

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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.info



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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.

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• **MMM color online downloadable PDF file version option for Moon Society Members** using their username and password – do write secretary@moonsociety.org if you need help with your password.

• **For additional space news** and near-term developments, there is a daily RSS feed space news section on <http://www.moonsociety.org>. You can also read **Ad Astra** magazine mailed to **National Space Society** members. •

Milwaukee Lunar Reclamation Society is an independently incorporated nonprofit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. MLRS serves as the Milwaukee chapter of both **The National Space Society** and **The Moon Society**: – <http://www.moonsociety.org/chapters/milwaukee/>

• **The National Space Society** is a grassroots pro-space member-ship organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.

National Space Society 1155 15th Street NW, Suite 500 Washington, DC 20005 (202) 429-1600 – www.NSS.org

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

• **NSS chapters** and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.

• **Publication Deadline:** Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, Sooner is better! – **No compensation is paid.**

• **Submissions by email** to KokhMMM@aol.com – Email message body text or MS Word, Text files, and pdf file attachments or mailed CDs, DVDs, or typed hard copy [short pieces only, less than 1,000 words] to:

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

In Focus Matching Research needs on Earth to those on the Moon, Mars

Research in Hawaii Lays Groundwork for Developing Lunar Construction Materials

Report by Peter Kokh

On March 18, 2013 Space Age Publishing reported:

"A ... proposal by the Hawaii-based Pacific International Space Center for Exploration Systems (PISCES) is to

“develop “sustainable basalt concrete utilization” and “3D additive building techniques.”

This would provide Hawaii with a low-cost locally sourced alternative to imported (fossil) calcium carbonate-based concrete and facilitate analog experimentation for future Luna / Mars development.” (Towards end/bottom of 1st of 2 reports for issue linked below)

<http://www.spacecalendar.com/march-18-24-2013-vol-32-no-11-hawaii-island-usa/>

See also the following article this MMM, on “Contour Crafting – A Breakthrough in Lunar Construction Options”)

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

Editor's Comment:

What is most interesting is that our member Steve Durst (Editor/author of these SpaceAge Publishing reports) **links this lunar and Martian need to an economic plus for the state of Hawaii**. That bodes well for these projects getting real support from the state of Hawaii.

I had long ago thought of using "technology needs" here on Earth as a driver for ISRU technology development. I had even thought of using technology needs in specific places here on Earth as opposed to terrestrial needs in general. We think of the concrete industry as being universal here on Earth. But that assumption is not true on Hawaii! or on/in other locations "happily unblessed" with the needed ingredients.

Applying this lesson to other Lunar Technology Problems

We had already noted in an early 1987 article about the possible terrestrial market for glass-glass fiber composites, a technology, if developed, could be most useful on the Moon, "replacing wood" for example, would also be marketable in desert or other areas without forests, if we learned how to supply many furniture needs.

Check: http://www.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm

And maybe that is how we should try to "sell" additional ISRU ("on location" i.e on the Moon) technology developments: alternative building and manufacturing materials, but also in many other technology areas in which operations on the Moon will present a challenge. We have noted many times that "lessons learned on the Moon" will pay for their development by application to special problems on Earth.

In anticipation that we will find this so, we might look around our well-blessed planet for

"areas less blessed" to the point of being "moon-like" or "Mars-like" in the sense of being deficient or challenging in one respect or another.

This gives us **terrestrial market incentives** for pre-developing technologies we will need on the Moon. This reverse process we had dubbed "Spin-Up" as opposed to "spin-off," finding a strong market here on Earth for the off-planet technology in question.

In "**spin-up**" a private enterprise, motivated by profit, examines a technology needed on the space frontier and endeavors to identify potentially profitable terrestrial applications.

He then develops the technology, specifically for those terrestrial applications, with the **consumer** paying the bill.

As a result, when the technology is needed on the space frontier, it is already "on-the-shelf", at least in an analogous form in need of relatively inexpensive adaptation only.

Taxpayers and consumers are materially the same people, but unwilling in the first instance, and willing in the second. –

<http://www.moonsociety.org/publications/m3glossary.html>

More examples:

Needed Here: A light fast-deploy extendible-collapsible "ladder" into fresh sinkholes for rescue purposes.

Use on Moon & Mars: quick lightweight, easily deployed access into lunar and Martian lavatube skylights.

Needed here: organized army of heat-resistant robot "insects" that can survey places too dangerous to enter for survivors, or to report on damage in detail

Use on Moon & Mars: report to surface rover on lip of a lavatube skylight about conditions inside the tube: map the tube; identify talus debris piles, etc. etc.

Needed Here: ???

Use on Moon & Mars: ???

Moon Miners' Manifesto wants to pick your brains

Look for other matches for local terrestrial needs vs. technology needs on Moon and/or Mars

Write up your idea for an Earth-Moon/Mars technology need match

and send it by email to mmm@moonsociety.org subject line "technology match"

or by postal mail to: **Moon Society Publications, PO Box 395, Milwaukee, WI 53208**

No deadline: This is an open-ended invitation

Help us brainstorm the future and thus help us make it happen

"sooner, better, stronger, cheaper" etc.

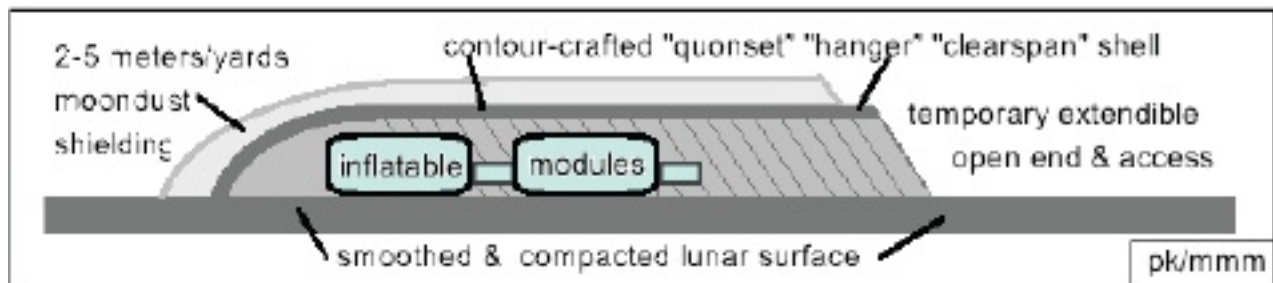
After all, that is what MMM is all about.

Contour Crafting – a Breakthrough in Lunar Construction Options

By Peter Kokh

“Contour Crafting” Video: <http://www.youtube.com/watch?v=JdbJP8Gxqog>

Contour Crafting on the Moon takes this new technology to a higher level



- **Clearspan structures** offer shared shielding, ease of rearrangement of sheltered structures, ease of module repair or modification and/or enlargement.
- **Height and width of shelter cross-section are adjustable** (taller multi-story and wider and/or side-by-side inflatable modules)
- **Clearspan structures** also offer “lee-vac” warehousing under pre-radiation-shielded hanger, and “lee-vac” sports in light, much-less cumbersome pressure suits.
- They are ideal also for highway junction “waysides” (with services) and for protected railroad sidings

Railroad sidings could be used to deliver modules made on the Moon and place them as needed inside the shelter



Concrete cement – lunar highland derived mix (Calcium or, more likely, Magnesium)

Needed Additive options:

1. **Polymers** expensively “upported” from Earth – **Research priority** >> a Moon-sourced substitute?
2. **Basalt fibers** made from lunar maria soils in mare or **highland/mare coast locations** where access to both moondust suites are available. (our choice)
3. **Sulfur** mined in “KREEP” rich soil around the Mare Imbrium perimeter
4. **Sodium silicate** (the only inorganic adhesive) produced on the Moon
5. **Once** we have selected a “coastal” (highlands/mare) site, materials cost will be significantly reduced

What to place inside

Inflatable modules weigh less, and, uninflated, take up **much less cargo space** than do hard-shell modules. Thus the cost of importing shelter drops significantly.



Left: Bigelow Aerospace <http://www.bigelow-aerospace.com>

Right: ILC Dover <http://www.ilcdover.com/Space-Inflatables/> – <http://www.ilcdover.com/Transhab/>
<http://nasansfantarctica2008.blogspot.com> – <http://www.ilcdover.com/InFlex-Hab/>
<http://www.ilcdover.com/X-Hab/>

Beyond Inflatables: Modules made on the Moon out of lunar materials

Once we are making modules on the Moon itself, out of the elements present in moondust, whether metal alloys, glass or basalt composites, or concrete, we can reduce import tonnage even further.

Note: On pages 10–11, below, Moon Society President Ken Murphy describes a “STEM Project” which might advance the technologies needed for building with “lunar concrete.”

Frequent MMM contributor Dave Dietzler has suggested that a **basalt/basalt fiber composite** be researched as another theoretically possible lunar-appropriate building and construction technology.

In the past, **glass-glass matrix composites** have been suggested, but basalt/basalt fiber composites may come on line sooner.

Dave has also looked into the possibility of **lunar iron and steel alloys** that may be used.

Magnesium, a metal little used on Earth because of its ready reaction with atmospheric oxygen, might be used to build pressurized habit and activity modules, lined with an oxygen resistant interior coating.

Contour Crafting Summary:

This new technology, still in its infancy, with many stages yet to be demonstrated, could well prove to be a major breakthrough in development of Moon-based technologies that have the capacity to significantly reduce the cost of setting up shop on the Moon, in particular, in setting up and expanding an **International Lunar Research Park on the Moon**, tasked with developing lunar resource technologies and industries. Such an ILRP, now in the first stages of prototyping on Hawaii Island, would evolve into the first permanent lunar settlement.

Read: “An International Lunar Research Park” MMM–India Quarterly #2 – Feb 2009, p. 20–21 (Kokh & Dietzler)

http://www.moonsociety.org/india/mmm-india/m3india2_Winter09.pdf

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New lands were discovered by iron men in wooden ships,
 Not by wooden men in iron ships.

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

Alternate Lunar Materials for Solar Power Satellites

By Dave Dietzler

The prevailing wisdom dictates that space solar powersats will be made of aluminum and titanium like jet fighters and that they will have vast areas of silicon. Other **writers** have pointed out that powersats could be less massive if the consisted only of lightweight reflectors concentrating solar energy on small high efficiency gallium based solar panel modules upported from Earth [1].

What if other materials more available on the Moon were used for solar power satellites? We have previously discussed concrete lunar habitat modules, concrete space stations, carbonless maraging steel and other unconventional solutions to the problems of space industrialization.

A new materials option: cast basalt and cast basalt/basalt fiber composites:

What if the frames of powersats that support sheet or foil reflectors were made of abundant lunar basalt, especially if it is reinforced with basalt fibers? This would require a formulation that had a lower melting point for the matrix than for the fiber by adding lunar sodium and potassium which can be extracted from large quantities of strip mined regolith without much difficulty. Common sense might exclaim that a hard, stiff material like cast basalt would tend to crack when stressed but a basalt/basalt fiber composite would not be so susceptible to cracks.

That aside, how much stress will there be on a powersat in weightlessness with no chance of high winds or earthquakes? The only source of stress on the structure that I can foresee is the centrifugal force caused by the once every 24 hour rotation needed to keep the powersat oriented towards the Sun. Since: $F=(0.0011)W^2R$ and a powersat might have a radius of 3000 meters and a spin rate of: $1/(60*24)RPM$ or $W^2 = 4.8E-7$ the force in gravities will be $1.59E-6$ G at the outer rim and that isn't much. The total force exerted by half the powersat, about 50,000 tons, would be 79.6 kg but actually less since much of the structure is within the radius of 3000 meters. Correct me if I am wrong. I am not a structural engineer; but it seems to me based on this "back of the envelope" calculation that the stress on a solar power satellite will be so low that they could be built with "gossamer" structures.

Cast basalt is an interesting material. It has a density of about 2.95 g/cc while aluminum has 2.7 g/cc and magnesium about 1.8g/cc. Titanium has a density of 5.41g/cc and iron/steel has 7.7 g/cc.

The tensile strength of cast basalt is 35MPa (**5000 psi**) and

Its compressive strength is 540 Mpa (**78,000 psi**).

So its density is comparable to aluminum but how does its strength compare to alloys we could cast on the Moon?

Aluminum Alloy	Composition	Compressive	Tensile
413	12% Silicon	18,000 psi	37,000 psi
518	8% Mg	23,000 psi	42,000 psi
520	10% Mg	25,000 psi	46,000 psi

We can see that cast basalt has superior compressive strength but inferior tensile strength. This is where basalt fiber reinforcement comes in. Makers of basalt fiber rebar claim that this material works in a temperature range of -260 C. to 980 C. It can certainly endure the temperature ranges of the Moon and outer space. Basalt fiber has a tensile strength of 4840 Mpa (702,000) and a compressive strength of 550,000 psi. See:

<http://www.sudaglass.com/chars.html>

Makers of basalt fiber rebar ("rockbar") claim that "Rods made of a unidirectional composite of basalt fibers offer significant advantages over steel rebar in a variety of applications...Higher specific strength than steel rebar....89% lighter...one tone of basalt reinforcement rods provides the reinforcement of 9.6 tons of steel rebar." See: <http://www.sudaglass.com/rods.html> Sudaglass also claims 1200 Mpa (174,000 psi) tensile strength and 420 Mpa (60,920 psi) compressive strength for their polymer bound basalt fiber rebar product.

We won't have polymers on the Moon so we must determine the properties of basalt fibers in a basalt matrix that has been doped with sodium and potassium to lower its melting point. If successful, basalt fiber reinforced basalt beams and tubes could definitely compare to and even be superior to alloys of aluminum that could be made on the Moon. It seems to me, a mere amateur, that fiber reinforcement would give the material resistance to cracking upon bending, if it ever even endures bending!

Additional advantages to basalt

To make basalt more tempting, it requires much less energy to produce than aluminum and no expensive chemicals upported from the Earth or complex equipment that much be constructed on the Moon. As the surface regolith in the maria is "polluted" by debris from impacts in bordering non-basaltic highlands regions" we need to strip mine the mare regolith to get to layers of higher basalt concentrations, and purify it perhaps by magnetic and electrostatic means to remove ilmenite and anorthite, melt it in solar or electric furnaces, run the molten mass

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

through a homogenizing drum, then mix it with basalt filaments and cast it in iron molds with a thermally sprayed in silica lining.

But there may be a much better way. Instead of strip-mining the mare surface, we can collect pure basalt that has fallen off the roof and sides of lavatubes – a process called “spallation.” As basalt is to be found only in the lunar maria – seas of frozen basaltic lava whose flooding resulted in sub-surface networks of lavatubes, both options – strip mining purer basalt below the regolith layer or collecting even purer basalt from within lavatubes, are available. But lavatube quarries would seem the better choice.

Collecting “pre-quarried” spallation debris would serve to better prepare a lavatube for human uses: settlements, industries, warehousing, etc. In addition to collecting spallation debris inside lavatubes, the process of constructing road way “cuts and fills” through any lava “flow fronts” (with elevation differences as much as a hundred meters) would expose pure basalt layers for quarrying. This type of “strip-mining” is both more productive and serves other purposes as well: road construction.

Basalt fibers

Making fibers is a little more involved as we will need platinum–rhodium bushings to draw the filaments through. Compared to metal extraction processes this is simple and it releases no oxygen into the lunar atmosphere that might degrade the vacuum. Bootstrapping a basalt fiber and composite industry on the Moon cannot be nearly as difficult as building an aluminum industry that compares with ALCOA in the USA alone!!!



“Rockbar™”

made from basalt fiber

Significant energy savings using basalt instead of aluminum

In an earlier article I stated that it should be possible to produce 8GWe worth of solar panels on the Moon in ten years' time with about 300 tons of equipment designed and patented by Dr. Peter J. Schubert. With solar energy available 50% of the time and processes that required 20MWh per ton of aluminum we could produce 1.75 million tons of aluminum per year.

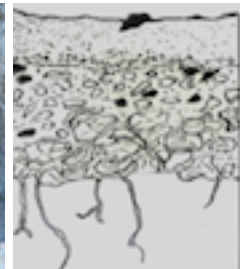
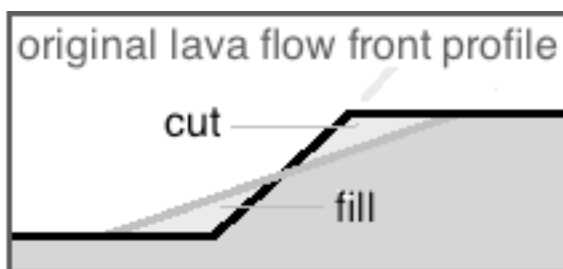
Since lunar basalt melts at about 1250 C. and has a specific heat of 840 j/kg. K and a heat of fusion of 420,000 j/kg, I calculate that to melt a kg. Of basalt starting with a daytime temperature of 100 C. a total of 1,386,000 j or 385 Wh is needed. To melt two million tons of basalt a total of 770 Gwh is needed. Comparing this to the 35,040 Gwh required to make nearly as much aluminum, we find that it takes 45X as much energy to produce that aluminum than to produce basalt!! Not only would we have enough energy to make basalt products for powersats, we would have enough energy to produce the limited quantities of steel needed to build strip mining machines and magnesium sheets or foils for powersat reflectors.

A role for magnesium

Since magnesium can be produced by silicothermic reduction and magma electrolysis can supply the necessary ferrosilicon it seems to me that magnesium, which is actually a slightly better reflector than aluminum, would be preferable to aluminum since it could be produced without upported chemicals. Magnesium smelting re-torts could be made of alumina produced by sulfuric acid leaching of anorthite and there is enough water and sulfur on the Moon to produce H₂SO₄. Some aluminum would still be required mostly for electrical wires and cables and this might demand paying the price for upported chemical reagents like LiCl or LiF but by using basalt instead of aluminum for powersat frames this price will drop to a small fraction of that which we would have to pay otherwise.

Footnotes:

- 1) The Space Grid Sun-synchronous orbiting SBSP Satellites with Equatorial orbiting Reflector Satellites for Earth and Space Energy By Royce Jones http://www.nss.org/settlement/journal/NSSJOURNAL_TheSpaceGrid_2011.pdf



IMAGES: Road cut & fill; Tube/cave spallation debris: Regolith cross section (less “foreign” further down)

Revisiting the “Snuglining” & “Snuglocks” Concepts

By Peter Kokh

In MMM #79 October 1994, in an article entitled “Vehicle Design Constraints,” in a section entitled “**Saving Atmospheric Gases: “Snuglocks”**” we wrote”

There is a seemingly limitless supply of Oxygen on the Moon. But the point is that the high lunar vacuum is an invaluable scientific and technological resource. It pays to do everything possible to minimize any slow degradation this vacuum will undergo from repeated airlock cycling.

More importantly, however, at least in its immediate economic ramifications, is the principally exotic, or Earth-sourced nature of the Nitrogen we will need as an atmospheric buffer gas, one with biospheric importance as well. In short we need to conserve both oxygen and nitrogen. One way to do this is to use matchlocks instead of airlocks for the delivery of goods and personnel between the exterior vacuum and the pressurized interior. Direct docking allows shirtsleeve passage.

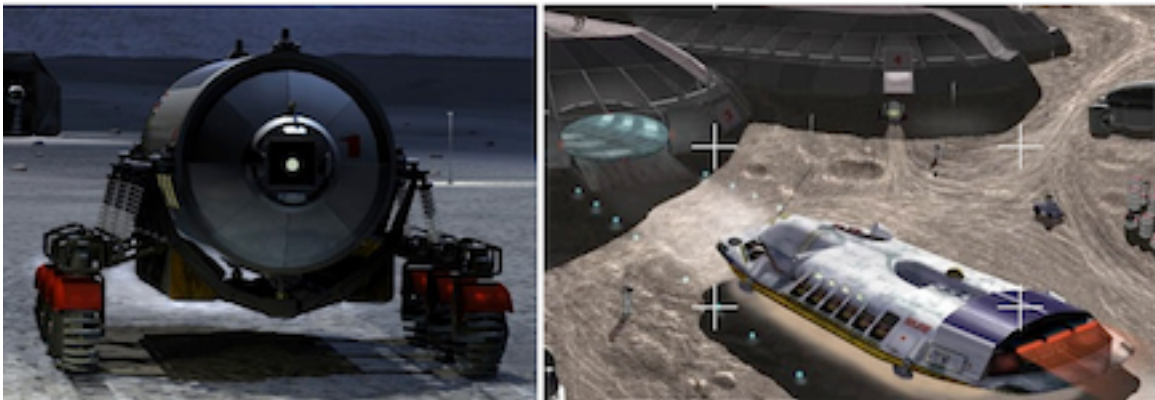
Those who must enter and leave, either the vehicle or habitat, on foot, can use turtleback suits, backing into a form fitting lock. Once secured with a pressure seal, first the concave mini-door to the habitat opens, then, into it, the conformal back of the turtle back space suit. The occupant reaches backwards inside the habitat for a bar above the turtle lock and pulls him/herself through the turtle back into the pressurized habitat. The dusty suit remains outvac. The back of the empty suit, then the door lock is closed, and the empty suit moved by a roboarm to an exterior storage rack

More salient here is the periodic need to bring vehicles into pressurized garages through large airlocks. The only way to minimize volatile loss in this case is to design vehicles so that all top and side-mounted protruding equipment retract into hollows in the hull, even the wheels can tighten up

for the taxi in, so that the vehicle fits through a much smaller standard size garage airlock as snugly as possible. This snuglock would have a conformal antechamber exposed to vacuum, so that when the airlock was opened, vehicle in antechamber, the outrush of air would be minimal. In other words, the type of vehicle we need as a mainstay is a “Snugger.”

Previously, in another article “**Harbor & Town**” MMM #56 June 1992 I wrote: “Detachable holds of trade vessels making circuit rounds between various settlements might be designed “snugline” fashion to slip into special airlocks and taxied or tugged to an in-city market berth where they could unfold for business,”

On target illustrations by noted space artist Pat Rawlings



Left: S173 – here we have a cylindrical vehicle with a detachable chassis

Right: S245 – we see an open “oval” “snuglock with an oval hull and detachable chassis

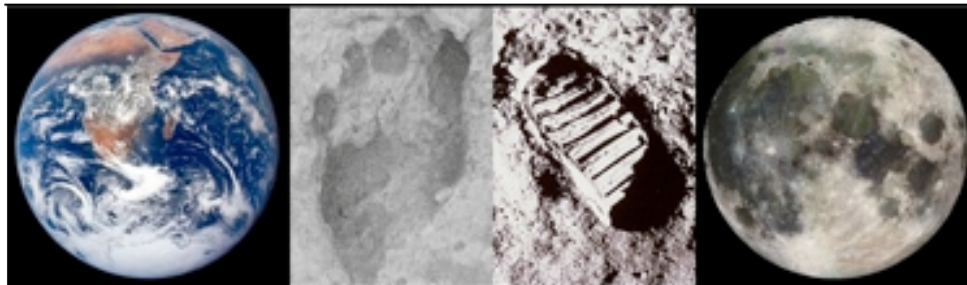
The advantage is that properly designed, vehicles in a short list of cross-sections, can slip in and out of such holds without their road chasses and with a minimum of air (oxygen and even more precious nitrogen) being exhausted into the vacuum. Obviously, this is a concept that needs to be more fully developed. In the process a short-list of vehicle minus chassis should be designed.

Voiding moist oxygen in either personal airlocks or vehicle locks, wastes precious water and will eventually give a rusty hue to the surroundings, a tell-tale sign of waste. As to Nitrogen, of all the gasses essential to life, Nitrogen is the one in shortest supply on the Moon, to the point that we may do well to use a less Nitrogen-rich air mix. That is something easily tested on Earth, or in the International Space Station. Otherwise, nitrogen, not water, could be the element that put limits on population growth as well as on open spaces and high ceilings.

This concept complements the turtle-back suit and suit-lock concept. See the MMM Glossary <http://www.moonsociety.org/publications/m3glossary.html> Entry: “**Turtle-back” Spacesuit Airlock** – 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
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

Yuri's Night – The World Space Party

With April comes the annual celebration of Yuri's Night on April 12th. So what is Yuri's Night? How did it start? The genesis of Yuri's Night actually stretches into the last millenium, to the Space Generation Forum (SGF) at UNISPACE III. This was a gathering of over 160 young space advocates from over 40 countries under the aegis of a United Nations conference on the future of space activities. One of the recommendations submitted to the UN General Assembly was that there be more organized celebrations as a way of sharing space with a broader audience that wouldn't normally have an avenue for engagement. On the institutional side this led to the creation of World Space Week, celebrated each year from October 4–10 each year.

One of the participants in the SGF was a young Mars–maven astrobiologist by the name of Loretta. She took the idea of a space party and ran with it. Her birthday happens to correspond with the anniversary of the launch of Yuri Gagarin, the first human into orbit, as well as the anniversary of the launch of the first Space Shuttle.

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

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

Tapping the international network developed at SGF a global space party was organized that would start just over the international date line and be celebrated over the next 24 hours. Given that Yuri Gagarin was the first human to orbit in the heavens, in 1961, Yuri's Night became the obvious name.

Plans gestated through 2000 and gained momentum in early 2001 in order to coincide with the decadal anniversaries of Yuri's flight and the launch of the first Shuttle. Resources were marshaled, networks worked over, and volunteers in Los Angeles were coordinating the global effort and distributing publicity materials around the city. Soon, April 12th rolled around, and the party began.

One of the notable features of Yuri's Night is that it is celebrated on all seven continents of planet Earth, as well as on the ISS. (your Moon Society president is looking forward to the first YN on the Moon!) This has been true since the first year. Another notable feature is that the celebration of space exploration takes whatever form the local celebrants choose. Some read space poetry in a public venue, others have private dinners, still others watch space movies. For the first year in LA, we took over a nightclub and had a huge dance party. There were over 60 other parties around the world, many of which were webcast. Your Moon Society president's contribution, besides manning the ISU booth, the ticket booth, and pre-event marketing, was the Dancing Astronaut Snoopy Medal, developed in conjunction with Loretta and given to outstanding volunteers at the celebratory dinner afterwards. The award is still given each year to those that contribute significantly to the event.

Since then the event has continued to grow around the world. Many Moon Society members already participate in events, but all members are encouraged to support the event. If there's not a Yuri's Night where you are, make one!

- This year here in **North Texas** your president is helping to organize an event at the UT Arlington Planetarium that will feature Anousheh Ansari,
- And our newest chapter, the **Greater Fort Worth Moon Society**, is organizing a day of activities at the Benbrook Public Library.
- The **Phoenix NSS/TMS chapter** will support a Yuri's Night event in conjunction with the Space Access Society, featuring a trivia contest and an update on planetary exploration from Dr. Dave Williams of ASU at InnPlace Hotel Phoenix North in the MetroCenter Mall Complex.
- In Wisconsin, **Milwaukee Lunar Reclamation Society (NSS/TMS)** is celebrating the event the next afternoon as part of their regular monthly meeting, showing videos and having a pot-luck luncheon.

If any of our members do celebrate Yuri's Night, please let us know so that we can share the fun. In an age when most citizens are convinced that the U.S. is shutting down its space program (perhaps not unreasonably so), this is a way to show that space exploration is an ongoing part of the human story. Be a part of it! **KM/P-TMS**

President's Rant – Preparing a series of STEM* Challenges

- Science, Technology, Engineering, Mathematics

I'd first like to thank everyone who has responded so far to my request for help with the **first Lunar Laboratory – Mooncrete**. [p. 11] Once finished, we will make it available to educators through e-readers. The goal is to prepare a number of these for a variety of STEM fields, all of which use the Moon as a key aspect of the exercise.

The second exercise is slated as a "**Lunar Orbit Insertion**" mathematics exercise, and the third will be "**Aqua Luna**," about splitting water into hydrogen and oxygen rocket fuel. The fourth is under consideration, possibly a fuel cell engineering exercise following on from the Aqua Luna exercise.

This is something that all members can help with, irrespective of your particular skillsets. The main thing is to come up with unusual experiments that involve the Moon in some way, shape or form. Most Moon "science" lesson plans are either a crater-making exercise or a Moon-phase exercise. We are going to trail-blaze new exercises.

Besides providing The Moon Society with a new set of assets, this is also a way to bring visibility to our organization. No one else is doing this right now, but don't be surprised if others start doing it as well if we're successful. And I really believe that this project can be successful. Especially with your help.

Your Leadership Team can't make The Moon Society a world-class organization all on our own. We need your involvement. We need your time. You do have something to contribute, even if you think you don't. The Mooncrete exercise was the result of an off-hand comment in an e-mail exchange. Your Leadership Team is pre-occupied with getting the new website pulled together, getting the financial house in order, locking down internet agreements and accounts for our web commerce efforts, planning a conference track, and a million other things. By the end of the year we will be in a much stronger administrative and operational stance and can focus on our communications strategies.

We want you to be proud of your membership in The Moon Society. Proud of the work we do in communicating the importance of the Moon in our human future, and proud of the work we do to make that happen. History happens to those who show up – will you be there?

Ken Murphy

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

Lunar Laboratory: Mooncrete: A STEM Chemistry project from The Moon Society**Designed for High School/College-level students**

Problem: Water, while present on the Moon, is exceedingly rare. When engineers on the Moon need concrete, they may need to use something different to create a concrete-like substance for building purposes.

Hypothesis: Students will be able to mix Sodium Silicate with Lunar Regolith Simulant to create a concrete-like substance.

Preparation: Have students do background research on:

- (a) Sodium Silicate and why it might be useful as a binding agent for 'Mooncrete'
- (b) Lunar regolith simulant and its properties
- (c) Review safety procedures for handling of Sodium Hydroxide and Sodium Silicate

Materials:

- (a) Distilled water, Silica gel beads, Sodium hydroxide (lye, or caustic soda) – Or Prepared Sodium Silicate
- (b) Lunar Regolith Simulant
- (c) Forms
- (d) Oven

Procedure:

- 1) Using a mortar & pestle, crush Silica (SiO_2) gel beads into 6 grams of fine powder
- 2) In a flask, heat 10 ml of water and dissolve 8 grams of Sodium Hydroxide (NaOH) into the water
- 3) Slowly add crushed Silica, heating between additions, to create Sodium Silicate.
- 4) When finished, add 15 grams of Lunar Regolith Simulant and mix thoroughly
- 5) Pour mixture into form and place in oven
- 6) Bake at 400° until dry
- 7) Remove Mooncrete from form

Formula: $2\text{Na}(\text{OH}) + \text{SiO}_2 \rightarrow \text{Na}_2\text{O}_3\text{Si} + \text{H}_2\text{O}$

Sodium Silicate can be prepared using methods found on the internet, in particular:

<http://chemistry.about.com/od/makechemicalsyourself/a/make-sodium-silicate.htm>

Be sure to also watch the video at:

<http://www.youtube.com/watch?v=xltvwhogkll>

Warnings: While Lye (Sodium Hydroxide, $\text{Na}(\text{OH})$) has a documented history dating back thousands of years, it is nevertheless a chemical that must be treated with great care. Even in the small amounts being prepared here there is a risk of scarring from splashes. Gloves and goggles must be worn in handling this chemical. A full face shield is recommended for maximum safety.

Preparing Sodium Silicate from Sodium Hydroxide is extremely dangerous if not properly handled, so you should never handle sodium silicate without protection. Aqueous solutions can easily penetrate the skin. If the solution penetrates your skin, it will dry inside the top layer and "petrify" it. Gloves and goggles must be worn in handling this chemical. A full face shield is recommended for maximum safety.

NOTE: prepared sodium silicate in liquid form can be purchased from chemical suppliers and is relatively harmless to handle. Of course, this option removes the opportunity to learn how it is made chemically.

Lunar regolith simulant was created as a substitute for scarce quantities of the real thing. Only a fraction of the Moon rocks and dust in storage at NASA Johnson Space Center has been parceled out for study or use in science experiments, NASA must be parsimonious in its use as we don't know when we'll go back to get more. One of the features of the regolith simulant is that the smallest particles are of the same size as those found in real Moon dust. There is a real risk associated with inhaling regolith simulant as these smallest particles can pass from the lungs into the bloodstream. Which is not good. Careful handling can mitigate this risk, but a face mask is recommended.

Sources of Regolith Simulant: Orbitec: <http://www.orbitec.com/store/simulant.html>

ScienceMall-USA: <http://www.sciencemall-usa.com/lunsimsoil.html>

Lab Equipment:

- | | |
|---|--|
| Lab Book (to record experiment) | Graduated Cylinder (for measuring water) |
| Mortar & pestle (for crushing silica gel beads) | Lab Scale (for weighing silica) Glass rod |
| Beaker (for mixing ingredients for sodium silicate) | Torch (for heating mixture during mixing) |

Safety Equipment: Protective Eyewear, Gloves, Lab Coat, Face Mask, Face Shield, Fire Extinguisher ***

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

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

April

Chapters & Outposts

2013

>>>>>>>>> MOON SOCIETY 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 – APR 17 – MAY 15 – JUN 19

Report by Bob Perry: Space night was held at Rockwood Valley Middle School on March 13. Chris Nobbe manned the Exploradome. It went quite well – Dabney and I spoke with several students and their friends and families. We even went out to the school's athletic field and checked out the comet. One of the other groups was the St. Louis Astronomical Society and they brought out telescopes and binoculars.

March 20 Meeting Report: Present were Karl Strassman, Mark Rode, Rufus Anderson, Keith Wetsel, Dave Dietzler, Jim Merriman, Tom Kullman, and Bob Perry. Karl had checked out the DVD "Moonshot" produced by The History Channel from the St. Charles Library. There were segments of NASA footage interspersed with reenactments – more of a movie than a documentary. Very enjoyable. Bob brought in the science article from the recent Analog Science Fiction & Fact magazine about the new company, www.planetaryresources.com that intends to find and mine near Earth asteroids. Bob will be sending followup emails to the chapter members about the article.

Jim Merriman announced that Earl Mullins of the Space Museum in Bon Terre, MO, is organizing a tour to the Stafford Air & Space Museum in Weatherford, OK, and the Kansas Cosmosphere in Leave Hutchinson, KS, for Monday, April 29, through Wednesday, May 1.

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

>>>>>>>>> JOINT NSS/MOON SOCIETY CHAPTERS <<<<<<<<<<<

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

Contact: Eric Bowen eric@streamlinerschedules.com – We will hold our next regular meeting in the conference room of the Bay Area Community Center in Clear Lake Park at 7:00 in the evening of Monday, May 13. Everyone welcome.

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

Meeting the 3rd Sats monthly at HSGP Community Center, Mesa Next meetings APR 21 – MAY 19 – JUN 15

March 16th Meeting Notes: – Thanks to all who attended today's joint meeting! We had nine members plus a guest (Anita) from HSGP. We had some great discussions and made progress on several fronts (Yuri's Night, by laws, a mission statement, etc.) I added a page on the blog and posted meeting notes there:

<http://nssphoenix.wordpress.com/meeting-notes/> – Mike Mackowski, joint President

Clarification of the current Phoenix NSS–Moon Society chapter collaboration: Mike Mackowski writes: We had a decent turnout at our joint NSS/TMS meeting last Saturday with a total of about 11 people. Most were NSS members, maybe three primarily Moon Society, and some both.

I am president of both local groups, for better or worse. The situation with the Phoenix MS chapter is that I am the only national member who is willing to be an officer. That makes me the only acting officer at this point.

My plan is to maintain both groups as parallel entities but functioning as one unit. The only differentiation is that both groups will maintain separate identities and separate bank account and websites. But all activities, communications, etc will effectively be as a single group. The Chapters–coordinator's advice is to consult with Eric Bowen of the merged Clear Lake NSS/Moon Society Houston and see how they work things out. This is "undiscovered country." I posted meeting notes at the Phoenix NSS blog: <http://nssphoenix.wordpress.com>

April 12th Yuri's Night in conjunction with Space Access Society at InnPlace Hotel Phoenix North

April 20th Field Trip to Tucson: All members and friends of the Phoenix Chapters of the National Space Society and Moon Society are invited to attend the April 20 meeting which will be a field trip to Tucson. The plan is to hire a bus, meeting Mesa at 7 am and visit **Biosphere 2** and then the **Pima Air and Space Museum**, and return by 7pm.

Seating is limited by the size of the bus, so we encourage you to contact Chuck Leshner who is coordinating this event to get your name on the attendee list. We would also like a deposit of \$50 (payable to Phoenix NSS) for the bus rental so we can commit to this in advance. Attendees will pay admittance fees at the door upon their arrival. If you would like to go, please contact Chuck at 602-616-3162 or via email at chuckmiester999@yahoo.com. His mailing address is in the flyer. This should be a fun day of exploring local aerospace-related institutions.

Additionally, there is another attachment with more info on other upcoming events, including Yuri's Night, the June meeting and an interesting talk coming up at the Humanist Center.

Tucson L5 Space Society - www.tucsonspacesociety.org c/o Al Anzaldia alanzaldia706@yahoo.com

Meetings: 2nd Saturdays, 6:30 pm.

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 + COMMERCIAL SPACE

<http://www.space.com/19918-space-google-hangout-nasa-astronauts.html>

http://en.wikipedia.org/wiki/Interplanetary_Internet

<http://www.space.com/19960-china-space-station-europe-cooperation.html>

<http://www.space.com/19416-hypersonic-spaceliner-fly-passengers.html>

<http://www.space.com/19953-space-tourism-canada-xcor-lynx.html>

http://articles.economictimes.indiatimes.com/2012-12-28/news/36036517_1_manned-mission-selection-process-iaf

http://www.spacedaily.com/reports/Chinas_space_station_will_be_energyefficient_999.html

<http://www.space.com/20006-deep-space-missions-private-companies.html>

China and Europe to cooperate on China's Space Station

<http://www.space.com/19960-china-space-station-europe-cooperation.html>

NASA to turn ISS into the coldest spot in the universe

http://articles.timesofindia.indiatimes.com/2013-02-22/science/37241491_1_iss-universe-mars-science-laboratory

EARTH + LEO + GEO

<http://www.space.com/20136-snowball-earth-ocean-mixing.html>

<http://www.space.com/20138-russian-satellite-chinese-space-junk.html>

http://www.nasa.gov/home/hqnews/2013/mar/HQ_13-069_Northern_Growing_Seasons.html

www.huffingtonpost.com/2013/03/01/huge-meteorite-found-antarctica-rock-largest_n_2789850.html

Technical approaches to removing space debris - <http://www.thespacereview.com/article/2187/1>

<http://www.thespacereview.com/article/2204/1> - <http://www.thespacereview.com/article/2255/1>

Sphire Satellite to monitor space debris - www.reuters.com/article/2013/02/25/idUSnCCNq7tKwa+1c4+MKW20130225

MOON

<http://timesofindia.indiatimes.com/india/India-to-go-solo-on-second-lunar-mission/articleshow/18124826.cms>

http://articles.economictimes.indiatimes.com/2012-12-28/news/36036517_1_manned-mission-selection-process-iaf

MARS

<http://www.space.com/20133-olympus-mons-giant-mountain-of-mars.html>

<http://www.space.com/20190-mars-mission-sample-return.html>

<http://www.space.com/20242-mars-rover-curiosity-next-drive.html>

<http://www.space.com/20111-mars-mega-flood-underground-radar.html>

<http://www.space.com/20111-mars-mega-flood-underground-radar.html>

http://www.esa.int/Our_Activities/Space_Science/ExoMars_ESA_and_Roscosmos_set_for_Mars_missions

http://www.slate.com/blogs/bad_astronomy/2013/02/28/mars_impact_the_red_planet_may_get_hit_by_a_comet_in_october_2014.html

ASTEROIDS + OTHER PLANETS + OTHER MOONS

<http://www.space.com/19905-dangerous-asteroid-deflection-paint.html>

<http://www.space.com/19930-asteroid-tracking-satellite-neosnat-launch.html>

<http://www.space.com/19933-asteroid-deflection-mission-aida-didymos.html>

<http://www.space.com/20086-mercury-map-nasa-messenger.html>

<http://www.space.com/20140-mercury-mission-messenger-spacecraft.html>

<http://www.space.com/20078-jupiter-moon-europa-ocean-surface.html>

<http://www.space.com/19925-jupiter-moons-spacecraft-instruments-selection.html>

ASTRONOMY + ASTROBIOLOGICS

<http://www.space.com/19915-milky-way-galaxy.html>

<http://www.space.com/19962-habitable-planets-binary-stars.html>

<http://www.space.com/20096-exomoons-habitable-alien-life.html>

<http://www.space.com/19610-exomoons-alien-planets-photography.html>

http://www.nasa.gov/home/hqnews/2013/mar/HQ_13-072_JWST_Mirror_Wings.html

<http://www.space.com/20263-life-on-mars-human-society.html>

EDUCATION + OUTREACH + INVOLVEMENT + MEDIA

http://www.esa.int/Our_Activities/Technology/Smartphone_app_turns_home_drone_into_spacecraft

GREAT SPACE VIDEOS

<http://www.space.com/20254-spacex-reusable-rocket-grasshopper-test.html>

<http://www.space.com/19920-mercury-color-video-messenger-spacecraft.html>

<http://www.space.com/20086-mercury-map-nasa-messenger.html>

<http://www.space.com/10223-xcor-flight-lynx.html>

<http://www.space.com/20144-dark-craters-of-the-moon-get-lit-up-video.html>

<http://www.space.com/20250-curiosity-finds-ancient-mars-habitable-opportunity-not-so-much-video.html>

<http://www.space.com/20247-watch-how-a-solar-panel-could-repel-dust.htm>

<http://www.space.com/19430-darpa-s-satellite-repurposing-program-shows-progress-video.html>

GREAT SPACE BLOGS

<http://lightyears.blogs.cnn.com/201>

<http://hobbyspace.com>

<http://moonandback.com>

<http://selenianboondocks.com>

<http://blogs.airspacemag.com/moon/>

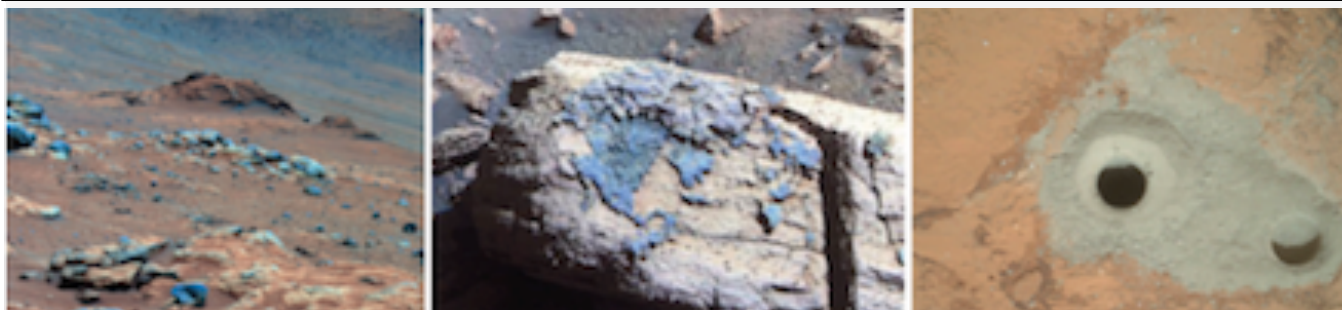
<http://spudislunarresources.blogspot.com>

<http://www.blogs.com/topten/top-10-space-blogs/>

<http://dsc.discovery.com/space/top-10/best-space-science-blogs.html>

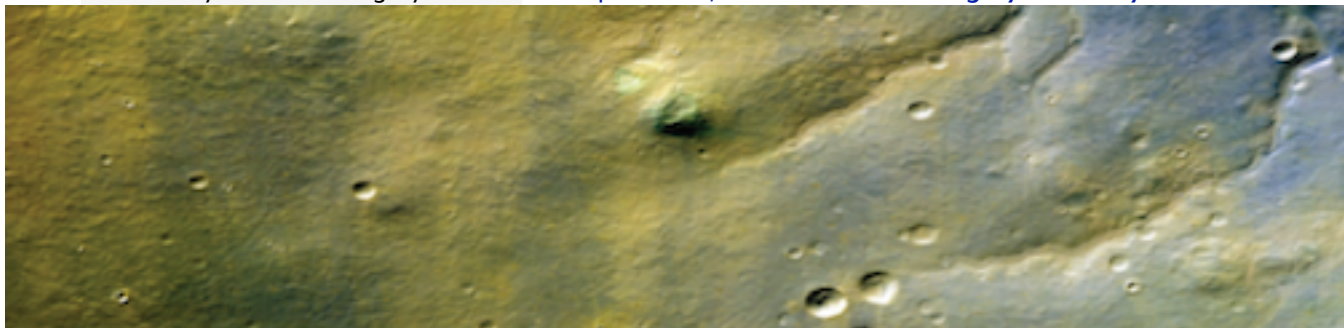
<http://space.about.com/od/computerresources/tp/blogsastropace.htm>

MMM PHOTO GALLERY #S 263+4

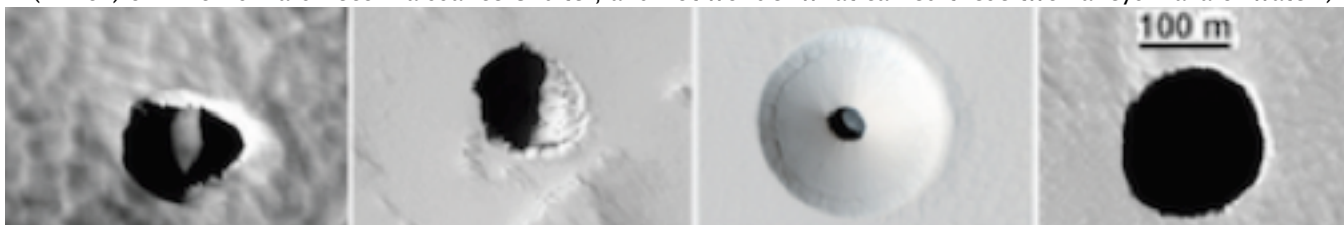


Will Mars' Pioneers collect "blue rocks" for color relief in rock gardens outside their homestead airlocks?

R: Curiosity's drill found gray below: www.space.com/19932-mars-color-gray-curiosity-rover.html



It is hard to look at this first false color image of Mars from the High Resolution Imaging Science Experiment (HiRISE) on NASA's Mars Reconnaissance Orbiter, and not wonder what carved these two valleys. Lava or water?)



<http://www.space.com/18519-mars-caves-lava-tubes-photos.html> – not all to the same scale

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AFD NEWS

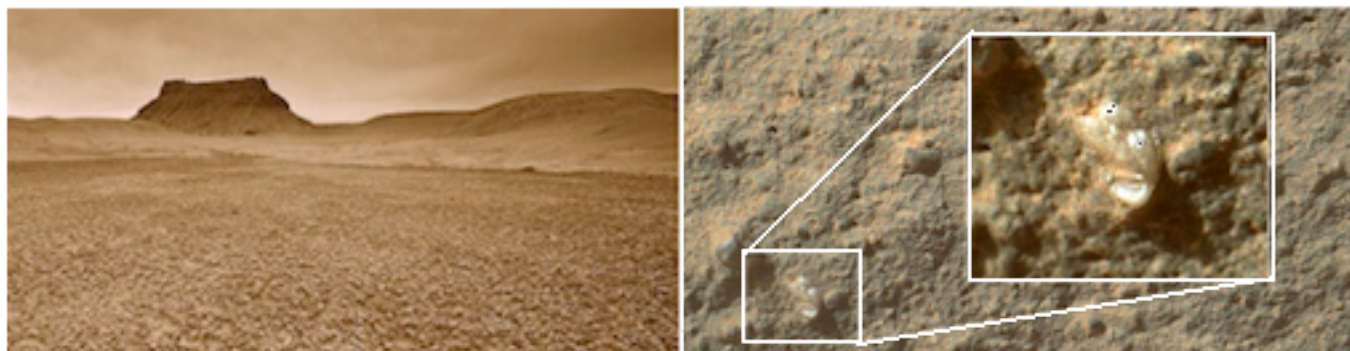
WORLD WATCH

SERVICE



JPL, PASADENA, CALIFORNIA On an alluvial fan area once flowing with liquid water, now with a possible aquifer below, Curiosity has found what scientists have playfully dubbed “dandelions” only to begin to suspect that the fun name may not be far from the truth. A study of the lack of dust drifts in any direction hints that these “whatevers” are not old and may be a seasonal feature, related to temperature and near-surface liquid aquifers. These “dandelions” could have roots reaching very deep below to tap that life-supporting resource. See Photo at left, below.

- 1) **orange/tan hued dandelions:** there is some minor color variation. All these objects have the same design, of leathery cactus like water retentive “spines” instead of leaves, closed to retain moisture, water-retaining sponge roots, and having evolved some kind of organic antifreeze.
- 2) A **sort of symbiosis** is evident here, with a **white** calcareous sheathed snail-like creature (in function, if not in appearance) feeding on the dandelions by tubes probing under the dandelion spines, withdrawing below at night and in winter.
- 3) The two life forms would seem to be the **backbone of a mini-ecosystem** with additional plants and animals providing ancillary roles. In other words, there must be a kind of ecology here, with the “dandelions and snails” being the visible part.
- 4) Neither Spirit nor Opportunity visited any areas where the climate and mineralogy and landforms were favorable to the dandelion-snail ecology.



Above Left: the “dandelion” fields from a distance. **Right:** “snail” example up close.



Marshall Mike Moondust and the Sinister Selenian Subterfuge

[MMM Fiction by George von Mond]

Chapter VII: “Stephen Sinn collapsed into his bunk after another hard day in the slusher bucket pits. The Lunar Guard had done an impeccable job creating a cover background that allowed Mike Moondust to get a job at Archaea Mines. Even with his improved musculature, courtesy of experimental nanomachines that had slowly knit him back together after he had “died,” the work in the pits was arduous.

Using a mining technique with a long-proven record on Earth, a series of guide wires maneuvers a giant scoop at one end of a pit and then drags it to the other end. The Moon had introduced its own complications to the process with its much lower gravity and compacted soil from aeons of impacts. Adapting to local conditions, mining operations had introduced a few innovations.

First was the whisk, a rotating wire brush that scrubbed and loosened the regolith in front of the collection bucket. Without this the buckets would be perpetually jamming up on tightly compacted subsoil.

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

Next were the "elephant trunks" which bore an uncanny resemblance to the blunderbusses of yore. These were long electromagnetic hoses that workers would use to try to collect materials thrown loose in the collection process, mostly charged SWIEs (Solar-Wind Implanted Elements) disturbed from their long slumbers.

Last were the groomers, workers who wandered in front of the bucket in its slow progress to poke and prod rocks to loosen them, and otherwise watch out for things that could bind up the equipment. This was where the Noobs started, as in the minds of management it was a great way to determine if new workers had a survival instinct or not. Besides, it was cheaper to ship a body back to Earth after one month than pay it for a year or two of substandard work.

This was where "Stephen" was spending his days ñ pushing rocks. That and listening to his co-workers joke about his name. They were apparently mishearing it as "sin" and mocking him accordingly. No sense of history, those Earthers.

Still, he was making friends, and learning the layout of the Archaea Mines operations. He hadn't seen anything unusual yet, but he hadn't been here long. Unfortunately, he was also developing a rep as a bit of a goodie two-shoes, which he was going to have to do something about. The next step after that is narc, which would get him nowhere. Speaking of which, he could smell cannabis creeping into his cubicle. Sighing, he rolled his sore body out of his bed and headed for the corridor.

"Hey Steve-o, came the voice of another noob, Frankie Jones. "Looking for some fun? I thought you Loonies didn't do this sort of thing," he said as he took a long draw off a pungent "Brooklyn Blunt,"

"Hey, it's no fun if Sinn isn't involved," replied Mike. "We just like growing it and selling it to you Earther rubes. Lunajuana was one of our first profitable exports."

"It is good," coughed Frankie as he passed the blunt over to Mike. Mike eyed the clumsy amalgamation of cigar leaf and cannabis buds, and took a puff.

The next morning, Mike was up bright and early. He looked over his work suit carefully, and noticed a nick on one of his feed lines. Nothing that looked dangerous, but he decided to swap out for a new one. No sense taking a risk. After a double-check he headed out to another day's work in the mines.

In the slusher bucket pit, the Sun cast long shadows from the equipment and the occasional rock sticking out from the ground. The other members of his team were taking their places around the bucket as it slowly dragged to the apex of the bit, scooping large quantities of regolith into its maw before dumping it onto a conveyor that carried the soil into the processing facility. Over and over the bucket was dragged back and forth across the pit, digging deeper and deeper into the past of the Moon., uncovering new obstacles with each cycle.

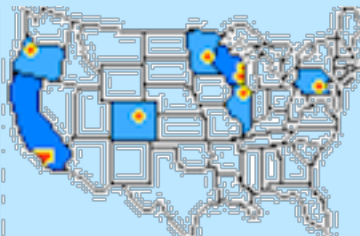
Mike kept himself well ahead of the bucket, levering up larger rocks and jabbing others to make sure they were loose. Glancing around he saw the other folks scattered around the pit. All of them were from Earth and lumbered unevenly in the low gravity. Most also steered well clear of the big bucket, but a few seemed willing to ignore the danger from the machinery, wandering perilously close to the whisk as it thrashed at the ground.

Frankie was one of those idiots, and just as Mike's eyes fell on him he saw Frankie flailing as he fell to the ground on his back. Flailing his arms helplessly he started screaming on the common frequency as he saw the whirling rods of death of the whisk bearing down on him. Mike paused - would he blow his cover if he saved his teammate? The massive machinery lumbered on, indifferent to the frail human in its way.

Next month **Chapter VIII**

MISSED PREVIOUS INSTALLMENTS? The whole series is now online, up to the latest issue at:
<http://www.moonsociety.org/publications/fiction/MMMSSS.pdf>

NSS Chapters that share Moon Miners' Manifesto



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

WISCONSIN



MLRS – Milwaukee Lunar Reclamation Society
 PO Box 2101, Milwaukee, WI 53201 – www.moonsociety.org/chapters/milwaukee/
Also serving SE Wisconsin Moon Society Members

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

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

✓ Our first ever “Yuri’s Night” party is set for the afternoon after, Sat. April 13th in our regular slot and place

WISCONSIN



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

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

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

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

NEXT MEETINGS: FEB 17 - APR 20 - JUN 15 - AUG 17 - OCT 19 - DEC 8 (SAT in Milwaukee)

CALIFORNIA



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

Members will soon be getting our new Membership Packets.

We are planning for our biggest annual event – Yuri’s Night Thursday April 12th

CALIFORNIA



OASIS: Organization for the Advancement of Space Industrialization & Settlement
 Greater Los Angeles Chapter of the National Space Society
 PO Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine: 310-364-2290 – Odyssey Ed: Kat Tanaka odyssey_editor@yahoo.com
<http://www.oasis-nss.org/wordpress/> - oasis@oasis-nss.org – Odyssey Newsletter www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd SAT monthly – APR 21 – MAR 19 – APR 21 – JUN 16 – JUL 21

Fri. April 12th 9 pm Yuri’s Night Los Angeles: “under the Space Shuttle Endeavor,” California Science Center

Fri. April 19th 7pm Sky Show & Lecture “How much would you pay?” John Drescher Planetarium, Santa Monica

Sat. April 20th 3 pm OASIS Board meeting: Home of Gareth and Lisa-Kaspin Powell, 3206 Summertime Lane #206, Culver City

ILLINOIS



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

COLORADO

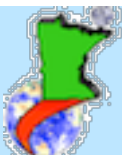


DSS: Denver Space Society fka Front Range L5

1 Cherry Hills Farm Drive, Englewood, CO 80133

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

MINNESOTA



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

OREGON



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

(LBRT - Oregon Moonbase) moonbase@comcast.net

Meetings 3rd Sat. each month at 2 p.m. - Bourne Plaza, 1441 SE 122nd, Portland, downstairs
 Regular Meeting 3 pm 3rd SAT monthly - APR 21 - MAY 19 - JUN 21 - JUL 16 - AUG 21

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 locations: Our next meeting will be at the Science Carnival on the Parkway, in Philadelphia, **April 20th**. On **May 4th** we will do outreach at the New Jersey State Museum in Trenton (Google them). On **May 11th** we meet at our regular location at the Liberty One Food Court, from 1 to 3 pm.

March 9th Meeting Report:

There was a lot of talk on various subject, including the effect of the sequester on NASA and the science community in general. We have a mixed group and some of our conservative members thought it was a bad move as did our liberal/progressives. However: there was a repeated call to consider privatizing major space operations (Rich Bowers talking point at several meetings) with the idea of making the corporation an offshore entity immune to this sort of crap being a major objective. The other topic that came up, and became part of the main meeting talk: making movies via the crowd funding route. Both Earl, and later Mitch, pointed out that there is a movie creation group that has successfully reached its funding goal+ and another group is planning one also. There are bound to be a number, and as Rich said and we mostly agreed with, they should be on the positive aspects of entering space. We have plenty of the negatives already.

Larry, our webmaster, pointed out that he has been in that position for thirteen years! His work has kept our presence alive on the web, from the initial adoption by him of the job, to the change from the old Liberty groups site, to the expansion that he produced for us into the areas of a blog, Facebook, Twitter, and portable viewing platforms. His most recent work has been to connect us to the Blossom donations network. As we are a 501c3 organization we are eligible for donations to support our outreach to the public and the awards we give for the James H. Chestek and Oscar H. Harris Awards. Larry asked that Mitch Gordon be our p.r. contact for this and he has accepted the job. Its' a good fit.

Dorothy brought much material on various activities at the museums since she, and Larry, will be unavailable due to other commitments in April. The Intrepid will be open and Women in Space will be one of the presentations in March. The Shuttle will be opened for visits again in early summer. The 3D movie "Space Junk" continues through June at the N.Y. Museum of Natural History. Lots of ongoing exhibits including those at the Hall of Science in Queens which will host the Makefest 2013 in September. Hank Smith is planning to go to the Balticon event in May, and, has brought us the first flyers for the November Philcon. It will be at the Royal Suites in Cherry Hill again. Principal speaker will be Allen Steele. He will help at the Science Carnival mentioned above.

Mitch brought details about the Science Carnival and our part in it: April 20 in the Non Profits Circle on the Parkway. The public will be allowed in from 11a.m. and 4 p.m. We set up around 10 a.m. and should be ready rain or shine. Mitch has two tables at the event for us and we should draw a crowd with Frank O'Brien and his Apollo Flight Computer (the real deal!). The next week we will be part of the Astronomy Day evening event, a Friday evening, and we will find out where our telescopes will be set up. He also brought the Spring issue of Ad Astra with Curiosity in the center fold. We go from our present achievement on Mars to our far future in the same issue: The 100 Year Starship Project is also featured with Dr. Mae Jemison, founder, being quoted and pictured. Many well known people, from scientists to entertainers attended this inaugural event. And much more on commercializing space (Dragons and Cygnus capsules for example) and S.P.S.. Get the magazine (by joining N.S.S.). And then there is the movies! Dorothy had brought the announcement of the Kickstarter funding campaign beginning last month, and, this month brought the word on the successful reaching of the funding goal. In fact: the film, by N.S.S., was oversubscribed! The title, from Dorothy's notes, is "Our Future in Space – A National Space Society Video," Yeah!

Janice brought in material about the recent Russian meteor strike and previous impacts, including Tunguska, and the near miss in February (inside the geosynchronous ring), and, the way the people in Russia were injured because of the timing of events surrounding the meteor strike: bright flash, people go to window, shock-wave blows in windows. She may have developed this herself. Dennis Pearson, our Region 7 and 8 N.S.S. Chapters Coordinator, told us that N.S.S. wants "us", the local chapters, to be part of "open assembly" meetings and be able to participate in events like the I.S.D.C. from our various locations. We discussed the possibility of using Skype or similar conferencing technology accessible to the general public. He has also posted a note on gathering ideas that may help improve the N.S.S. outreach efforts. He will help at upcoming events.

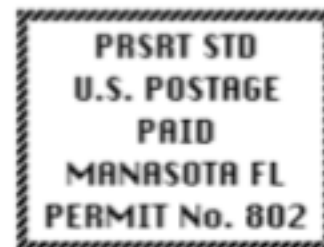
Earl brought a number of science and technology related material, but, the most important item is: The winner of the Oscar H. Harris Award is Erick Beck, a senior at The Philadelphia Academy Charter School. His research topic was "How Do Solar Flares Affect Radio Frequencies". The George Washington Carver medal recipient for 2013 was Dr. Sharon L. Haynie (at DuPont Company now). Besides working as a Chemist she does a number of educational outreach activities to promote science careers among young women and minorities. Other news: In NASA's Technology Briefs is an ad for Stratasys and it's products: 3D printers. Examples are given including components for a proposed Mars Rover that has elements created directly from the C.A.D. file description. Individualized prosthetic aids are also shown (think long term flights and assistive exoskeletons). In the "Who's Who" column on NASA employees we meet David Mitchell, who is project manager of the MAVEN program (Mars Atmosphere and Volatile Evolution spacecraft) which will study the upper atmosphere of Mars and it's changes over time. And more interesting material: "Using Combustion Synthesis to Reinforce Berms and Other Regolith Structures" where a specially designed material can be formed into sheets that are "fired" with the result being a binding of regolith and other materials into a crusty composite. Much description of what can be done with some details missing. See the NASA website (Techbriefs.com, under physical sciences). A very dense issue. Lots more but just two in closing: Analog for May has a report: "The Golden Age Comes to Seattle: Is Asteroid Mining Really Part of our Near Future?" by Dr. Richard A. Lovett. He points out that there are a number of good materials reasons for going out to the asteroids and that there has already been samples collected and brought back! This was by the Japanese asteroid explorer/rover Hayabusa in 2005. It returned in 2010 with only a few milligrams of material but we did get something. Further on he points out that NASA has a mission to launch in 2016 to collect several ounces of material. And the commercial mining plans of Planetary Resource and others include getting the platinum group metals, and, the stuff that habitats are made of, carbonaceous matter and water. A very good report with lots of footnotes and details on the subject, with long term supporter John Lewis (and author of "Mining The Sky" in the 90s) featured as an advisor to Planetary Resources.

And from N.S.S.: The NSS Downlink. The March posting has a large number of interesting items and places to look for more. This included the note that the movie funding mentioned above took only 24 days and was oversubscribed by over 50%. Much more...but "Inspiration Mars" is reported to be working towards a launch to send people out and around Mars (no landing this time), beginning in 2018, at the first window. The reasoning behind the private group doing this is the diminishing capability by the government to implement an aggressive exploration program in a timely manner. The mission will be 501 days long and two people will crew the trailblazing flight. **Note:** Thanks are due to Mike Fisher and Dennis Pearson for judging at the Fair, and, Nancy Peter of the Carver Fair, for critical last minute information. Thank you all!

– Submitted by Earl Bennett.

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

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