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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

#246 | JUNE 2011

The Moon may have as much water encapsulated in crystals as "315 Lake Superiors!" See pp 1-3.

Feature Articles in This Issue

Turtle-back Spacesuits & Suit-locks Revisited ➔

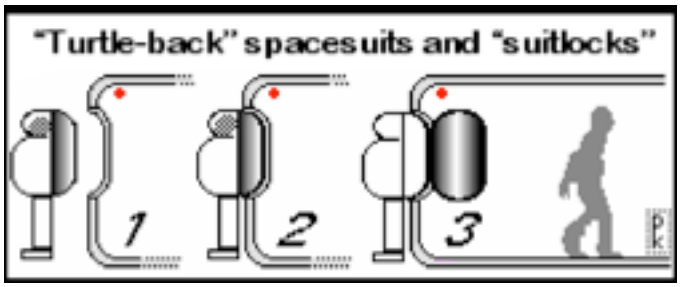
This is an option that makes so much sense, that analog stations like MDRS and FMARS and the proposed MMARS in Chile should be redesigned with "suitlocks" and mated suits to simulate it. This would provide ample opportunity to identify and work out any bugs.

www.moonsociety.org/images/changing/turtlebacksuit.gif

Video http://www.wimp.com/lunarrover/ See page 3.

IN FOCUS ◎ The Moon has 100 times as much water as previously thought

May 26, 2011 – "Researchers have measured for the first time water from the Moon in the form of tiny globules of molten rock, which have turned to glass-like material trapped within crystals." The data indicates the water content of lunar magma is 100 times higher than previous studies suggested. This magma extruded onto the lunar surface in lava sheets that filled major impact basins, creating the maria or "seas." [=> p. 2, col. 2]



Moon Miners' Manifesto

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• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first twenty years have been re-edited, reillustrated, and republished in 20 PDF format volumes, for free downloading from either of two locations:
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"; the early era of heavy reliance on Lunar materials; early use of Mars system and asteroidal resources; and establishment of 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.** MMM serves many groups, each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test. [Opinions expressed herein, including editorials, are those of individual writers and not presented as positions or policies of the **National Space Society**, **Lunar Reclamation Society**, or **The Moon Society**. **Copyrights** remain with the individual writers. Reproduction rights, with credit, are granted to NSS & Moon Society chapter newsletters.]

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• **The 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. LRS serves as the Milwaukee chapter of both NSS & Moon Society: http://www.moonsociety.org/chapters/milwaukee/

• **The National Space Society** is a grassroots pro-space membership 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; Ph: (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.

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√ CDs, DVDs, /or typed hard copy must be mailed to:
Moon Miners' Manifesto, c/o Peter Kokh,
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⇒ In Focus Editorial continued from p. 1.

The specific evidence was found in Apollo 17 sample 74220 "orange glass soil" which erupted onto the surface some 3.7 billion years ago. The findings were published in the May 26th issue of *Science Express*.

The implications are profound. The current theory of the Moon's formation from the debris of a giant impact of Earth by a "Mars-sized" body – the only way to explain the *apparent very low water content* of the Moon. But if the Moon's mantle contains one hundred times as much water as previously thought, then this impact theory loses a major argument.

It's back to the drawing board! This is not a surprise as various other bits of evidence have turned up that do not seem to be explained by the giant impact theory.

Three other theories, "daughter", "sister", and "wife" (the Moon was spun off from a bulge in a rapidly spinning Earth; the Moon was formed with Earth in its orbit, the Moon was captured by Earth) all have their serious problems. The giant impact theory was a surprise love affair with a concept previously put forth by the much-maligned Immanuel Velikovsky, who espoused such inter-planetary collisions in fairly recent times.

If a solution can be found that suggests that the formation of the Moon was by a process that should be fairly common, then the likelihood of other "earthlike" planets having sizable moons goes up. If, as in the giant impact theory, a fluke incident is involved, then our having a fairly large moon involves a high degree of chance. The implications are great for the number of Earth-like planets endowed with a major and close satellite that can serve as a springboard for a technological civilization becoming interplanetary.

If we are honest, and Earth had no major moon, but there were just asteroids and Mars. Our space program might have been delayed for decades and may have remained "unmanned." The Moon's prominence and proximity have played a pivotal role. Such favorable and unfavorable "coincidences" could have much to do with how far a technological civilization advances.

It has been apparent for some time that there are those who "want" or "need" to find that our Earth-Moon system is exceedingly rare or unique, for philosophical or religious reasons, and those who "want" or "need" to find that our Earth-Moon system is fairly common. The truth is probably something in between.

On a more practical and immediate level, if it can be shown that this encapsulated water content, protected from evaporation and/or sublimation, is true of mare basalt in general and not just of isolated violent volcanic episodes as opposed to common lava outflows that created the lavatubes and the lava sheets that layer upon layer created the "seas" or "maria" then, assuming we find a practical way to harvest this captive water content, the nearside maria will look even more attractive as the future major populated areas of the Moon.

The poles, in contrast, will be like Prudhoe Bay – a major pipeline source. [If there are abundant carbon monoxide or carbon dioxide ices as well in these polar cryogenic lodes, it would be simpler to produce methane CH4 instead, and pipe that to settlements elsewhere, then "burn" the methane with local oxygen to produce H2O water and CO2 carbon dioxide.] The point is that a

"lunar Prudhoe Bay" is not exactly where we would want to build "a Lunar Los Angeles."

Why we are so surprised

This tremendous reserve of water is something that we did not expect or suspect as it is not at all obvious from any remote analysis of the Lunar surface which appears to be thoroughly desiccated, moondust and rock and nothing more. This is the ultimate embodiment of the old proverb, "appearances can be deceiving."

That is because this water is *locked inside* "**in the form of tiny globules of molten rock, which have turned to glass-like material trapped within crystals."** Had this water not been so "locked up" in this manor, it would long ago have evaporated and or sublimed away into the lunar vacuum, then spread through space by the solar wind.

How can we tap these tremendous reserves?

Now the "64,000 dollar question" is how can we unlock this water in a mass production manner. It will take a lot of experimenting with an appreciable sample collection to work out **a practical, energy-efficient way to unlock this reservoir so that it can quench the industrial and agricultural thirst of a number of quickly growing lunar settlements.**

We will be watching with interest how this all plays out: just how widespread are these inclusions? And just how did the Moon form? The practical as well as the philosophical implications will be profound.

May 26, 2011 – remember this date!

One thing is for sure. Mars has now lost its major bragging point. The Moon emerges as "clearly, the most logical place to begin off-Earth settlement. The "Human Epic" journey from an African "world" to an "intercontinental world" to an "interplanetary world."

And Aldrin's "been there, done that" is disrobed as one of history's most superficial statements to date. It is clear, that as to the Moon, we have but scratched the surface. The direction of US space policy needs to be reversed.

PK

Lunar Water Find Analysis
"The Moon might have as much water as 315 Lake Superiors"

By David Heck – dheck01@yahoo.com

Boeing St Louis, Moon Society St. Louis

"What was recently thought to be billions of gallons on the Moon based on the LCROSS Lunar Impact at the south polar Cabeus crater, is now thought to be **Billions of Cabeus's** (=1E18 gallons, which I believe is quintillion (mill, bill, trill, quad, quint)

Lake Superior (largest fresh water lake in the world in surface area – Siberia's Lake Baikal is the largest fresh water reserve in volume) is 12,000 km^3 of water, which is: 3,170,064,628,300,000 gallons (3.1E15). I did NOT do the math. I used on-line conversion.

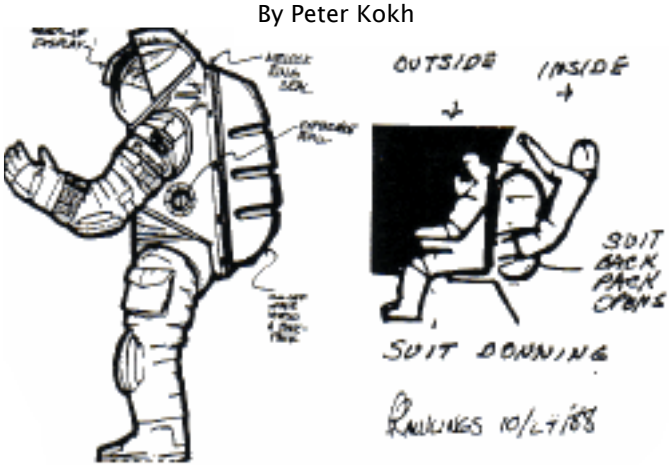
That would mean the Moon might have as much water as 315 Lake Superiors.

Each Shuttle launch uses 146,181.8 of LOX, and 395,581.9 of LH2 ~ 540,000 gallons.

1E18 gallons of water is about 1.85 TRILLION Space Shuttle External Tanks!! **DH**

Turtle-back Spacesuits & Suitlocks
Recent NASA Experiments

By Peter Kokh



VIDEO: http://www.wimp.com/lunarrover/

The suit demonstration is 6-7 min. into 10.3 min. video

Foreword:

NASA is now working to engineer a concept that seems to have originated with Pat Rawlings way back in 1988, and about which we have written several times since then: a minimal air-lock of which the spacesuit itself is an integral part.

We got the idea from a 1988 sketch Pat Rawlings did for the then upcoming made-for-TV science fiction movie "Plymouth" aired May 29, 1991. The concept did not make it into this movie itself, however.

From Past Issues of MMM

MMM #89, October 1995 "**Dust Control: Engineering Counter-measures – Suit-Locks**" – reprinted in MMM Classics #9 pp, 43-44

MMM #151 December 2001, p 3. "**Engaging the Surface with MOON SUITS instead of Spacesuits**– reprinted in MMM Classics #16 pp. 2-4

www.moonsociety.org/images/changing/turtleback.gif

"The idea behind this 'turtleback' or 'clamshell' suit is to avoid tracking moondust into interior spaces without the expense of sizable and complex 'carwash' airlocks. Ideally, the back of such a suit would include the back of the helmet as well. The wearer would back in to a conformally shaped dock, with the suit locking to it. The dock and the suit back would open together into the habitat space, and the wearer would reach up inside to a grab bar and pull him/herself out of the suit. The dock would close and the suit taken away for storage outside as in a dry cleaner rack. Very little inside air would escape in a very tight cycle process."

The whole idea is to conserve interior air by prevent wholesale exhausting into the exterior vacuum by the repeated cycling of airlocks. Not only do we need to conserve oxygen, though it is abundant on the Moon locked into the various minerals in moondust, but even more importantly, the nitrogen component: Nitrogen, of all the major elements needed to support life, is the least abundant on the Moon, present only as a solar wind component. In contrast to "turtle-back" suit-locks, inefficient airlocks would be more expensive to produce, and take up a lot more space. This last point is critical for vehicles from which egress to the surface is provided.

Differences in Rawlings/MASA version from our earlier suggestion

You will notice that in the Rawlings' version, the suitback does not include the back of the helmet; nor does NASA'x new experimental version. We personally think that this makes ingress and egress from the suit more of an acrobatic chore. The advantage is that the wearer can turn his/her helmet side to side, up and down. But with a wrap-around panoramic visor, the wearer's head could turn and tilt freely inside if the helmet was rigid, its back a part of the rigid suit-back.

But to see this concept finally taken seriously by NASA is very encouraging. It is a sea-change in suit design that is long overdue.

Stills from the video, showing step by step process:

two empty suits ride on back of rover

Inside suit-lock entrance at left, climbing in at right

From outside, astronaut getting into suit at right

astronaut extending arms into suit sleeves and gloves

suit back has closed, suitlock begins to close, closes

leftt: astronaut ready to leave porch – on foot right

The future of Space-suit design

Previous NASA manned rover research has been concentrated on unpressurized vehicles. But the clear need for more capable pressurized vehicles has forced major rethinking of air-lock concepts. To include the much larger "car-wash" type airlocks that included "de-dusting" operations and suit-storage, would greatly increase the size and cost of surface vehicles.

We predict that as these new suit-lock concepts are perfected, suitlocks will become the obvious choice for fixed moon bases and outposts as well. The plusses overwhelm the minuses:

- **vastly more compact**
- **conserves oxygen**
- **conserves nitrogen**
- **greatly reduces import of moondust in habitat and vehicle interiors**
- **greatly reduces size and mass and cost of vehicles**
- **requires standard backpack, while allowing personally tailored suits**

NASA's switch to this concept will instantly date all past depictions in art and film of what operations on the Moon and Mars will be like. **PK**

Could Some Lunar Lavatubes Be Hiding Valuable Resources? *Let's Speculate!*

By Peter Kokh with input from David Dunlop

Forward [Reprint of an article in MMM #44, April 1991]

For centuries we've realized that the Moon's surface was desert-dry. The first good telescopes had shown the great dark areas hopefully called "Seas" to be really dry low-lying plains (filled with a dry quicksand of dust, many wrongfully supposed). We took it for granted that the Moon had formed wet, as had Earth, and that it its low gravity was insufficient to hold on to its aboriginal atmosphere so that its waters had been lost to evaporation and ultraviolet disassociation.

The findings of the Apollo missions and follow-up studies of their precious hoard of Lunar Samples told another story. The maria seas were really great sheets of frozen lava with the upper few meters pulverized and gardened into a dust blanket (the regolith, a feature shared with highland areas). Moreover, nowhere was there to be found any relics or clues of a past wetter epoch. There is no rusted iron. In fact, even with a gross composition of 42-45% oxygen, the Moon seems under-oxidized. For what iron there is, is either FeO, ferrous oxide (a less oxidized state than our commonplace Fe2O3), or pure iron fines. Nor are there any hydrated minerals or clays, so common on Earth. The Moon had apparently formed hot and dry, quite unlike the Earth, perhaps from vaporized material cast off (but retained in orbit) following a major collision between the forming proto-Earth and a smaller but rival body forming at roughly the same distance from the Sun. One day we may know the 'rest of the story' but this is our current best solution to the puzzle.

What we have found instead, quite by surprise, is a non-negligible endowment of hydrogen atoms (1 ton in a football field sized area 1 yard deep - far less than in Earth's driest desert sands) adsorbed to the fine particles of the regolith 'top soil', apparently a gift of the Solar Wind which has been softly buffeting the Moon's surface for billions of years.

[skipped paragraphs irrelevant to argument]

Yet it has occurred to the writers that there is some possibility, indeed an appreciable chance that *vaporized cometary materials have been cold-trapped in places not exposed to the loss mechanisms of cosmic radiation and solar wind gusts. The greatest wave of comet bombardment of the Moon may have been in the formative era. But even in the past 3 plus billion years since the great impact basins were filled with runny lava, an appreciable number of comets (in episodic waves or not) may have impacted the Moon.*

The maria are not totally flat, but have a slow gradient, stepped by lava flow fronts, with highest elevations near the source(s) of the magma upwellings. *It is in these relatively higher regions of the mare seas that we expect to find lava tubes.* Very near-surface [and especially large] lava tubes would have collapsed, and it is probably their relics we see in the many sinuous rilles (like Hadley, visited by Apollo 15). *And we see winding 'rows' of rimless sinkholes, which would seem to indicate partially intact tubes a bit deeper below the surface. Here and there, a stray comet might have hit the jackpot, crashing through the roof of a lava tube and vaporizing. While perhaps most of the vaporized material would have escaped out of the impact crater, it is possible some fraction fleetingly pressurized the adjacent segments of the lava tube (too much pressure would only blow out the roof) long enough to freeze out as frost on its floor, ceiling, and walls, at a distance where they wouldn't have been heated by the thermal shock of the impact. Down here, there is no exposure to cosmic rays or errant wisps of solar wind. We may have won the Solar 'Lottery'!*

[skipped paragraphs irrelevant to argument]

The technical feasibility of deep-looking radar is quite real. Improvements on the radar that have revealed ancient river bottoms beneath dry Sahara sands, may someday reveal the existence and whereabouts of many near surface lava tubes in the lunar basalt seas. In our earlier article "Lava Tubes" in MMM # 25 APR 1988, we stated our belief that deeper lava tubes may lie in subsequently buried early lava sheets. Many of these may have been later filled and plugged, but some few could remain void. But whatever the case, only near surface tubes could have been entrusted with this gift of the comets. Will such improved deep-looking radar find a few unmistakably ice-walled lava tubes as well as the more common bone-dry ones?

If so, will the frost layers be so diffused and thinned out on the inner surfaces of these voluminous hollow sanctuaries that, scientific treasure trove or not, they won't be economically recoverable? That's a possibility. The history of space development scenarios and speculations has been heavy on overly romantic expectations. Despite the dashing of many naive hopes, from hydrated minerals on the Moon, to lichen covered fields on Mars, the promise of a human-settled inner solar system rooted in the use of extraterrestrial materials, spring-boarding from Earth's ever growing energy thirst, is still concrete enough to keep us planning ways to work with the grain of nature off planet.

Ice encrusted cavernous tubes on the Moon may or may not be found. But if we don't find any, it will be a matter of bad breaks only. Until we've checked our ticket stub, we can't dismiss the not-so-unfavorable odds that we've won this Solar Lottery! < MMM >

Twenty Years Later – Revisiting the Question Lavatube Ice Reserves?

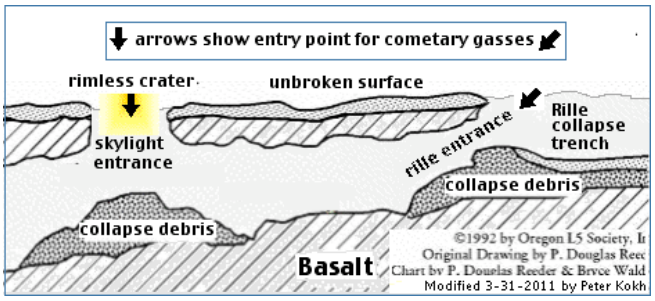
Most of us, I suspect, imagine these underground lairs to be nothing but barren, and somewhat boring caverns whose main value is their capacity to shelter extensive human settlements and all the activities that go with it.

Two decades ago, I wondered aloud (in MMM #44 bulk of text reprinted above) if it might just be possible, however low the odds, that a comet small enough not to obliterate a tube, but large enough to penetrate its ceiling with a precise hit, against very high odds, and vaporize with the cometary ices freezing out on the tube's inner surfaces, waiting hundreds of millions of years for some intelligent explorer-settler to discover this treasure. I dubbed such a comet strike "winning the cosmic jackpot."

But now we know that objects, probably small astrochunks rather than comets (but who can be sure?) have penetrated lavatube ceilings in several places on the Moon. And it occurred to me, that even if none of these

penetrators was cometary in nature, the very presence of an opening might invite cometary vapors from a nearby strike to wander in, and take up abode. After all, this is how much if not most of the ice deposits in permanently polar craters slowly built up. Comets can strike anywhere at anytime, The sun and the solar wind will work to blow those gases away from the Moon. But if a comet strikes on a part of the Moon experiencing nightspan, and some of the vapors spread to the polar regions before the Sun rises, they are sequestered in these polar cold traps.

Now Chandrayaan-1 and Lunar Reconnaissance Orbiter data both show intact lava tube sections that open onto rilles, the collapsed remnants of once extensive tube sections. These entrances could also be penetrated by cometary vapours.



NOTE: The age of skylight collapse pits could be consi-derably younger than most rille collapses, thus skylight cometary volatile sequestration should be much less rich on the average than rilleside tube entrances. The former are easier to find at low-res, the latter requiring high-res for confirmation and even for original notice.

But there is a catch to this idea. When it first occurred to me, 20-some years ago the "word" was that we expected the temperatures inside intact lunar lavatubes to be on the order of 80° K, -193° C, -315° F. ***But that may not be the case.*** There is good reason to believe that lavatubes should be of a temperature that we would expect at that depth below the lunar surface.

Now during the Apollo missions. We probed the surface to a depth of 2 meters, not far, but far enough to suggest that at that depth, the temperature was fairly stable no matter whether the surface above was experiencing full dayspan heat or bone-cracking nightspan cold. While we did not really probe deeper, other evidence suggests that as we go down deeper, we should reach a point at which residual heat from the lunar interior balances any neat heat loss to space over the dayspan-nightspan cycle.

Polar craters are different. *They are permanently exposed to the heat sink of cosmic space at a few degrees above absolute zero.* Lavatubes are not so exposed, so they will not have cooled down below the temperature prevailing in the surrounding rock

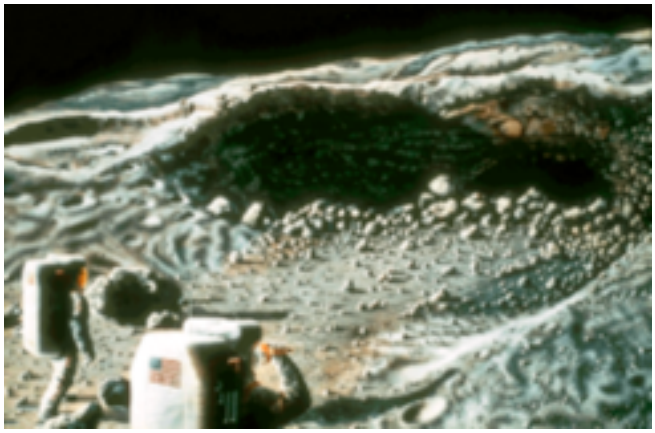
I put the question to ***Dr. Alan Binder***, Principal Investigator for the **Lunar Prospector** mission 1998-9, and received the following prompt reply:

"As I state in [my novel] MOONQUAKE (p 170), the temp at 1 meter depth in the regolith is (in the equatorial regions - it will be somewhat colder at high latitudes) -20° C, is essentially constant, and the gradient in the regolith is 1 to 1.5° C/meter via Apollo measurements. Thus at the bottom of a typical 3-5 m deep mare regolith layer the temp is about -15° C.

"Now, the Apollo conductivity measure-ments were made in the outer couple of meters of the regolith, i.e., not even to the bottom of the regolith, but, we know from the passive seismic measurements that show that the P-wave velocity of success-ively deeper layer increases dramatically as a result of the decrease in brecciation of the mare basalts with depth. Thus, the thermal conductivity must increase and the thermal gradient will decrease with increasing depth.

"But right now, we do not know how much. Clearly, the deeper a lava tube is, the hotter it will be -- but right now we have no good data to tell us the gradient. Lets say a tube were 100 meters deep and the gradient is 0.1° C/meter, the tube temp would be say +5° C. But as you can see, until we know the latitudes' depths and the temperature gradients as a function of depth, this is just a game of rough estimates."

This argument explodes the previously heard expectation that Lavatubes would be cryo-environments, cold enough to preserve refrozen cometary ices indefinitely.



The classic Pat Rawlings painting above shows astro-nauts gazing at such an entrance, which as collapsed rubble or talus, will be challenging to traverse in order to get inside. Now we know that they won't need ice-picks or iceskates!

Oh how reality has a way of dashing one's favorite expectations. If cometary ice were available at lavatubes far from the Moon's poles, the prospects for early settlement in those areas would have been much brighter.

As usual, simpler understandings give rise to expectations that are dashed by more complete knowledge.

What about volcanic gasses?

We now know, or suspect, that lunar volcanism may have been far wetter than previously expected, that the Moon did *not form "bone dry."* So in lavatubes that remained plugged at both ends, could there be trapped volcanic gasses of economic value? Sulfur, carbon, nitrogen, and hydrogen oxides? In a world where the key elements of organic chemistry are extremely scarce, such underground reservoirs or gastraps could be game changers.

Now to be fair, we can't yet pinpoint the location of lavatubes that are wholly intact, only those that have

been compromised by skylight collapse pits or rille collapses. But even in these tubes open to the outside vacuum, if there had been some volcanic gasses, there might be residual traces left that could be detected and analyzed by sophisticated equipment.

This is certainly more than just an interesting question, it is one of potential great economic significance. On the downside, the surrounding basalt is likely fractured, allowing some slow seepage of such volcanic gasses to the surface to be blown away by the solar wind. But in cases were seepage has been at a minimum, what kind of pressure (and desitiy) might we expect? Could some such deposits be of economic significance? We will never know if we never probe further.

Volcanic gases on Earth:

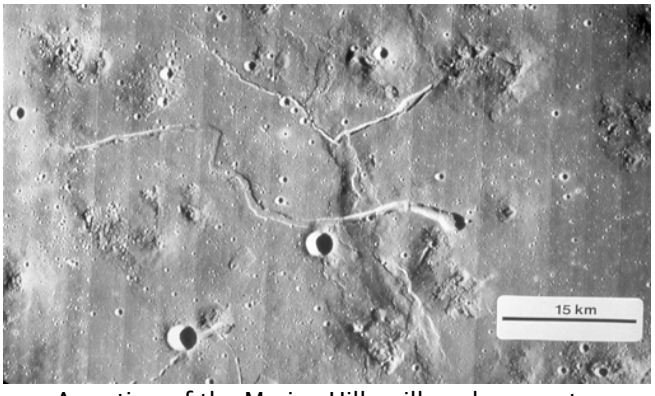
The principal components of volcanic gases are water vapor (H_2O), carbon dioxide (CO_2), sulfur either as sulfur dioxide (SO_2) (high-temperature volcanic gases) or hydrogen sulfide (H_2S) (low-temperature volcanic gases), nitrogen, argon, helium, neon, methane, carbon monoxide and hydrogen. Other compounds detected in volcanic gases are oxygen (meteoric), hydrogen chloride, hydrogen fluoride, hydrogen bromide, nitrogen oxide (NO_x), sulfur hexafluoride, carbonyl sulfide, and organic compounds. Exotic trace compounds include methylmercury, halocarbons (including CFCs), and halogen oxide radicals.

The abundance of gases varies considerably from volcano to volcano. However, water vapor is consistently the most common volcanic gas, normally comprising more than 60% of total emissions. Carbon dioxide typically accounts for 10 to 40% of emissions.

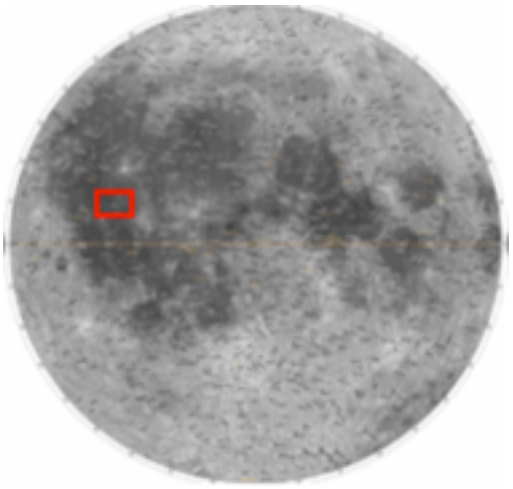
http://en.wikipedia.org/wiki/Volcanic_gas

Now until recently, the prevailing dry-Moon hypo-thesis strongly suggested that there would be no water, water vapor, or hydrogen in lunar volcanic gas. But given the findings of Chandrayaan-1 and other recent probes, this expectation has turned on its head. But without any experi-mental evidence we have no idea how "humid" lunar volcanic gases may be.

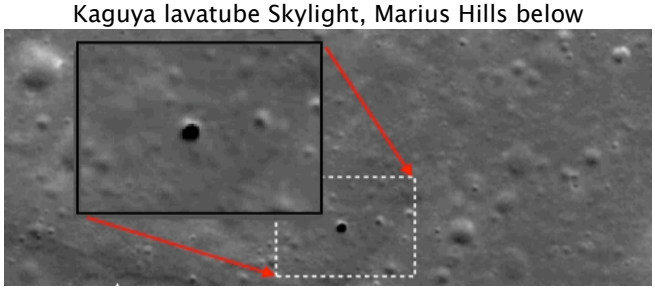
Instead of turning its back on the Moon, one would think that the agency would be working diligently on a mission to probe the Marius Hills area of Oceanus Proccel-larum, the "Ocean of Storms" where there is much evidence of past volcanic activity, a number of suspiciously volcanic "domes", and a confirmed lavatube skylight!



A section of the Marius Hills: rilles, domes, etc.
Location of the Marius Hills, next column top



Kaguya lavatube Skylight, Marius Hills below



What are people in Washington thinking? But we already know that the political process is rarely moved by reason. Rather by "how many jobs will it bring to my district?" or "How will this help my re-election chances?"

What's at Stake

At present, these are just interesting questions, and it is frustrating, that even if the Obama Admini-stration had not altered NASA's course, that the agency had no specific plans, at least none announced or even proposed in the public domain, to begin any kind of lavatube exploration. Why? NASA is driven by scientists rather than by potential settlers, and a determination of resources of economic value to settlers is of little interest to many if not most of them. This is a case of impatient shortsightedness, as there will be far more science done on the Moon if it is settled, by the settler population, than will ever be done by scientists from Earth, returning to Earth, laying no foundations., only interested in pubishing arcane papers.

The Good News

There is a trade-off and something in our favor. If Lavatubes were truly cryogenic environments, heating settlements and factories and agricultural areas within would be a major challenge. That they are nonetheless below room temperature is also good. All human and industrial activities create heat, and if these tubes were any closer to room temperature, we would have a major problem in shedding excess heat.

So while we may not find much ice, if any within these voluminous "Hidden Valleys" and maybe precious little in the way of volcanic gases (we expect this to vary widely from tube to tube so it's definitely worth exploring them all) we are still blessed with a world well-endowed with these spacious pre-shielded environments that will make "settling in" on the Moon in a major way much more feasible. Again, it is the nearside maria, not the poles, where the bulk of Lunans will live and work. **PK**

Most Popular Souvenir from the Moon?

By Simon Cook

Now wait a minute! Bringing home a try of moon dust with one's boot print sintered in to keep the shape forever is going to be expensive. While it would cost much less fuel to bring such a thing back home than to bring something of equivalent mass to the Moon, it will still cost extra fuel and something this large might not be part of your "allowance." (Unless you earn points by being "underweight" in the first place! Hmmm?)

As proud a specimen and souvenir as a real boot print would be over someone's mantle, few will be able to fork up the cash. And a photograph won't quite do it.

Here is a compromise idea. A bootprint, yours, is scanned in 3-Dimensions on the spot, along with its surroundings, say a 1 foot by 2 foot area. You take the scan home with you on a CD (or its successor medium) or have it sent home to you by email. On Earth, a company takes the scan and faithfully reproduces your bootprint in your choice of media, some more expensive and realistic than others, and you have this as a faithful copy, fixed dimensionally so that it can't be disturbed or lose the fidelity of shape and detail in any way. Now you can hang it over your fireplace or plasma screen without any dust coming off, as the trophy it is.

Here is one way companies on Earth can cash in on early lunar tourism, perhaps offering a vaiety of moon dust simulant for the cast. And that day is coming sooner than you think. If Space Adventures doesn't sign up a $150 million dollar tourist for the second seat on the Russian Soyuz first loop-the-Moon tour, Space-X might beat them to it with lower prices.

Of course, you will come home with photos and videos as well! But your recreated 3-dimensonal boot print would be special. **SC**

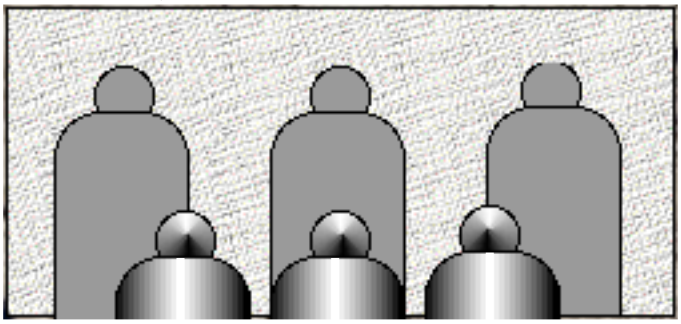
How to go for a nice Walk on the Moon
And not get lost!

By Peter Kokh, Wisconsin Northwoodsman

May 17, 2011 outside Florence, WI – This morning my 9-year old "alley" shepherd (va)Nessa and I went for a long walk along a dead end country road, facing east towards the sun, but then returning through the woods west-bound. While we were walking back through the woods (Spring is best, before the trees are too leafed out, so that the sun gets through), it occurred to me that my Northwoods instincts might work on the Moon.

Always keep the sun to your back
and follow your shadow.
You won't get lost or go far astray!

Now on the Moon, the "Dayspan" is 14 and 3/4 of our 24-hour Earth days long. So my advice is to pick a destination towards the west (WSW-W-WNW) for an early morning walk (1-4 days after sunrise) and towards the east (ESE-E-ENE) for a late afternoon hike (1-4 days before sunset)



Now to return, if you don't want to wait a week or more until the Sun-angle is just right for following your shadow, you can follow your bootprint trail – if – and this is a very big "if", you walked through "virgin" territory, and there are no other boot-prints but yours. But that's risky, as someone may have crossed your path since you made it, and then you could get confused. It is better to wait to follow your own shadow!

Dress for comfort

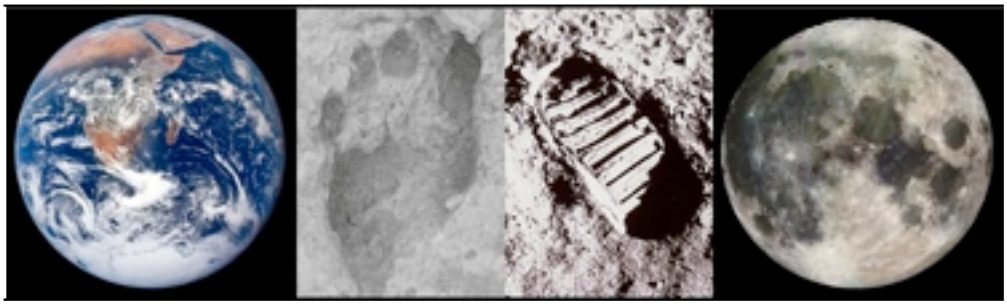
Don't wear a NASA-Apollo suit *designed for maximum fatigue in the minimum amount of time.* The traditional "spacesuit" combines two separable functions in one garment: (1) maintaining breathable air pressure, (2) protecting from thermal extremes and punctures from sharp rocks and from the constant dust-particle size micrometeorite rain. Instead, a **mechanical counter-pressure "skinsuit"** will allow you to breathe and yet move your arms and legs much more freely. Then don **a *loose* outer suit** with the same layers as an Apollo suit, to provide the needed puncture resistance *without encumbering motion and tiring you out prematurely.* Then with water and air supply, you should be able to walk at ease for many hours, thoroughy enjoying your sense of freedom during your walk on the Moon, "as if you were at home on Earth." What an achievement!

[See **MMM # 238** Sept 2010, pp. 4-5
"**A Fresh Look at the Spacesuit Concept**"]

Now as to bringing your dog along, in an equally comfortable 2-part suit, he or she might get frustrated, as bending down to sniff rocks but unable to sense any odor will disappoint and confuse them. And for a male, trying to lift a leg and mark his territory will only make one leg of his suit very, warm and wet. Maybe in time he would stop trying. *Maybe a custom-made fitted urinal bag? Hmmm! I smell a lunar patent!*

Yes, there are many areas of the Moon that are very boring, especially out on the maria (Tranquility Base) but areas in the highlands or along highland-mare coasts, or along rilles and scarps could be pleasantly scenic. And just knowing that you are the very first human to pass that way could be especially rewarding (look, ma, no bootprints but mine!) Not all humans enjoy a quiet walk in a nature setting all alone, communing with nature, with themselves, while deep in thought. But perhaps you are one of those like me, for whom there is a special bond with the raw outdoors and nature, best enjoyed alone, even though we may want to share this experience with another *on a return trip!* **PK**

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



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

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 & utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to individuals and organizations which 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 Who We Are

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, in the effort 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

Moon Society Meetings Calendar

www.moonsociety.org/about/2011_meetings_calendar.jpg

Highlighting our Roving Ambassador

David A. Dunlop, Director of Project Development

By Peter Kokh, President

Dave Dunlop is a native of Oak Park (Chicago) Illinois, but now lives in Green Bay WI.

He has been a close friend & "companion in crime" of mine since we met on August 19,1989 at a NASA feed for the **Neptune-Triton Encounter** in Menasha, WI

When Dave retired, he asked me to "put" him "to work in The Moon Society!" We had already collaborated on many projects such as **LUNAX**, so I thought that Dave could help on those projects that I had introduced but had no time to advance. "Give me a title," said Dave and "**Director of Project Development**" is what we came up with. Since then, Dave has been the Society's only staff person and an unpaid one at that, operating on his own dime, not only in the above capacity, but as our roving ambassador as well. Dave spends many weeks, months each year actually, going to conferences, talking to scientists. researchers, movers and shakers, including our own Moon Society chapter people around the country.

Together we worked on the **University of Luna Project**, introducing the Society's "**University of Luna Awards**" of which four were given at the Huntsville ISDC this past month. Together we brainstormed and introduced the **MMM-India Quarterly**, "M3IQ", worked on the **Moon-Mars Atacama Research Station Project**. Dave has taken our **Solar Power Beaming Demo display** with him to many conferences. And has supported me in countless endeavors.

Without Dave, also a regular contributor to MMM and M3IQ, the Moon Society would not be where it is at. And, Dave has been cultivating a working relationship with Ken Murphy, most likely to be our new President as of the August 1st tally of the ballots. ***Thanks Dave!***

May 11, 2011 Town Meeting Report

By Peter Kokh

First my abject apologies to all would-be attendees for failure to post timely notice of this meeting in the April and May issues of MMM. We are taking steps to make sure that notice is given in a timely fashion in the future: in MMM, by email to ALL members (current and former) and elsewhere.

These meetings, except for the first, 2 years ago, held on the ASI-MOO, have been held on Skype, and discussion is free-wheeling and without agenda, except as after the first Tow Meeting when we conceived of a Town Meeting Project, the **Apollo** [11 – 40th Anniversary] **Moon Party**, which despite much brainstorming, never happened, but that's another story. The Town Meetings are open to everyone.

At this most recent meeting, members and non-members took part. Peter Kokh (host), Paul Banyai (candidate for Vice-President), James Gholston, Jason Tuttle (current VP candidate for Board), Keith Henson, Charles Radley,

TOPICS: Keith Henson led the discussion which focused on his major interest: innovative transportation technologies that have the potential to *significantly reduce the cost per kilogram of transportation to GEO.* Keith compared the rocket equation to that of compound interest working against us. His main focus at present is on the UK Skylon Project *(image p. 14),* and the use of laser heated hydrogen for the second stage that has the incredible exhaust speed of 9.8 kilometers per second.

We also discussed the status of the Lockheed Martin VentureStar, which the company has kept alive after NASA lost interest. Next we looked at the status of power beaming demonstrations, and which nations are most motivated to explore orbital power satellites: probably Japan India. Thorium reactors also came up. The Moon has ample thorium 233 reserves that can be processed into fissionable U-232 in breeder reactors. Peter Kokh has suggested that should the transport of fueled nuclear engines or devices through Earth's atmosphere be forbidden by treaty, this lunar resource could be the source of nuclear rocket fuel. Ships so powered might be the only way to really open the Mars frontier and the outer solar system in general as this is the only realistic way to cut down travel times considerably. Once again, the Moon becomes the key to the future.

Then we discussed the impending shutdown of the Allen Telescope Array right when it's most needed. Meanwhile the 500-meter Aperture Spherical Telescope (FAST) being built in China, and it will dwarf Arecibo.

There was some dissatisfaction expressed with using Skype as our meeting space. We can expect further discussion on this. There is parallel dissatisfaction expressed by some Society Officers and Directors with continued use of the 16-year old ASI-MOO environment for Management Committee and Board Meetings. With major changes coming with the current election, we can expect this topic to be addressed later this year.

Paul Banyai asked what possible means might exist to get ASI functioning again. Peter Kokh pointed out that Artemis Society International was a proprietary corporation and reviving it was not a legal possibility. He pointed out that the start of a similar effort has been made: OpenLuna.org (assistance welcome!) **PK**

Don't Forget!

√ July 1st Deadline for entries to our

Space Tourism Essay Contest

http://www.moonsociety.org/reports/space_tourism_contest.html

http://www.moonsociety.org/publications/moonscapes/2011/moonscapes7.html

A new "Artemis Project?"

Open Luna Foundation – OpenLuna.org

By Peter Kokh

"The Open Luna Foundation seeks to return mankind to the lunar surface, and to do it in such a way that is is accessible to everyone. Our research will be Open Source and one of our specific aims is to reach out to the community and educational systems to spread interest, enthusiasm, and involvement."

The OpenLuna effort is spearheaded by Paul Graham, who was Peter Kokh's commander on MDRS Crew #34 in 2005, a year before Moon Society Crew #45.

A current project is a Lunar Agricultural analog project near Guelph, Ontario, in connection with the University of Guelph. ***Explore!***

Are you a retired person twiddling your thumbs, looking for something to fill your days with a sense of achievement?

One frequently hears a senior remarking that he or she is busier than ever, but doing what he or she always wanted to do but never had time for, and while not getting paid for it, enjoying his/her new life very much. That is certainly the case with myself. I have on occasion been offered post-retirement work for "good money" and my response has always been the same: "you could not possibly pay me enough money to make up for the loss of my free time."

If you are retired, this may not apply to you. You may already have much of your time structured with family duties or post-retirement employment.

But if you find yourself watching too much TV or playing to much golf, or without satisfying hobbies, you might want to consider looking into what you could do for the Moon Society. Send us a list of your qualifications, as well as of your interests, and we will see if there is some way you can fill a part of your free time (up to you) in a way that you find fulfilling and that will advance the work of the Society.

We have announced many projects only to see them whither on the vine for lack of "team members" to help in one way or another to make these project ideas become a reality.

Yes, we very much need many more younger members, but retirees – *we need you too!*

Getting the Most out of Your Membership

Yes, you get **Moon Miners' Manifesto** ten times a year. If you get the pdf file instead of the hardcopy, do you download it when you get the notice that it is ready?

If you get the hardcopy In the mail, do you know that *you can also* download the color-packed PDF file as well? If you have checked the hardcopy preference, you do not lose your right to download the PDF version.

Further, while you may have a collection of hard copy MMMs since you joined the Society, by going to http://www.moonsociety.org/members/mmm/ and using your Moon Society username and password, you can look at all the MMM issues from #145 forward (the past ten years since we began producing the electronic version). If you don't know or remember your username and password, email me at president@moonsociety.org and we will get you set up.

You can also access past pdf files of Selenology from our affiliate American Lunar Society at:

http://www.moonsociety.org/members/selenology/

The Space Chapters Hub
A Tool for Moon Society Chapters

http://nsschapters.org/hub/

"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

Attention Moon Society Chapter Leaders
Attention Moon Society Outpost Leaders

This site packed with resources for chapters of space organizations is something I created to fill a promise I made as chair of the NSS Chapters Assembly some ten years ago. While it hasn't been updated in the last few years, it is packed with information, suggestions, and examples to help chapter leaders grow their chapters and to make them more effective in many ways. Here are some of the key info-packed pages:

- Chapter Handbooks
- Meetings and Agendas
- Newsletters
- Project Menus Unlimited
- Events Calendar
- Publicity & Media Contacts
- Political Contacts
- Educational Contacts
- Annual Report Tutorials
- Growing your chapter
- Other Chapter Activities
- Chapter Scrapbooks
- Downloadable Flyers
- Transparency sets
- Slide sets
- PowerPoint Presentations
- Display blueprints
- Models & Exhibits
- Chapter-made Videos
- Speakers Bureau
- Space Conferences
- Science-fiction Conventions
- Website templates
- Move, Create free web site
- Image Libraries
- Automated images
- Web site assistance
- Web Sales
- Website Director Express Demonstration
- Merchandise

Please make use of these resources made to help you!

The *American Lunar Society* connects people interested in observing the moon, whether arm-chair enthusiasts or seasoned researchers, through its journal, ***Selenology***.

For a one year membership, make checks for $15 US payable to: Andrew Martin, American Lunar Society, 722 Mapleton Rd., Rockville, MD 20850.

Check out our websites:

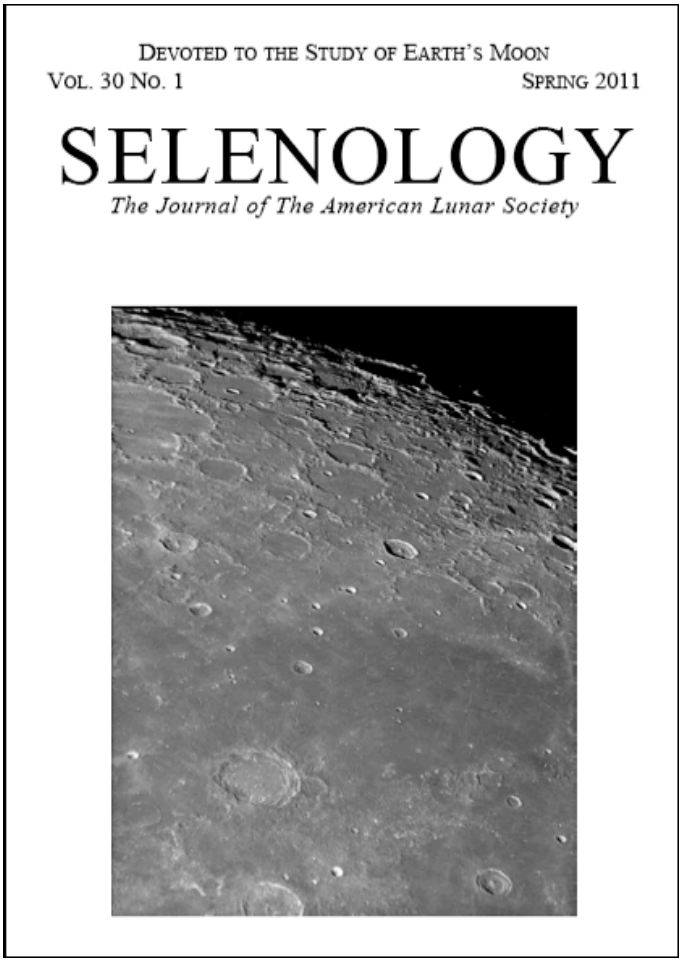
http://eselenology.offworldventures.com/

http://www.amlunsoc.org/ (currently being revamped)

Issues of ***Selenology*** can be freely downloaded by Moon Society members using their username and password at:

http://www.moonsocety.org/members/selenology/

Sample cover:


DEVOTED TO THE STUDY OF EARTH'S MOON
VOL. 30 NO. 1 SPRING 2011

SELENOLOGY

The Journal of The American Lunar Society

The Moon Society and The American Lunar Society have been mutually affiliated, since 2005.

Programs? See: www.moonsociety.org/reports/certificate_report.html

Chapters & Outposts

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>
Next meetings – Dec 16th, Jan19th, Feb 16th
Meetings 3rd Wed monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

Our May monthly meeting was on Wednesday the **18th** at the Buder Branch Library, was attended by Dave Heck, Bob Pery, Dabney Tolson, Karl Strassman, Tom Kullman, Mark Rode, Dave Dietzler, and Jim Merriman.

Dave Heck reported on the efforts of the Pacific International Space Center for Exploration Systems (PISCES) at the University of Hawaii-Hilo. Research is being done by NASA, JAXA, ESA and CSA (the Canadia Space Agency)in the lava fields, land very similar to the lunar maria. **The intent is to evolve into an International Lunar Research Park (ILRP), on the moon.** Dave met Professor Schowengerdt of PISCES at the NASA International Lunar Research Park Workshop earlier this year. Dave represented Boeing at the workshop and talked about his participating in Boeing's research and development being done at the Advanced Manufacturing Research Centre (AMRC) at the Univ of Sheffield, England. Dave showed us several slides from AMRC and PISCES including a video from a PISCES events a year ago.
http://www.bigislandvideonews.com/2010/02/05/video-hawaiis-lunar-like-mauna-kea-hosts-space-tests/

The next day, Bob Perry, Jim Merriman, Steve Massey, and Wesley Garener began their attendance at the 2011 International Space Development Conference. Bob purchased DVDs of the speakers at the Friday Lunch (Dr. Paul Spudis - Lunar and Planetary Science - "Goals"), the Saturday lunch (Adam Harris - SpaceX & the Future), and the Saturday supper (Jeff Greason - Xcor) and will show them over the next several chapter meetings.

Moon Society Phoenix Chapter

http://www.msphx.org
Contacts: Craig Porter portercd@msn.com
Chuck Lesher: chuckmiester999@yahoo.com
Meeting the **3rd Saturday of the month**
Moon Society Phoenix' next meetings are on
Saturdays **June 18th, July 16th, August 20th**

At LepreCon, the first weekend of May we scheduled five panels and two demonstrations. The panels, were of various success, the "Disaster Strikes Panel" went well, The "Lunar Surface Transportation Panel" was so-so because I left my slide show at home thinking it was in the equipment at the Out Reach Table, but other than that it was alright, The "Industrialization of the Moon" panel needed more preparation but did well considering the circumstances, Don's Panel went well, but the two demonstrations had to be canceled because of unforeseen circumstances, Vehicle malfunction and a lack of a second monitor.

We demonstrated the **teleremote racing** from the Out Reach Table and had people stopping by the entire weekend taking a look and commenting.

We had all but two members present for the monthly meeting and all were active in critiquing the panels and demonstrations. We felt that the presentations were fairly critical for their preparation and delivery and content. We agreed to develop Power Point programs of all of the panels and place them on the chapters upcoming web site for anyone to download and use, as long as the Phoenix Chapter is credited with them. Other Chapters may also upload programs that they develop for others to use as long as proper credit is given.

We are still discussing the new web site and I think that we are leaning toward resurrecting our old site and including our "Tranquility Community College" section for the use of the presentations we develop, both Power Point and standard Audio-Visual presentations.

We are interested in finding out how to get standard Topographic Maps of the Lunar features so that we can develop dioramas of various Lunar features, 100' to 100 Meter elevation steps are acceptable, even 1000 meter steps if that is the only ones available.

Don **Jacques** has published a new Book, **"The Homestead Project",** it is pamphlet sized. It is available through AZ Publishing Services, LLC, Scottsdale, AZ. www.azpublishingservices.com

Moon Society Houston Chapter

http://www.moonsociety.org/chapters/houston/
Contact: Eric Bowen eric@streamlinerschedules.com

The Clear Lake Area NSS and Moon Society Chapter met on Monday evening, **May 16**. Aside from routine chapter business, we also discussed the upcoming **ApolloCon** science fiction convention which will be held at the Intercontinental Airport DoubleTree Hotel on June 24-26. Two of our members, Marianne Dyson and Larry Friesen, will be featured guests at the convention. We hope to pass out brochures and promotional material for outreach to the fan community. Any interested Moon Society members who are thinking about attending ApolloCon are encouraged to contact Marianne at marianne.dyson@nss.org in advance.

The next regular meeting of the Clear Lake Area chapter will be at 7 p.m. on Monday evening, **July 18**, 2011 in the conference room of the Bay Area Community Center in Clear Lake Park; 5002 NASA Road 1; Seabrook, TX 77586. Come by and see us there! --Eric H. Bowen

Chapters & Outposts Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

===== Moon Society Outposts =====

www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society Nashville Outpost – Central Tennessee
Contact: Chuck **Schlemm cschlemm@comcast.net**

Bay Area Moon Society, CA Outpost – South Frisco Bay
http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net
Informal meeting at Henry Cate's home in San Jose
The 4th Thursday every month

Milwaukee, WI Outpost (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com
The monthly Lunar Reclamation Society meeting on the 2nd Saturday afternoon every month serves MSMO also

< End Moon Society Journal Section >

GREAT BROWSING

SPACE TRANSPORTATION

www.colonyworlds.com/2011/03/**cheap-interplanetary-travel-via-water-powered-rockets**.html

http://www.**popularmechanics.com**/science/space/rockets/**tech-behind-new-spacex-falcon-heavy-rocket**-5518955#ixzz1KRTNQ7Ee

http://sg.news.yahoo.com/**nasa-offers-200-million-gas-station-demo-space**-123601173.html

Vostok: an aerospace classic
http://www.thespacereview.com/article/1821/1

Space-X Falcon to allow more science missions
http://www.thespacereview.com/article/1846/1

COMMERCIAL SPACE

Canadarm may be used on commercial stations
http://www.ctv.ca/CTVNews/SciTech/20110419/canadarm-spacecraft-110419/

ASTRONAUTS

http://www.usatoday.com/tech/science/space/2011-05-05-**astronaut-corps-evolves**_n.htm

http://www.foxnews.com/scitech/2011/05/08/**robonaut-humanoids-space-program**/

EARTH

http://www.spacedaily.com/reports/**The_Importance_Of_Being_Magnetized**_999.html

THE MOON

http://www.timescolonist.com/technology/**Astronaut+billion+plan+mine+moon**/4718531/story.html

Lunar Wasystations: which is better: L1 or L2?
http://www.thespacereview.com/article/1808/1

Case for Tidal Capture of Earth's Moon April 16, 2011
http://wh-magazine.com/issue-printer/what-s-happening-magazine

RESOURCES

http://mwcnews.net/focus/analysis/9477-**the-race-for-space-solar-energy.**html

MARS

www.spacedaily.com/reports/**Are_You_A_Martian**_999.html

http://www.colonyworlds.com/2011/04/**the-key-towards-mars-is-deimos**.html

http://www.theregister.co.uk/2011/04/21/**musk_mars_dragon_claim**/

http://science.slashdot.org/story/11/04/22/189202/http://science.slashdot.org/story/11/04/22/189202/**The-Space-Station-As-a-Simulated-Mars-Mission**

http://dalje.com/en-world/**orbiter-makes-mars-atmosphere-discovery**/354023

http://news.softpedia.com/news/NASA-Studies-**Three-Proposals-for-major-2016-Mission**-198821.shtml

Imagining silicon based life forms on Mars (1976)
www.spaceref.com/news/viewsr.html?pid=36549

Curiosity's 3D camera nixed: won't be ready
http://www.msnbc.msn.com/id/42275969/ns/technology_and_science-space/

Book Review: Martian Summer
http://www.thespacereview.com/article/1833/1

Future Mars Astronauts to Report Live via Internet?
http://news.discovery.com/space/internet-evangelist-connecting-the-solar-system-110511.html

OTHER PLANETS

http://news.softpedia.com/news/NASA-Studies-**Three-Proposals-for-major-2016-Mission**-198821.shtml

ASTEROIDS & COMETS

http://www.space.com/11556-**earth-asteroid-flyby-2005yu55.**html

http://news.softpedia.com/news/NASA-Studies-**Three-Proposals-for-major-2016-Mission**-198821.shtml

ASTRONOMY – OTHER SOLAR SYSTEMS

http://www.spacedaily.com/reports/**Titan_Like_Exoplanets**_999.html

http://www.space.com/11420-**alien-planets-radio-aurora-exoplanets**.html

http://www.space.com/11627-**alien-planets-rogue-interstellar-extraterrestrial-life**.html

James Webb Telescope launch delayed to 1918
http://www.spacenews.com/civil/110412-**jwst-launch-2018.**html

Allen Telescope SETI Array mothballed – no funds
http://www.scientificamerican.com/blog/post.cfm?id=budget-crunch-mothballs-telescopes-2011-04-24

SPACE STATIONS ISS

www.spacebridges.com/S3-blog-English/bid/60420/S3-infos-**ISS-international-terminal-in-the-sky-historic-moment-this-week**

http://spacefellowship.com/news/art25556/**station-crew-marks-10th-anniversary-of-robotic-arm-s-launch.**html

www.businessinsider.com/**china-space-station**-2011-4

TECHNOLOGY

http://sg.news.yahoo.com/**ideas-wanted-100-starship-project-darpa-nasa**-122201770.html

Beyond Cubrsats, way beyond!
http://news.yahoo.com/s/space/20110429/sc_space/shuttlelaunchtocarryexperimentalcrackersizesatellitesintoorbit

http://www.colonyworlds.com/2011/03/**what-off-world-farms-need-are-termites-and-ants.**html

http://www.sify.com/news/**mars-spacesuits-unmanned-rover-tested-in-spanish-mining-desert**-news-international-lfepughhegd.html

SPACE TOURISM

http://www.space.com/11477-**space-tourism-options-private-spaceships.**html

http://www.tgdaily.com/space-features/55784-**moon-tourists-to-get-more-living-space**

OTHER SPACE AGENCIES

http://spacefellowship.com/news/art25564/**india-puts-three-satellites-into-orbit.html**

UK Space Agency launches in Swindon
http://www.bbc.co.uk/news/uk-12879219 (with video)

UK space given boost from Budget
http://www.bbc.co.uk/news/science-environment-12833654

ESA and the advantages of the Collective Approach
http://www.thespacereview.com/article/1843/1

FUTURE DREAMS = http://www.worldof2001.com/

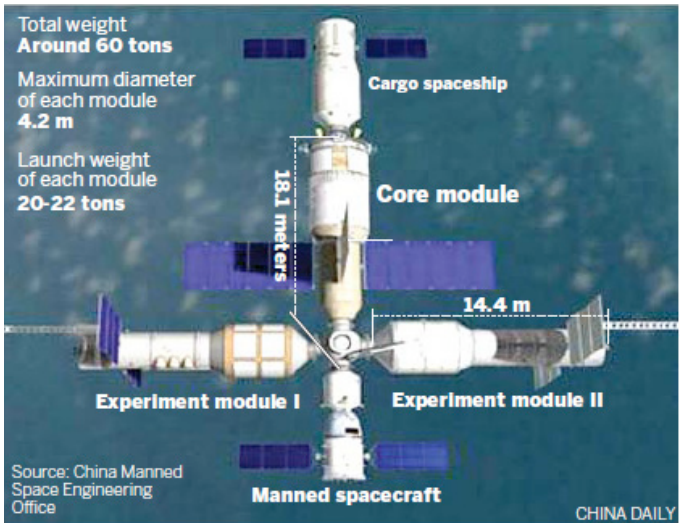
FICTION

http://listverse.com/2011/03/17/**10-things-you-probably-dont-know-about-star-trek/**

http://www.avclub.com/articles/**spaceracism-is-bad-and-17-other-notsosubtle-lesson,**27462/

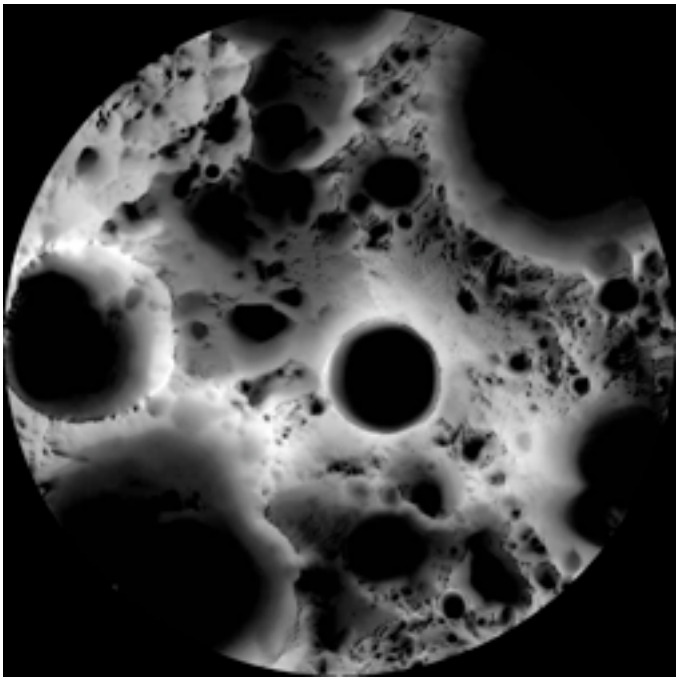
http://io9.com/#!5781358/**are-we-ever-going-to-use-antimatter-to-drive-a-starship**

MMM PHOTO GALLERY

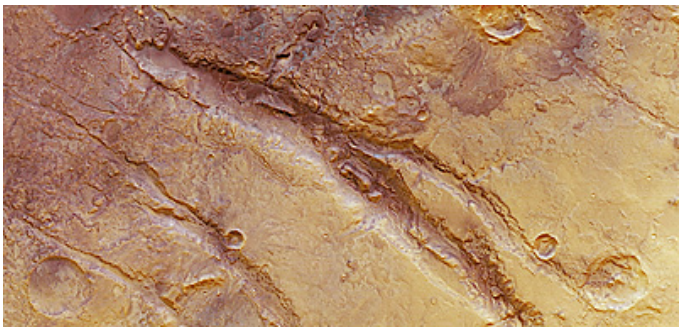


Design Plan for China's Space Station 2020

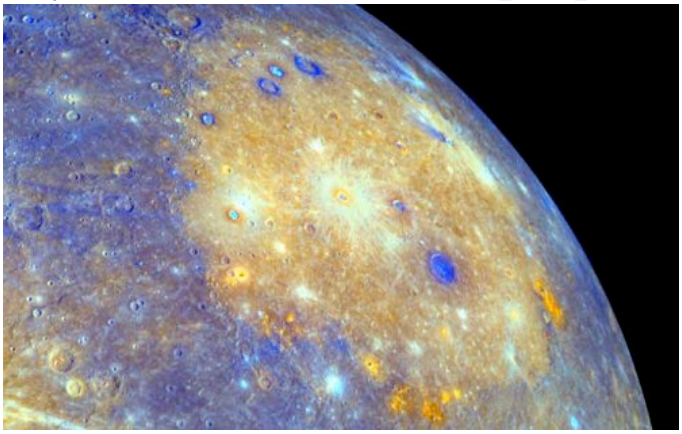
A model of the station impresses viewers: at 60 tonnes it will be less than half the 137 tonnes of MIR in its final state, and only a 7th as massive as ISS (now 419 tonnes)



Shadows over the Lunar South Pole – to appreciate this, go to: http://apod.nasa.gov/apod/ap110423.html



500 m deep fractures on Mars
http://www.esa.int/esaSC/SEMT4TZ57NG_index_0.html



Above: A color image of the Caloris basin and adjacent regions. Orange hues inside the Caloris basin rim mark features thought to be volcanic or basaltic. Science/AAAS

Artist rendering of Reaction Technologies Skylon
http://www.tgdaily.com/space-features/56170-skylon-spaceplane-gets-esa-approval

JAXA's Fukishima Rover Concept

Where would you put a Capital City for the Moon? And why?
What should you name it? And why?

That's what Luke Kursar (Perth, Australia) and Peter Kokh (Milwaukee, WI) were asking each other, when they decided to open this discussion to our readers.

Help them write this article for an upcoming issue of Moon Miners' Manifesto. It's simple: send an email to mmm@moonsociety.org with "**Capital City Luna**" in the subject line. We will post your suggestions and give you credit for them, then Luke and Peter will each toss in their own 2 cents worth.

If this exercise gets good response, we may ask for your input on topics for other future articles.

http://sandiegospace.org/2011/05/20/win-your-own-piece-of-mars/

Win your own piece of Mars!

A prize that is out of this world…

New Scientist Magazine will offer one lucky winner their very own piece of Mars! All you have to do is tell them **in no more than 140 characters what you think the first person to set foot on Mars should say.**

There will also be great prizes for 9 runners up who will each win a copy of Colin Pillinger's autobiography 'My Life On Mars' and a Beagle 2 mug.

What would you say if you landed on Mars?

Everyone is familiar with the words relayed by Neil Armstrong when he stepped off Apollo 11's lunar module and onto the moon itself: "One small step for man, one giant leap for mankind." New Scientist is looking for something even more memorable or funnier that you think the first man or woman to set foot on Mars should say. *Enter on webpage below.*

www.newscientist.com/marscompetition/login

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, which will complete its "first" 25 years with the November issue, MMM #250.

SO NO MMM NEXT MONTH – JULY

The Homestead Project,
12 Steps to a Permanent Lunar Settlement

www.weaversofdreams.com/FreeRead.php?lnTitleId=179

By **Donald Jacques** (Moon Society Phoenix Chapter)

"Whether looking at Earth orbit, the Moon, or Mars, humanity will someday settle space. In this volume, I take a minimalist approach, much like those of the early colonists to America; and the intrepid travelers who undertook the westward migration of the United States in the 1860's. Asserting that colonists to space will face many of the same constrictions in weight, and technology, this handbook builds a foundation for survival in almost any hostile, planetary environment."

Print Book $ 1.99
Instructions: go to
http://www.azpublishingservices.com/BookStore.php
Select Author Donald Jacques,
Click "submit"

The Homestead Project is the last selection of 4 works by Don.

Moon-Loop Tourist Tour Update

An artist's conception shows a Russian-built propulsion module and habitation module at left, linked up with a Soyuz spacecraft at right to create a complex designed for flying around the moon and back to Earth.

http://www.tgdaily.com/space-features/55784-**moon-tourists-to-get-more-living-space**

According to Space Adventures, the firm that is arranging for two tourists for this trip at $150 million each, this habitation module will offer **18 cubic feet of interior space** for the crew of 3 on a 7 day long loop-the-Moon trip featuring a close pass over the farside never visible from Earth.

Besides the 7 day round trip to the Moon, the crew will get to spend 10 days at the International Space Station. The habitation module will come in handy there as well, as all berths aboard the station may be taken.

The three, two tourists and a Russian pilot, will be the first humans beyond low orbit in over 4 decades. It is hoped that the trip will take place by the end of 2015.

- The customer who has signed up already plans do more than just gaze out the window.
- Anderson wouldn't get into the specifics. He said only that the mission "is something that is going to address *an issue and a concept that is of great importance to the world.* It will be some-thing that captivates a lot of people, I really do look forward to our ability to announce that."

Design the Habitation Module Interior!

18 cubic meters = 23.85 cu yds = 644 cu ft

- **Assume inner dimensions** of 7' diam, 17' length (c. 654 cu ft)
- **Consider** features and facilities: berths; toilet; food center; entertainment (note:
- **Look at** what features are in various ISS hab modules: remember this tour is about a week long, much shorter than many astronauts stay on ISS.
- **Send us your design** for this module interior-mmm@moonsociety.org "Habitation Module"
- **Deadline August 15th (for MMM #247 Aug 2011)**
- **MMM will publish the best design(s)** and send them all to Space Adventures

Relevant Reading for Design Ideas

Cf. MMM Classics #3 pp. 4-8

"**Sooner than you think Lunar Overflight Tours: The Fight of the A.F. Jules Verne"**

[First published in MMM #21, December 1988]

Download from:

www.moonsocieety.org/publications/mmm_classics/

14th Annual International Mars Society Convention

"Mars, The Next Frontier"

August 4-7, 2011

Embassy Suites Grapevine Dallas, Texas

https://sites.google.com/a/marssociety.org/www/home/membership/convention

Convention Rates:

	Members	Non-Members
Full Convention + Banquet)	$150.0	$210.00
Student/Senior (- Banquet)	$40.00	$70.00
Banquet (adult)	$50.00	$50.00
Banquet (child)	$25.00	$25.00

Registration will be on the website soon, until then please Contact Patricia Czarnik to Register for the convention.
patt@marssociety.org

HOTEL: The **Embassy Suites Hotel** located in **Grapevine, Texas** will offer a first-class setting for the Convention. Grapevine is a thriving community in the DFW Metroplex, and **is in close proximity to DFW International Airport**.

With **complimentary airport shuttle** provided by The Embassy Suites hotel, attendees can enjoy the conference without the expense of a rental car.

Thw room rate of **$119.00** includes a cooked-to-order **breakfast buffet** and a **reception each evening**. To book your room, call **972-724-2600** and identify yourself as being with the Mars Society Convention.

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

2011 LRS OFFICERS | BOARD* | Contact Information

PRES. / MMM Editor – *Peter Kokh **NSS**
kokhmmm@aol.com 414-342-0705
VICE-PRES. Doug Armstrong **NSS** 414-273-1126
SECRETARY – *James Schroeter **NSS**
James_Schroeter@excite.com 414-333-3679
TREAS./ Database – *Robert Bialecki
bobriverwest@yahoo.com 414-372-9613

LRS News

● **At our May 14th Meeting:** We discussed options for our summer field trip and decided to tour the **Milwaukee Metropolitan Sewerage Facilities** on Jones Island, **Saturday August 13th.** Peter had toured this facility some 20 years ago and at that time got to go down into the deep tunnel (through Silurian age rocks 550 million years old) some 300 feet below the surface. Whether tours still include the tunnels is not known. .

● **Plans for LRS 25th Anniversary coming up:** Seems like we just had #20! Where does time go? One thing is for sure: we aren't calling it quits like Oprah! No details were decided, but this will be a topic for the June 11th meeting, our last before September 10th

● **Dave Dunlop goes to ISDC 2011 in Huntsville:** Peter did not go this time, in part out of protest against the-rank-and-file-unfriendly high registration rates. Above all this annual NSS conference should be for NSS members, not just for professionals!

LRS Upcoming Events
Saturdays: 1-4 pm

June 11th – Sept. 10th – Oct. 8th

No meetings in July or August as usual

LRS Meeting, Mayfair Mall, Garden Suites Room G110

www.moonsociety.org/chapters/milwaukee/meetings.htm

AGENDA: ● What do we want to do *special* for our 25th Anniversary/Christmas Party this coming Dec. 10th?
- One suggestion is that everyone bring his or her favorite kind of 12" **Pizza** to share.
- As for the feature Sci-Fi film, the recent comic UFO alien flick "**Paul**" may be a great choice *if* it is out on DVD by then. We could get "Spaced Invaders" but that would not be as special. Apollo 18 is not out yet and is very unlikely to be o DCD on time.
- We briefly discussed a "special location" but that would cost money and confuse many who come to this annual special meeting.

News & Events of NSS "MMM" Chapters

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

OREGON

Oregon L5 Society

P.O. Box 86, Oregon City, OR 97045

voice mail / (503) 655-6189 -- FAX (503)-251-9901

[http://www.OregonL5.org/]

Allen G. Taylor allen.taylor@ieee.org
Bryce Walden moonbase@comcast.net
(LBRT – Oregon Moonbase) moonbase@comcast.net

* **Meetings 3rd Sat. each month at 2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, downstairs
June 18th – July 16th – August 20th

MINNESOTA

Minnesota Space Frontier Society
c/o Dave Buth 433 South 7th St. #1808
Minneapolis, MN 55415

David Buth (w) (612) 333-1872, (h) (763) 536-1237

Email: info@mnsfs.org

www.mnsfs.org/

MN SFS Research & Development Studies & Links
http://www.mnsfs.org/studies/index.html

MN SFS Education Resources
http://www.mnsfs.org/education/index.html

The Works Balloon Launch of BHALDI III & IV _See the world from space!_May 7th, 2011
http://freemars.org/mnfan/TheWorks/2011-05-The-Works-Balloon-Launch/
http://freemars.org/mnfan/TheWorks/2011-05-The-Works-Balloon-Launch/2011-05-07-034.jpg

Ben's Pics of MN CBA Springcon
http://freemars.org/mnfan/MCBA/2011-SpringCon/

ILLINOIS

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

Larry Ahearn: 773/373-0349 LDAhearn@aol.com

WISCONSIN

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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.net
>>> DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020
[http://www.tcei.com/sss/]
• We meet the 3rd Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI
August 18th - October 20th

Our December Meeting will be held as usual conjointly with the Lunar Reclamation Society in Milwaukee, Saturday, **December 10th** – Annual Christmas Party

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113
http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings 6:15 PM on Tuesdays
June 14th – July 12th – August 9th – September 13th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

PENNSYLVANIA

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

• **PASA** Meeting location and dates: Our next meeting will be at the Liberty One Food Court, between one and three p.m., on **June 11th**. *We have not set a July date.*

The PASA Report for May 2011

Super Science Weekend at the new Jersey State Museum! "We" where invited to exhibit at this annual family oriented event and had a great crowd! In addition to the swarms of children, we also had a number of teenagers and young adults, interested in the optimistic future that our visions represent. Visions? Yes, because we talk on going to various places and different areas of interest.

I had brought the popular Lunar Lava Tube display that resides in a large transparent storage container, which is great for talking about living on the Moon, and Mars, with a number of talking points that can be done from this relatively compact display. I use that to lead in to how we had been rather conservative on the size of available tubes, and diverged, for a moment into more science and the use of the laser altimeter and how the true size of one of the tubes was discovered. I had assumed that many in the New Jersey audience knew, from going to New York and seeing, the size of the Empire State building. This turned out not to be as true as I thought, so I had to explain just how tall it was, over 1000' plus radio masts, a number of times while pointing out that it would fit in a tube found via the altimeter.

The idea of having such large spaces ready made sparked a number of imaginations! And, I mentioned, they are on Mars too! I had several handouts that described the reasons that at least some of our habitats should be put in these locations and a number of other things. I have created several hand outs on transport in space, and up from, and down to, planetary surfaces and other objects, prizes for space and other research, and science and thought. And, of course, various neat little demo items that included powering L.E.D.s with a solar panel (after figuring out the right connections with people watching). And then there was other great stuff that Mitch brought and the rest of our crew did!

The ever-popular Gravity Bricks where enjoyed by a number of children, with Mitch initially handling visitors for this and all of his great exhibit/outreach material. He was later joined by Dotty and Larry, who assisted with that exhibit, the Mars Globe and Rover sites (past, present, and near future), and the Mars Rover and deployment platform model, contributed by Dennis Pearson (who came later and discussed this and space exploration and the work of NSS on getting us "here"), and the other fun things that people interested in space exploration and habitation do; like travel to actual launches and museum events, planetarium shows, and science and technology exhibits in general.

And, of course, Science Fiction Conventions (like Balticon at the end of May). In addition Mitch brought a number of free copies of Ad Astra, which all went, a number of ISS bumper stickers/ decals, which also went, and other material given to promote the hopeful future mentioned before. There was a major sized rockets display from another group in the exhibit space with us, and the head of that visited Mitch's' display, and our other displays, several times during the day for ideas and to kibitz on public outreach. However, the crowds where more or less continuous, so we seldom got away from our area. The Museum had free bagels and coffee for the

exhibitors early on, and later brought us parched speakers bottled water! Great!

Also: We had a visit from Michelle Baker, who took pictures (posted to our webmaster Larry and Peter Kokh of Moon Miners) and cheered us on. This was fun, and we reluctantly tore down while visitors where still coming. But since the tables we used where about to be folded and put into storage we had!.

Since this was also our meeting for May we talked, a little of upcoming events: Dotty brought material on several events, including the about to happen (but postponed untill May 16th) Endeavor launch, the anti, and, dark matter instrument to be put into the I.S.S., the fact that Gabrielle Giffords, wife of Commander Mark Kelly, was well enough to go to the launch after the assassination attempt earlier this year on her. And Mitch is now looking for a publisher for his first work of fiction. Go, Mitch! *Submitted by Earl Bennett*

CALIFORNIA

SDSPACE.org

San Diego Space Society
http://sandiegospace.org/
info@sandiegospace.org

Meeting the 2nd Sunday monthly
Next Meetings: Oct. 10th, Nov.14th
2:30 to 4:30 pm
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

Alliance

The San Diego Space Society is a chapter of the National Space Society. As part of our mission to encourage space exploration and science education, we partner with other space and science organizations–both local and international–to assist them in reaching students and space enthusiasts in the San Diego area.

The Mars Society

The San Diego Space Society also serves as the local chapter of The Mars Society, a global organization founded to further the goal of the exploration and settlement of the Red Planet. For more information on Mars Society activities in San Diego, see our Mars Society page.

The Moon Society

SDSpace is a Partner Chapter of the Moon Society – an international non-profit educational and scientific foundation formed to further scientific study and development of the moon.

San Diego Air and Space Museum

SDSpace has worked with the San Diego Air & Space Museum and it's Education department for many years now. We will continue to participate in and cross-promote each other's events. This further's each organization's goal of reaching out to San Diegans and enabling them to take an active part in local space activities.

Reuben H. Fleet Science Center

SDSpace recently formed an active partnership with the RHFleet Science Center and it's Education department. The partnership will enable unique opportunities of participation and support for each other's events.

CALIFORNIA

OASIS

OASIS: Organization for the Advancement of Space Industrialization and Settlement
Greater Los Angeles Chapter of NSS
P.O. 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 Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month

Next Meetings: Oct 16th 17th, Nov 20th, Dec 11th

Information: OASIS Hotline, 310/364-2290; website.

June 18, 3 pm – OASIS Board Meeting
Home of Greg Slaughter

July 16, noon – Anniversary Potluck Picnic
Polliwog Park, Manhattan Beach

August 20, 3 pm – OASIS Board Meeting
Home of Craig and Karin Ward, 1914 Condon Ave. Redondo Beach, CA

Sept. 17, 1 pm – OASIS Board Meeting
Home of Steve Bartlett and Tina Beychok, 7108 East Peabody, Long Beach, CA

Sept. 17, 3:30 pm – OASIS LECTURE SERIES
Cassini Lecture by Trina Rey, Location **TBD**

Oct. 7, 3:30 pm – OASIS LECTURE SERIES
"Not Just a Rocket Scientist", Location TBD

Nov. 19, 3pm – OASIS Board Meeting
Home of Steve Bartlett and Tina Beychok
7108 East Peabody, Long Beach, CA 90808

Nov 25-27 – LAX Marriott – LOSCON 38
"Where's My Flying Car?" Come join is for this annual science fiction convention. This year's theme is, of course, *SCIENCE*!

Dec 10, 3 pm – OASIS Board Meeting, Holiday Potluck to Follow. Home of Bob Gounley and Paula DelFosse, 1738 La Paz Road, Altadena, CA

Above all, listen first,
and listen patiently and at depth.
You cannot convert someone
if you haven't taken the pains
to learn what buttons to push.
Unknown author

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
PO Box 2102, Milwaukee WI 53201-2102

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- **$45 National Space Society dues** include ***Ad Astra***
- **$20** NSS dues **if under 22 / over 64.** *State age* ___

600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include *Moon Miners' Manifesto*
Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S. & Canada **$35** – Elsewhere: **$60**
P.O. Box 940825, Plano, TX 75094-0825, USA

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Member Dues -- MMM Subscriptions:
Send proper dues to address in chapter news section

=> *For those outside participating chapter areas* <=

- **$12 USA** MMM Subscriptions; • US **$25** Canada;
- US **$55** Surface Mail Outside North America

Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CHICAGO SPACE FRONTIER L5

- $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

- $15 low "one rate"

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 for all with MMM $25, due in March or $6 times each quarter before the next March

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SHEBOYGAN SPACE SOCIETY (WI)

- $15 regular, • $10 student,
- $1/extra family member

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