location like the northern coast of Mare Frigoris that isn't too far away.

Basing on a coast will allow access to basalt, iron, magnesium, titanium rich mare regolith, although Frigoris contains only low titanium regolith. Highland regolith will provide cement, glass, aluminum and calcium and both kinds of regolith will supply oxygen and silicon. Smooth mare plains will be easier to mine than rough highland terrain. Vehicles conveying water could supply propellant for landers, but this will depend on actual production rates.

Energy for Metal Production

We could use aluminum and LUNOX burning rockets but Al production by direct electrolysis of anorthite or acid leaching and electrolysis will consume huge amounts of power on the order of tens of kilowatt hours per kilogram of aluminum. The Hall-Heroult process uses about 13MWh to 16MWh to produce a ton of aluminum but the processes we use will be less efficient since there is no bauxite, large amounts of carbon or cryolite on the Moon. Based on a proposed system that uses acid leaching of anorthite, carbochlorination and electrolysis, we will need at least 18.4 MWh per ton [3]. Direct solar carbothermal reduction of alumina requires at least 9MWh of energy per ton of aluminum and would use only reagents available on the Moon and solar furnaces but this also requires very high temperatures like 2100 to 2300 C. [4].

Carbon would have to be recycled and this would use more energy. Much research is going on in the field of solar carbothermal aluminum production for Earth and if perfected this method might be applied on the Moon. Another possibility is the use of the FFC Cambridge process to reduce anorthite to aluminum, silicon and calcium [5]. Silicothermic reduction to produce magnesium requires even more power; on the order of 35 to 40 MWhrs per ton of Mg using the Pidgeon process but the Magnatherm process is more efficient. Only reagents available on the Moon would be needed to produce magnesium and mare regolith is loaded with magnesium bearing minerals but the energy requirements will be challenging. Magma electrolysis to produce oxygen, ferrosilicon and ceramic will

consume about 13 MWhrs for every ton of oxygen generated along with over a ton of FeSi and a few tons of ceramic from about five tons of regolith [6]. We'd need 600 kWe to produce this by magma electrolysis every 24 hours. So here again we are limited by energy and we must produce solar panels on the Moon. By comparison, it takes about 5.5MWh to split a ton of water at 80% efficiency for the electrolysis.

The Bottom Line

Energy. The first major goal of a lunar research base will be solar panel production.. Until an International Lunar Research Park proves that solar panels can be made on the Moon in large quantities, say hundreds of tons yearly to supply many megawatts even gigawatts of power, bootstrapping industry on the Moon will be a paused. As for producing enough aluminum, magnesium and titanium for large solar power satellite reflectors that concentrate solar energy on upported high efficiency solar panels that job will probably be done in space where energy is available 24/7. We will still need hundreds of megawatts of power to launch regolith payloads via mag-lev track into space. This will require thousands of tons of solar panels!!!

Footnotes:

1) Solar Panels from Lunar Regolith Peter J. Schubert, Ph.D., P.E.
Packer Engineering, Inc., Naperville, IL 60563

2) A Lunar Volatiles Miner. Matthew Gajda et. al. 2006.
http://www.nasa-academy.org/soffen/travelgrant/gadja.pdf

3) Colonies in Space. T.A. Heppenheimer. Chp. 7. 1977.

http://www.nss.org/settlement/ColoniesInSpace/index.html

4) Aluminum Production Paths in the New Millenium. Barry J. Welch.
http://www.tms.org/pubs/journals/JOM/9905/Welch-9905.html

5) **The Electrochemical Production of Oxygen and Metal via the FFC-Cambridge Process.**

K. C. Tripuraneni Kilby1a, L. Centeno1, G. Doughty2, S. Mucklejohn2, and D. J. Fray1b

http://www.lpi.usra.edu/meetings/roundtable2006/pdf/tripuraneni.pdf

6) Oxygen from Lunar Soil by Molten Silicate Electrolysis. Russel O. Colson and Larry A. Haskin
http://www.nss.org/settlement/nasa/spaceresvol3/oflsmse1c.htm

DD

ISS-Mars Simulations - a long way to go

By Peter Kokh

Foreword

ExploreMars.org and the **National Space Society** have together sponsored two "ISS-Mars" Conferences: in Washington, DC in 2011 and at International Space University in Strassburg, France, this year. We have applauded these efforts to find, illuminate, and develop ways in which ISS can be used to prepare for human ventures to Mars.

We wish to chip in some constructive suggestions, on

1. **how ISS, as currently constructed and staffed, can help,** and
2. **how we could do much more with some key additions to the station.**

But we also want to point out that key failures of the ISS program to advance in the directions space enthusiasts had expected from the outset, cripple the station's ability to support development of technologies and systems needed for Mars.

Mars cannot be explored, much less settled, at the end of an "umbilical cord"

Currently, ISS is periodically restocked with food and other supplies, by Russian, European and Japanese unmanned cargo ships, as well as (until recently) by the Space Shuttle. On a 6 month trip to Mars, there will be no freighters sent to catch up with the Mars-bound craft, for resupplying needs of any kind. Indeed, the Mars craft must carry all the supplies needed for the trip to Mars, for the months long stay on Mars, and for the long trip back. There is no way we can simulate this on ISS which exists on the end of an umbilical cord of freighter shipments. Why? The reason is simple. Orbital mechanics opens a launch window, about a month wide, every 25+ months. The further outside this window we need to launch to Mars, the more prohibitive the "Delta V" fuel expenditures would be needed for both acceleration out of Earth orbit and deceleration into Mars orbit.

If we are serious about using ISS as prep for Mars, we have to make the station more autonomous, able to subsist without resupply for year plus long periods - it must do a better job of recycling water, including black water, and raising its own food. The test of "a better job" is a simple one: the ability to reduce the need for resupply ships dramatically. How dramatically? **Ideally**, ISS (or the portion of it involved in the simulated Mars mission, should have a large locker-larder that can be filled every 2 years with no resupply in the interim, even if crews are replaced.

ISS should also have an attached 3/8th G Mars Crew Habitat facility and maybe a Lunar 1/6th G one as well (both can easily enough be designed as one facility as a barbell with facilities at different distances from the center of rotation.) to be able to mimic the conditions crews will find on Mars (and the Moon) and to learn in advance what effects lower "partial" or "fractional" gravities will have on their physiologies and abilities to function efficiently long term. Some assume in a totally illogical jump in reasoning that if humans cannot operate indefinitely in zero-G, then nothing else than full Earth gravity will do.

We need to dump that non sequitur for real long duration tests at Mars-level and Moon-level gravities. It is more likely that in each cases, any loss of physiological fitness will level off at an acceptable plateau. We absolutely must do these tests. We cannot just wait and see what happens to our Mars explorers during their many months on Mars. The reason is simple. If they make the trip without gravity, they will arrive weak and unfit for duty. **We need them to hit the ground running.** This time on Mars is too precious and expensive to waste it recuperating. Arguing about this is senseless. It is a slam dunk conclusion that we must provide Mars-level gravity en route to Mars.

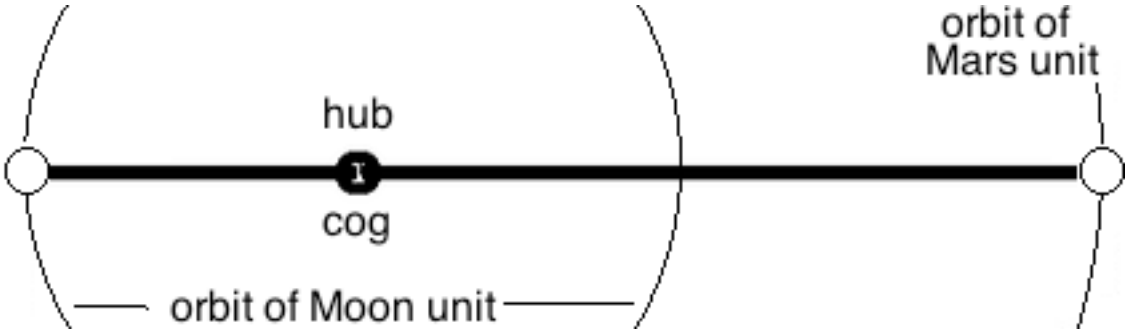
Back to the early 1980s

When President Ronald Reagan finally agreed with space enthusiasts that we needed to build a space station, there was premature rejoicing. But the battle was long and by the time Clinton finally convinced Congress that building a space station "together" was the best way to keep former Soviet scientists out of mischief, the station became something quite other than what we had wanted. It would not be a way station depot to "outer space" but a perch over "space down here" to learn more about Earth.

It would not be the rotating torus of Space Odyssey 2001. No artificial gravity. Nor would NASA try to make it independent of supplies of oxygen, water, and food. Some token "biospheric" experiments, but that was it.

Fast Forward to tomorrow: ISS as a Mars Ship analog

To wait until the first manned trip to Mars to "test" biospheric self-sufficiency good enough to run without resupply for 2+ years, would be rather foolish and involve a high level of risk and disaster. There is no escaping that ISS must be upgraded drastically, both to operate many months without resupply (except for scientific instruments needed for ongoing experiments) but also to simulate "fractional gravity" levels. If there are other ways to build the high degree of confidence we need before sending a Mars crew on a journey that once launched, cannot be cancelled or called back, we need to test the needed capacities and equipment at ISS where rescue is possible.



To provide both 1/6th Lunar gravity and 3/8 Mars gravity, radius of Lunar arm to Mars arm is 1<>2.25 or 4<>9. Both Units have same cross section but Moon Unit would be 9<>4 longer than the Mars unit perpendicular to orbit

This will cost money. A lot of money. But we need to much or most of this for manned trips to the asteroids. As to the Moon, where resupply and frequent changeout of crews is easily managed, it would still help in planning if we knew ahead of time how long human physiology can stay at an acceptable level at lunar level 1/6th gravity, and how long lunar outposts can survive without resupply in case war or other catastrophe should interrupt the umbilical cord resupply arrangement.

As to radiation protection, the journey to the Moon is short enough, and advance warning of solar storms long enough, that this is not a problem for travelers, though we must provide it on the Moon itself - not a problem. For crews bound for Mars, even in quiet sun years, cosmic radiation is a big problem, and we must provide protection. We are hoping that instruments to monitor radiation levels en route to Mars aboard Curiosity will give us superior data about the kind and strength of the radiation to be expected. But does ISS have to model that protection? We don't see any justification for it, as ISS is not at risk itself.

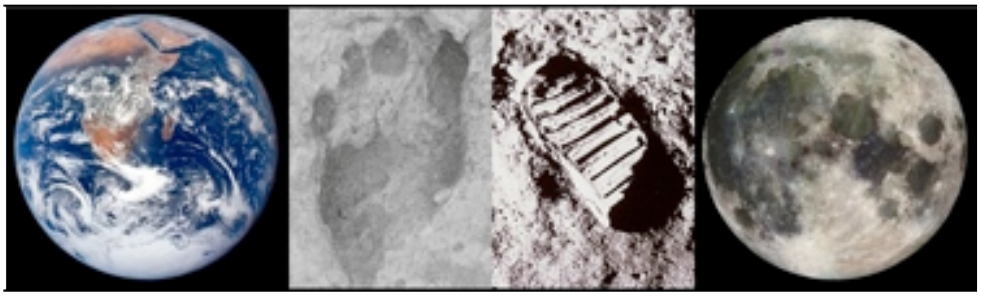
Modeling Activities en route to Mars

In the recent ESA-Russian Mars 500 simulation, we believe not enough attention and forethought was given to how to keep the crew sufficiently and productively - active for the duration of the portion of the time "en route" to Mars and "en route" back to Earth. Some twenty-two plus years ago, in Moon Miners' Manifesto #30, November, 1989, I wrote an article I predicted some of the problems that came up in Mars 500.

"**WANTED: Split Personality Types for a Mars Expedition**" Reprinted in MMM_India Quarterly #14, pp. 25-26. http://www.moonsociety.org/india/mmm-india/m3india14_April2012.pdf - a free access download **PK**

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

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



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

The Moon Society Journal Section (pages 9-12)

About the Moon Society

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

- **Creation** of a spacefaring civilization, with communities on the Moon, 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

Introducing our newest Board Member, Al Anzaldua

Last October, at the invitation of the Moon Society Management Committee, Al Anzaldua of Tucson, Arizona, began attending our **bimonthly** meetings and participates (without the right to vote) in our deliberations with the view to his eventually becoming a Board Member. Al did not have a full year of membership, but that requirement is now fulfilled.

At the May 16, 2012 meeting, the Board unanimously appointed Al to the seat recently vacated by Ron Brooks. Ron has written some outstanding in depth articles for MMM, on lunar "Mascons" and on "Regolith" (moondust), but had accepted a new teaching assignment that made it impossible for him to continue meeting with us.

Although Al has been with the Moon Society for only a year, he has been a long time space advocate. He joined the L5 Society in the mid-1980s, shortly before the organization merged with the National Space Institute to become the National Space Society (NSS) at the 1987 ISDC in Pittsburgh. In 1990 – 91, he served as president of Tucson L5 Space Society (TSS), a chapter of NSS. During that time he also hosted a community-access cable show on space development. In March 1993 he entered the U.S. Department of State's Foreign Service, where he worked overseas and in the U.S. as a Science and Environment Officer. Three years ago Al retired from the Department of

State and almost immediately became involved with space advocacy in Tucson, organizing six or more space exhibitions a year and giving space presentations before school groups or adults every few weeks. he is presently serving his second consecutive year as president of the TSS.

Al is motivated by the new private space companies that have reenergized the space community, and he sees an opportunity to harness some of this energy to advocate for more effective space advocacy. He believes that developing the cis-lunar econosphere is key to sustainable Mars settlement and even the effective utilization of asteroids. As a Board Director, he intends to push for 1) more collaboration among various space-advocacy groups, 2) more engagement with private-sector space development, and 3) a campaign to bring younger people into the space-advocacy movement.

Al will be eligible to run for a full 2-year term in the 2013 elections. **MSJ**

Revised Moon Society Elections Ballot

In the May issue, the portion of the ballot that deals with Officers is unchanged

Ken Murphy, who last year ran to fill the remaining year of the **President**'s term vacated by retiring Peter Kokh, this year is running for a full term. His Candidate Statement appeared in the May issue.

Peter Kokh, who had retired as President ran for the remaining year of the term for **Secretary,** which had been vacant. This year he is running for a full term. His Candidate Statement appeared in the May issue.

The ballot for the open positions on the Board of Directors has changed.

We did not have enough candidates to fill the two full term slots open. Thus the Ballot was incomplete. Ken Murphy appealed for "younger members who had a desire to help direct the future of the Society." Two members submitted their Candidate Statements. All Director Candidate Statements are printed (or reprinted, as the case may be, below.

The Amended 2012 Ballot for Officers and Board of Directors Positions:

OFFICERS VOTE

President (Vote for one) for 2-year term ending in 2014

[ ] Kenneth J. Murphy #1272 (member since May 4, 2003)

[ ] write in candidate _____

Secretary (Vote for one) for 2-year term ending in 2014

[ ] Peter Kokh #239 (member since June 26, 1995)

[ ] write in candidate _____

BOARD OF DIRECTORS VOTE: Two openings, three candidates – VOTE FOR 2

[ ] Ben Nault #1365 (member since April 1 2005)

[ ] Alan Steinberg #1531 (member since December 5, 2008)

[ ] Phillip Crume #1623 (member since May 13, 2011)

Voter's Signature_____

Your Membership # (if known) _____

BOARD OF DIRECTORS CANDIDATE STATEMENTS

For Director, 2 year term ending in 2014: Benoit Nault #1365

I have been fascinated by the Moon ever since I first looked at it with my small telescope as a 7-year old. A short few years later, men orbited the Moon and then walked on it. I remember skipping school to watch the moonwalks. A new frontier was opening and I wanted to be part of the adventure.

Many of us share that same experience. The adventure has turned out to be a long, mostly fruitless, walk in the wilderness. But the goals of creating a space-faring civilization and of settling the Moon make as much sense today as they did all those decades ago. In fact, they probably make even more sense today than 40 years ago. Science tells us that the Moon probably holds key answers to the creation of the solar system and of Earth itself. Advances in technology make lunar resources available to us to help mankind move out into the solar system and quite possibly make life on Earth better in many ways. It is time to go back to the Moon to stay and the Moon Society intends to be part of the adventure.

I have been a "space activist" for more than 27 years. More recently (since 1991), I have been involved in National Space Society chapter activities. I have had the privilege of holding various positions in the Tucson L5 Space Society including four consecutive terms as chapter president (my last term ended in November 2007). I was

also webmaster (and web developer) for the ISDC2000 website which included the very first online registration and payment form for an ISDC.

Professionally, I am a consultant in e-business and e-commerce technologies for medium sized companies. In that capacity, I manage fairly large projects with substantial budgets and work with teams that can range up to 20 people.

As the United States revamps NASA's priorities, the Moon Society is uniquely poised to continue to build on the interest in the Moon that remains. But we must plan our initiatives carefully.

I do not think I have the answers to all challenges facing us. And the challenges are substantial. All space activist groups face a declining and graying membership. I believe that attracting and retaining new and younger members is our number one challenge. Societal change is accelerated by technologies that are changing the world around us at a rate unseen in many generations, perhaps in human history. New ways of thinking and of doing things are appearing quicker than they can be inventoried. The Moon Society must find way to keep up and communicate in modern, relevant, ways.

In real world terms, the Moon Society must continue to work on a strategic plan to favor growth and a higher public profile. We should also put in place tools and instruments to help individual members and chapters with their projects and outreach efforts. I wish I had easy answers but I do not. But I would like to contribute to the debate. Your support is much appreciated. ###

For Director, 2 year term ending in 2014: Alan Steinberg # 1531

My interest in space began at a young age, and like the generation before me I was inspired by the Apollo Program. However, it was not the moon landing that did it for me, as I would not be born for another 13 years, but rather a Saturn V rocket that just laid on its side at Johnson Space Center. My dad took me to JSC many times during my childhood, the late 80s and early 90s... and from those experiences I grew to love the idea of space and space exploration, and this passion pushed me to strive academically and guided my educational pursuits.

Today I still have those feelings, but they have been coupled with new ones. Rather than just be awed at space, I see the value of its ability to inspire. I see my space mission not as an explorer or a scientists, but instead as a historian or cheerleader, engaging the public in order for them to be similarly inspired as I was, and from that, push to new heights to succeed. The moon society represents just such an inspired concept, though promoting large-scale human exploration, research, and settlement of the Earth's nearest neighbor. I do not expect to be the person who does all of these things, but rather a person who helps encourage others to do so by providing the needed resources and inspiration.

I feel that as a member of the board of the Moon Society I can help guide the organization along its mission, using the experience I have built up being a part of Yuri's Night's Global Executive Team and volunteering on the ground with YN events as well as the leadership and organizational experience I have gained serving for the last five years with the Space Generation Advisory Council, first at the National Point of Contact for the US, and currently as the Regional Coordinator for North America. However, more than any resume line I may offer, my real ability to help comes from a passion to see the organization succeed.

For Director, 2 year term ending in 2014: Phillip Crume # 1623

As for why I believe I am qualified to be on the BoD:

I have given talks on lunar development at the Mars Society Conference in 2006 and at ISDC in 2010,
I am a former chairman of my local Sierra Club group (5,000 members),
I was a member of the executive committee for the SC Ohio Chapter (20,000 members),
I have served in the SC as communication, membership, and political committees chairman,
I have received political organizing training through Wellstone Action (affiliated with MoveOn.org),
I have received board management and fundraising training at the Cleveland Foundation Center,
I've been developing expertise in international finance, economics, and space policy, and
I would like to eventually start a mutual fund or hedge fund related to the space industry.

In the interest of full disclosure, I founded two space-related nonprofits, the Solari Society and Solari Institute, which takes a perspective that encompasses both planetary and orbital development and colonization. Each organization would focus on respectively on popular and technical audiences. If you were to merge the NSS, Moon Society, and Mars Society, you'd get my approach which is focused on pragmatic scalable solutions centered around economic sustainability. I have a few ideas that could help renew public interest in space and increase membership.

This year, for the first time since 2006, we have a contest! Three Candidates for Two Openings. We encourage all current members to participate in this election so that the future of the Society is best promoted.

TO VOTE, copy the ballot, fill it out, and **email to elections@moonsociety.org or mail it to Moon Society Elections, PO Box 940825, Plano, TX 75094-0825 ---------- BALLOTS WILL BE COUNTED AUGUST 1st**

From the desk of Moon Society President Ken Murphy

Moon Track at ISDC 2012 Washington DC – "Unmitigated Success!"

Sunday, May 28, was The Moon Society's time to shine. Our track was scheduled against the Student Track (presentations from the ISSDC), the Transhumanism & Space Exploration track, the Living in Space track organized by the Kepler Space Institute, and General Presentations in the big room. And the lunch went long. Nevertheless, your Moon Society president started promptly at 2pm to a full house. His presentation on an overview of cislunar space was well-received, and set the stage for the following presentations. John Cserep then gave an overview of an Earth-Moon L1 facility that could be used to control telerobotic mining operations on the Moon, in addition to serving other customers.

This led nicely into Jim Keravala's talk on Shackleton Energy's plans to mine at the Lunar poles to provide propellant to cislunar space. Dr. Carl Brandon from VT Tech then described their project to land a CubeSat on the Moon. (continued next page)

We then had our first student presentation. As background, the National Space Society and NASA Ames run an annual International Space Settlement Design Competition that draws entries from around the world. When the track chairs were putting together their tracks, they received a request from Lynne Zielinski of NSS leadership to make some time available in our tracks for the students to give presentations. It's excellent experience for them, and so The Moon Society immediately agreed to 3 presentations (30 minutes) to incorporate into our four hour track, with the proviso that they all had to be located in cislunar space.

Our first was from Tanmay Band, who presented for Team Aris from India. Their proposal is for an L5 facility with a scalable structure, allowing for the eventual housing of hundreds of thousands of individuals. Paul Graham then described OpenLuna's work on communications and surface transport hardware. The Moon Society has long had a good relationship with OpenLuna as our efforts are very complementary, and Paul allowed us to share space on his display table in the exhibit hall. He's got a great exhibit, but the genuine fake Moon rocks that were on display from TMS helped draw people to the table to be engaged in Moon talk. We also showed off some nice selenospheres, including the new Sky & Telescope Moon globe that uses LRO imagery for the most up-to-date globe around.

The second student presentation was from Team Plenidus, also from India. Ashish Chadda, Rajat Kalia, and Deigant Yadava had scripted their presentation to an movie, essentially a moving ppt, and so were able to keep right to ten minutes. I can say they had some nice villas in their design. Next up was John Strickland, from NSS Austin and a long term leader in NSS, who gave an overview of transportation considerations for cislunar space. One of the key takeaways is that with depots in LEO, at EML1, and on the Moon, you don't need more than 4 km/s of delta-V to either get to the next gas station, or go to/from any destination of interest in cislunar space. This is a helpful thumbnail for designing transportation systems.

The last student presentation was from Team Concordia from Romania. The most notable part of their presentation was their proposal for retrieving asteroid materials, wherein they would use what I dubbed a Space Squid. A module latches onto an asteroidal body and then deploys long arms that wrap around the asteroid. Each arm is laden with thrusters, which are then used to direct the asteroid to where they want it. I suggested they go talk to the Planetary Resources folks.

Our last speaker for the day was Dr. David Smith from the GRAIL mission, who gave an overview of the mission, and shared some of the early results they're seeing. One notable result is that it looks like the data might be able to unveil lavatubes, especially in conjunction with some of the data from LRO. This was the perfect lead-in to our topic for The Moon Society's theme for their track at next year's ISDC: Lunar Lava Tubes.

Attendance was good throughout the day, even with very compelling presentations in other tracks. We were able to hold very closely to the schedule, and our content nicely interwove to make a compelling case that cislunar development is important, and entirely doable given where we are technologically.

As a Thank You to each of the speakers, TMS leadership suggested a lapel pin and one-year membership in TMS for each of the speakers, so we just got a small boost in membership. Hopefully we've also helped to establish some more credibility for our organization as a Moon advocacy entity. Special kudos go out to our at-large Ambassador of Goodwill, Dave Dunlop, who is already busy networking for our track at next year's ISDC. **KM**

ED: The theme for next year's Moon Track at ISDC 2013 San Diego is **Lavatubes**- as lavatubes have also been confirmed on Mars, we hope to have Mars Society collaboration on this track.

March Chapters & Outposts 2012

Chapters & Outposts Map (North America) - www.moonsociety.org/chapters/chapter_outpost_map.html

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
Rockford, IL Outpost - Contact: Bryce Johnson – lesausl@sbcglobal.net
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
Welcome the TUCSON OUTPOST meeting with Tucson Space Society (NSS) – www.tucsonspacesociety.org

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 – JUN 20 – JUL 18 – AUG 15**

May Meeting Report: The St. Louis Chapter of the Moon Society, due to a scheduling problem with the library, held their May meeting on Tuesday, the 15th at the Buder Branch Library with Mark Rode, Dave Dietzler, Karl Starssman, and Tom Kullman attending. By 7:30, having only four members in the conference room, we moved the meeting to the more comfortable patio, with refreshments, of the St. Louis Bread Co. A few of the topics covered were:

1) How someone should do a write-up on the history of science fiction as it relates to some of the fundamental ideas that actually developed in real life. There was some dissent as to whether the cell phone and the internet were predicted by some of the more famous writers in the 50s and 60s, like Asimov. We debated on what was the first Sci-Fi story – perhaps it was it the legend of Icarus and Deadelus (the persons who first wanted to fly with the birds and made wings of feathers and wax.) Was Jules Verne, author of "From the Earth to the Moon" the father of modern ("hard science") Science Fiction novels?

2) Conditions for sighting of the ISS (the few times I've seen it, it came from the NW and moved to the SE. Can it have a different orientation?) (addendum by Bob: short answer, yes; for a longer answer, see http://www.moonsociety.org/chapters/stlouis/MoonMadness2010.htm and, a few lines from the bottom, check "favorable ISS flyovers for several days following MMN 2010")

3) Since we were outside and Venus was very bright in the evening sky, Tom launched his cellphone app. on star position that displayed the night sky in any direction, orienting with GPS. The app. doesn't work for planets, too complicated to program, but not impossible, we concluded.

4) Karl's Question : "What would happen on the Earth if the Moon didn't exist?î – Possible answers: (Well, the tides wouldn't exist Dave, well there would only be the solar component; The Earth would spin faster on its axis- Tom; Night life as we know it would be disrupted – General conclusion from all of us. Not so simple a question – insect life, predator and prey relationship would be disrupted. Creatures that depend on night vision from the Moon would find themselves depending on just starlight. Circadian rhythms of all life would be possibly irreparably damaged. Could the creatures of the Earth ever evolve to adapt?

5) What if all electronics / electricity were to be suspended on earth – who would keep order? How? Note that our Founding Fathers in the Continental Army defended freedom with no electricity.

6) How Galactic Clouds consisting of H and He form into higher atoms ñ by gravitational and static (coulombic forces) and stick together to form stars and planets. The microcosm forming into the macrocosm of the Universe evolution debated as to Strong and Weak force interactions.

7) Results of a visit by a really massive, extra solar or a long orbiting body from deep space (7,000 Au ?) as compared to Pluto (73 Au ?) passing near the sun, and disrupting all orbits in the solar system, especially, Earth's.

8) Possibility of water trapped really deep in the Earth's crust. as one continental plate is subducted uner another – Dave. I stated that temperature really goes up at great depths – 2 mi deep Earth mines can reach 140 °F.

9) Possibility of lunar lava tubes containing deep pockets of gas.

10) Reasons for reversal of magnetic poles on the earth in a relative short geological time span. History of Magnetic Poles on Moon and Earth.

11) Mercury is a Really a dense planet with a disproportionately large Ni and Fe core. It has nearly the same gravity as Mars with only 2/3rds its radius.

12) The planet Venus named as either the Morning or Evening Star depending on time of year.

13) Earth/Thea debates, the "big splat" theory of the Moon's formation. – notes by **Karl Starssman**

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 – JUN 16 – JUL 21 – AUG 18**

At our Saturday, May 19th meeting, 6 members present, 4 regular and 2 affiliate members. We discussed new projects to add to the Chapters program, but were unable to decide on an new ones at this time.

Ways to improve our meetings were called for prior to the meeting, but only one suggestion was emailed in in time. But the member making the suggestion was not at the meeting to elaborate on his suggestion. As a result at this time we have no definitive suggestions for improvements.

Of our older projects, we will be contacting the Challenger Center in Peoria, AZ to setup a demonstration of the "Lunar Rover" Challenge and the "Pneumatic Rocket" launching venue for including them as a part of their activities. We will also include them as part of our presentation at CopperCon32 , Labor Day Week End and again next year at LepreCon39. Again, this will be a youth participation event in each case.

The Tour of the "Space Plane" facility was not finalized for two reasons, 1) Mr Jarvis has been out of town on business, and 2) not enough of our membership was present to to set a group of dates and times to shoot at for the tour.

Beginning with the June meeting the voting members present elected to move our meeting hours from 3:00 – 5:00 pm to 6:00 – 8:00 pm. This will reduce the Solar stress on everybody to get around and help one of our members better attend the meetings and make a schedule their own time for Saturdays.Meetings remain at Denny's at US 60 and Rural Road, SE corner. -- **Craig D. Porter**

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: **July 9, September 10, November 12**

Report on May 14th Meeting: among the topics of discussion were:

Chapter Web Site There is strong support for us obtaining our own website address. Our website hosted by Marianne Dyson on her personal web space gets little to no traffic, and our old website under the Moon Society's domain gets little more. I can provide the web hosting under my own personal account for Streamliner Schedules, but we want to come up with our own unique web address for the Houston Chapter. Your suggestions are solicited. Suggestions so far:houstonmoondust.org, houstonstarroad.org, highfrontierhouston.org

Requirements: Any name must not be already taken in the InterNIC WhoIs database. Ideally, the domain name will be available in the .com, .net, and .org top level domains. The name should have some obvious relation to space, and to the Houston area. Submit suggestions to me by return email, and I'll attempt to pick out the best of the lot.\

Moon Society Forum: The Forum has been on hiatus the past couple of months as all legitimate traffic had dried up and fighting off the spammers had become a full time job with no help in sight. At our meeting tonight some expressed positive interest in keeping the forum going, perhaps with a reboot and a facelift. The domain names have been renewed for another year, and we will see how we can give the discussion forum a rebirth.

ISDC: Marianne Dyson and myself are confirmed for ISDC 2012.and staying at the Grand Hyatt. Any chapter members or friends planning to attend are invited to contact me by return email so we can get together. **Eric Bowen**

The Space Chapters Hub

CHAPTER RESOURCES, PROJECT IDEAS and much more:

http://nsschapters.org/hub/ – http://nsschapters.org/hub/hub_main.htm

This site serves the chapters of the **Moon Society,** the **Mars Society**, and the **National Space Society**

The Space Chapter HUB is a **Clearing House** of Information for Local Chapters, of whatever affiliation, involved in public space outreach.

Agendas and priorities may differ. But we all face the **same set of challenges** and have the **same set of methods and tools** available to us.

Our Mission is to make easier the tasks facing us all through **a common watering hole** where we can all trade know how and techniques. Peter Kokh, Hubmaster

GREAT BROWSING LINKS

SPACE STATIONS + COMMERCIAL SPACE

http://www.space.com/15414-**spacex-space-station-launch-date**.html
http://www.space.com/15417-**dream-chaser-space-plane-private-spaceflight**.html & **Video**
http://www.space.com/14446-**photos-dream-chaser-space-plane**.html
http://www.space.com/15438-**blue-origin-secretive-private-space-taxi**.html
Do it yourself suborbital space – http://www.thespacereview.com/article/2068/1
http://www.space.com/15651-**private-space-stations-spacex-bigelow**.html
NASA offers expertise to help private companies build rockets, capsules
http://www.space.com/15464-nasa-private-spaceflight-unfunded-agreements.html

THE MOON

http://www.universetoday.com/93384/**russia-sets-its-sights-on-the-moon**-for-2020-2/
GRAIL mission probing Moon's interior is extended –
http://www.spaceflight101.com/grail-mission-updates.htm
NASA picks Earth-Moon L2 point for next manned mission
http://www.space.com/14518-**nasa-moon-deep-space-station-astronauts.html**
Canadian Mining Firms eager to mine the Moon
http://www.ctvbc.ctv.ca/servlet/an/local/CTVNews/20120226/bc_mining_moon_canada_space_race_120226/20120226/?hub=BritishColumbiaHome

MARS

http://www.marsdaily.com/reports/**Russia_and_Europe_give_boost_to_Mars_robotic_mission**_999.html
http://news.discovery.com/space/**exomars-mission-europe-russia-nasa-mars**-120410.html
http://www.marsdaily.com/reports/**Mars_Astronauts_Could_Risk_DNA_Damage**_999.html – **Mars 500 results**
http://lightyears.blogs.cnn.com/2012/04/23/**why-we-shouldnt-wait-to-go-to-mars/**– **Zubrin**
www.marsdaily.com/reports/**WSU_astrobiologist_proposes_fleet_of_probes_to_seek_life_on_Mars**_999.html
www.marsdaily.com/reports/**Technology_developed_at_Caltech_measures_Martian_sand_movement**_999.html
First Mars Express Gravity results plot Mars' volcanic history –
http://www.esa.int/esaSC/SEM6HJNW91H_index_0.html
Canberra, Australia wins right to broadcast Curiosity landing on Mars
http://www.abc.net.au/news/2012-04-03/**canberra-lab-to-broadcast-mars-landing**/3930118
Roscosmos to give Phobos-Grunt another try
Per a side comment on http://www.marsdaily.com/reports/Mars_Astronauts_Could_Risk_DNA_Damage_999.html

ASTEROIDS

http://www.space.com/15416-**asteroid-mining-planetary-resources-hiring**.html
http://www.space.com/15419-**asteroid-mining-billionaires-private-spaceflight**.html
http://www.space.com/15405-**asteroid-mining-feasibility-study**.html
http://www.space.com/15401-**asteroid-mining-huge-dollars-sense**.html
Don't send astronauts to the asteroids, bring asteroids to the astronauts
http://space.alglobus.net/presentations/DraftAsteroidMiningTalk2012.pdf

ANALOG STATIONS AND RESEARCH

Antarctic Research Stations: Parallels for Interplanetary Design
http://www.spacearchitect.org/pubs/AIAA-2010-6106.pdf

ASTRONOMY + ASTROBOTICS

http://www.space.com/15430-**alien-planets-outnumber-solar-system**.html
http://www.space.com/14692-**alien-life-saturn-moon-enceladus-ice-drill**.html
http://www.space.com/15433-**alien-life-red-dwarfs-habitable-planets**.html
Who will get the Square Kilometer Array, Australia or South Africa?
http://www.skatelescope.org/news/**ska-members-meet-discuss-site-selection/**

COMPUTER SPACE WALLPAPERS

http://space.desktopnexus.com/cat/**planets/** **/moons/** **/stars/** **/rockets/** **/satellites/** **/space-stations/**

GREAT SPACE VIDEOS

http://spaceports.blogspot.com/2012/05/**europeans-will-look-for-life-on-jovian.html**

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

THE book WORM

Three very different Science Fiction Novels Reviewed by Ken Murphy
http://www.outofthecradle.net/categories/books/

Back to the Moon: "The time is the near future,sometime late in the 20-teens or early 2020s. NASA is engaged in an a dry-run of the Altair system for a Lunar return. Probes are mapping the surface with increasing resolution in preparation for the next landing. On the private sector side, Space Excursions is about to embark on their first free-return trip around the Moon with paying tourists in the Dreamscape. Things are looking up for the space industry, and that has some folks jealous. ----- "sssssssss Emergency! Please help! sssssssssss SOS! This is the crew of the .....

Luna: Sometime in the near future, there's a crew on the way to the Moon to check-out and turn the key on an extensive Lunar facility that will eventually house thousands of residents. 300,000 km en route, they get to see the end of the world, consumed by nuclear fire. For all they know, -------

The Next Continent: The year is 2025. Tae Toenji is a 13-year old college graduate with a plan. Think Doogie Howser but totally precocious. ..... What she wants is a Moon base as a luxury destination for weddings. It's not as silly an idea as it may first seem. She's got her reasons, and ..... This book is an excellently crafted science "faction" tale of private interests setting up shop on the Moon. It's not action driven, but rather a long rumination on the manifold aspects to be considered in actually establishing a presence on the Moon.

Interested in a good read? Explore Ken's Lunar Library; Science, Fact, Fiction and more

NOTE: MMM is published 10 times a year, monthly, except in January and July
These are the Editor's twice a year **"burnout prevention" and "inspiration renewal" breaks,** which are the secret behind the longevity of this publication, now in its 26th year.

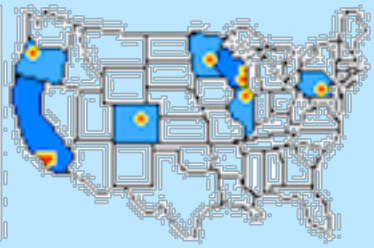
No MMM next Month – look for #257 in August

Note: We have just published **2 new MMM Theme Issues: The Lunar Economy:** 223 pp. and **Arts and Crafts** 123 pp. – Collected articles from MMM's 1st 25 years – illustrated

http://www.moonsociety.org/publications/mmm_themes/mmmt_LunarEconomy.pdf
http://www.moonsociety.org/publications/mmm_themes/mmmArts_Crafts.pdf

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

NSS Chapters that share Moon Miners' Manifesto



Space Chapter HUB Website: http://nsschapters.org/hub/

Feature Page: Project Menus Unlimited http://nsschapters.org/hub/projects.htm

WISCONSIN

MLRS – Milwaukee Lunar Reclamation Society
P.O. Box 2102, Milwaukee, WI 53201
http://www.moonsociety.org/chapters/milwaukee
http://www.nss.org/chapters/milwaukee

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

2012 LRS OFFICERS & • BOARD Contact Information

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

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

SECRETARY – **• James Schroeter NSS** (414) 333-3679 – James_Schroeter@excite.com

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

√ MEETINGS THE 3RD WEDNESDAY (Exp. July, August) **NEXT– SEP 8 – OCT 13 – NOV 10 – DEC 8**

√ **No Meetings in July or August – a field trip to Yerkes Observatory is under discussion**

WISCONSIN

SSS: Sheboygan Space Society
Center St. Kiel, WI 5402-1034
http://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: AUG 17 - OCT 19 - DEC 8 (SAT in Milwaukee)

CALIFORNIA

SDSPACE.org SDSS – San Diego Space Society
http://sandiegospace.org/

SETIcon June 22-24 – http://sandiegospace.org/?m=20120622&cat=3

Friday Night Launch Party w. live entertainment, Panels with Q&A; "fireside" chats; Luncheon with Scientists, SETIcon Awards Gala; Keynote Brunch; Silent, Live ;& Online Auction; Interactive Exhibit Hall; Space/Science Artist Showcase

Space Art Show July 14-28 – hosted by the San Diego Space Society and the Space Travelers Emporium
http://sandiegospace.org/?m=20120714&cat=3

15th Annual Mars Society Convention in Pasadena August 3-5
http://sandiegospace.org/2012/03/07/15th-annual-mars-society-conference/

CALIFORNIA

OASIS: Organization for the Advancement of Space Industrialization and Settlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA90278
http://www.oasis-nss.org/wordpress/

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 – JUN 16 – JUL 21 – AUG 18 – SEP 15 – OCT 20

Sat June 16 3pm – OASIS Board meeting home of Steve Bartlett and Tina Beychok, 7108 E Peabody St. Long Beach

Th & Fr June 21 & 22 7pm Melting Snows: The Threatened Lifeblood of the Western US, Dr. Painter, JPL

- Th at Von Karman Auditorium, JPL 4800 Oak Grove Dr, Pasadena
- Fr at Vosloh Forum, Pasadena City College, 1570 Colorado Blvd, Pasadena

Th June 21 5:30-9pm AIAA-LA- Las Vegas Dinner Presentation : "Mars Direct" Robert Zubrin. Presentation starts 7:15 pm S-Cafe, Northrop Grumman, 1 Space Par, Redondo Beach – $25 members, $35 others

COLORADO

DSS: Denver Space Society
(FKA The Front Range L5 Society)
1 Cherry Hills Farm Drive, Englewood, CO 80133

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

ILLINOIS

CSFL5: Chicago Space Frontier L5i
610 West 47th Place, Chicago, IL 60609

MINNESOTA

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

http://www.mnsfs.org/2011-Review/

MNSFS Continuing its tradition of putting up 'Current' space displays MN SFS's current space flight ISS-30 is now on public view at :Radio City Inc,.2663 County Road I. Mounds View, MN 55122

Display text & Graphics from ISS-30-31 Press Kit @
http://www.nasa.gov/pdf/605284main_Expedition_30_31_Press_Kit.pdf
http://freemars.org/mnfan/MNSFS/2011-12-ISS-30-Display/

OREGON

OR L5 - Oregon L5 Society
P.O. BOX 86, OR 97045
http://www.OregonL5.org

(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 – JUN 16 – JUL 21 – AUG 18 – SEP 15 – OCT 20**
* **Lunar Base Research Team – http://www.oregonL5.org/lbrt/**
* **Mars Instrument and Science Team – http://www.oregonL5.org/mist/**

PENNSYLVANIA

NSS PASA- NSS Philadelphia Area Space Alliance
928 Clinton Street, Philadelphia, PA 19107
http://pasa01.tripod.com/

c/o Earl Bennett, Earlisat@verizon.net - 856/261-8032 (h), 215/698-2600 (w)

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

Meeting Location and Times: Our next meeting is **June 9**, at the Liberty One Food Court, from 1 to 3 p.m. We meet on the west side of the court. Look for a table display. **Event note:** NSSPASA will be given "Chapter of the Year" at the I.S.D.C. this coming weekend. We plan to bring one of our table displays (the Lunar Lava Tube).

May 19th Meeting notes: A very good turn out with a visit from Rich Bowers again, and, Michael Stewart, who is thinking of rejoining us, also came to report on his Astronomy Day activity. And our regular compliment as well.

Larry, reported on his getting back to our webpage and putting our Science Carnival pictures up. He will also have added the Super Science pictures, from The New Jersey State Museum event he was part of (along with Dotty and Dennis). He also brought a chart he is working on about the rate of sunspot cycle occurrences. Solar weather is one of his interests that he is bringing to the group for our information and discussion. See our website.

Dorothy brought material from several sources including: **Time Out New York**, on The Enterprise exhibit being brought to the Intrepid (everyone loves a parade with a big star!), and a number of other events in the city.

Also on June 9th, there will be a special exhibit at the Udvar Hazey branch of The Smithsonian: an all day affair on energy with talks and exhibits. In Washington proper there will be "50 years of Manned Space Flight" on the Mall at the Smithsonian. Dorothy also reported on the unusual badges at the **Lunicon SciFi** convention she and Larry attended: the back of the badges indicated that this might be the last such event unless they have a lot more help and cost of the Ryerstown, NY location. Dotty and Larry did volunteer at this event as reported previously.

On the topic of conventions: Hank Smith reported on the difficulties of getting some answers about several matters, including financial, that he has been asking about for some months now. **Philcon** will be held at the Cherry Hill Crown Plaza, Nov. 9–12 and we will volunteer as always. Hank may or may not go to **Balticon** (where Dotty and Larry will be again) but will help at Philcon in the Fall.

Mitch Gordon gave us a number of interesting reports including one on a new X-Prize: Build and Demonstrate a working Tricorder like device that can diagnose 15 diseases. QualComm, the communications company, is sponsoring this and the value is $10 million dollars. This from The Futurists magazine reporting on the Consumer Electronics Show earlier in the year. Also from the Futurist, but a different publication, "Harnessing Heavenly Power" about space based solar power. The Futurist Society will have its' convention in Toronto this July from the 27–29th. He reported that the outreach done by Frank O'Brien for Astronomy Day was appreciated by The Science Fair organization. Frank did astronomy outreach at Congreso de Latinos Unidos in Philadelphia for us. He had a great time and plans to be part of the event next year. I should mention that Michael Stewart also helped someone for this event at another location (wait till next year! We could have three or four sidewalk astronomers!).

Rich Bowers did contribute to a number of the discussions around the reports, but, he also asked a question: from hearing about 3D printers he wondered if anyone had incorporated carbon fibers as strengthening agents as a component of the materials used to build up the products being made. I had reported on various printers before and have not seen this enhancement. Rich also reported that Obama is "space friendly" and that the Return to the Moon plan would have caused financial problems if it had continued as had been planned. We talked about this a lot, and, where the money we need has gone, and the possible post election futures.

Janice, who has renewed, reported on proof of water on Mars from Science Magazine of May 4. The Opportunity Rover had gathered the data reported as "Ancient Impact and Aqueous Processes at Endeavor Crater, Mars."

Earl brought a number of reports, that where passed out among our group, including: a report on the reexamination of the cause of failure of a number of fusion experiments. The proposed solution involves prevention of formation of "islands" that have interfered in the stabilization of the plasmas. The source of the material in the islands is from the walls of the chambers containing the fusion reaction. Some of the research on the problem was with an MIT and Princeton researcher collaboration. This was on line from an electronics publications. Also: from the May NASA Tech Briefs several abstracts on far infra red detection and calibration equipment and, on page 66, an article on mass spectroscopy on Mars using an ion funnel. I did not see it described as a part of Curiosity. The next page describes a report on a "Dual- Compartment Suitlock". This is something that Moon Miners has discussed and now we have a recent report from NASA.

And finally: from Analog for July/August 2012: Fluffy Impact: What LCROSS Found When It Hit The Moon (including some of the reasoning about why, and what, materials where found) by Richard A. Lovett (who has a fiction, with William Gleason: "Nightfall on the Peak of Eternal Light"), and, from NASA's Medical Design Briefs: 3d Printer With Nano-Precision on an impressive device, and an image of one of one of it's tiny products, from The Vienna University of Technology. May issue, pages 24 and 25. – Submitted by Earl Bennett.

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

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

PRSRT STD
U.S. POSTAGE
PAID
MANASOTA FL
PERMIT No. 802

Please renew promptly so as not to miss an issue

INDEX to MMM #256 JUNE 2012

2. **In Focus: The "Triway" to Space** By Peter Kokh and Al Alzandua
3. **Antarctic Cottage Industries based on "Found" Objects and Materials** By Peter Kokh
5. **Setting up Shop on the Moon: First Landing Tasks** by Dave Dietzler
7. **ISS-Mars Simulations – a long way** to go By Peter Kokh

Moon Society Journal Section

9. Introducing Al Anzaldua, New Board member
10 Revised Elections Ballot, Statements
12. Ken Murphy's report on ISDC 2012 Moon Track
13. Chapters & Outposts Report

---

15. Browsing Links – Video Links
16. Book Reviews – 3 Science Fiction novels
17. 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/**