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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

199 OCTOBER 2006

Published monthly except January and July., by the **Lunar Reclamation Society** (NSS-Milwaukee) for its members, members of participating **National Space Society chapters**, members of **The Moon Society**, and individuals world-wide. EDITOR: Peter Kokh, c/o LRS, PO Box 2102, Milwaukee WI 53201. Ph: 414-342-0705. **Submissions:** "MMM", 1630 N. 32nd Str, Milwaukee, WI 53208; Email: kokhmmm@aol.com

In FOCUS Protecting the Budget for Robotic Exploration Missions

It is rather unfortunate that unmanned space exploration and manned space activities and programs have perennially had to fight for the same piece of pie. It is even more mischievous that the NASA budget and the Budget for HUD are forced to compete.

But even if these were all separate budget items, there would be a problem. The fact is that the war in Iraq has created a Black Hole in the American financial picture. It has long since swallowed up what promised to be a budget surplus, and forces the country ever deeper and deeper into a bottomless pit of debt. Alas, it is not in anyone's power to make that Black Hole go away.

What is especially insidious is that the present situation of pitting robotic and manned space programs against one another is that it divides the space enthusiast community into fiercely competing factions instead of a broad based alliance working together productively.

On the good side, NASA is finally getting around to seeing its mission clearly. The recently released **2006 Solar System Exploration Roadmap** for the agency's Science Mission Directorate states:

> "*A unifying theme for the exploration of our Solar System is **habitability** — the ability of worlds to support life. As living, self-aware, sentient entities, we seek to know whether life is or was present elsewhere in our planetary backyard, how we and our planet came to be, and what are the future prospects for terrestrial life on and off the Earth.*"

Highlighting the importance of this exploration focus, the roadmap states

> *"The Solar System Exploration program described here directly addresses the key science questions regarding habitability in the universe."*

Now clearly, findings of habitability prepare us for a methodical, step-by-step, buget-paced advance of human presence – outposts and settlements – beyond our home planet into our "hinterspace."

It is absurd for devotees of the manned space program then to begrudge and denigrate the value of a continued robust program of robotic exploration in the solar system at large. Long term, such an attitude would end up starving the very rationale of human expansion.

The Mars Robotic Exploration program has been in full swing, on an international front, for some time now, and should definitely continue in vigorous fashion. It should continue and, if anything, be more generously funded. So should the next large "flagship" mission (on a par with Galileo and Cassini) in the works for Europa.

And surely, the planned fleet of Moonbound NASA probes should, if anything, be enlarged. For our part, we should lobby to favor instruments that would help complete a pre-outpost "Economic Geography of the Moon," telling us where all the resources are, in detail, including topographic resources such as lava tubes and subsurface gas pockets, if any. [⇒ p. 2, col. 2]

The Post-human Moon

While most peoples resist invasion, history proves that successful invaders are assimilated by the people they invade, and not the other way around. What will happen to the Moon as humans settle this "virgin" world? In all likelihood, the Moon will transform her settlers into her own adopted people, into Lunans, even as their activities gently alter her moonscapes from close up. This is the topic of our article, "The Moon as Virgin Territory, a World without History," pp. 7-8

Moon Miners' Manifesto

Moon Miners' Manifesto / Moon Society Journal is published every month except in January and July.

• **Moon Miners' Manifesto CLASSICS:** Beginning in July 2004, we began an effort to re-edit, reformat, re-illustrate and republish the timeless articles of MMM's first fifteen years, in PDF format only, for free downloading from either of two locations:

www.lunar-reclamation.org/mmm_classics/
www.moonsociety.org/publications/mmm_classics/

• **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" entrepre-neurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.

• **MMM retains its editorial independence.** MMM serves several 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. Any presumption that participating organizations can be labeled by indirect mutual association is unwarranted.

• **For the current space news** and near-term developments, read ***Ad Astra,*** the magazine of the **National Space Society**, in which we recommend and encourage membership

• **The Lunar Reclamation Society** is an independently incorporated non-profit 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 NSS' Milwaukee chapter => www.lunar-reclamation.org

• **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, 1620 I Street NW, Suite 615, Washington, DC 2006; Ph: (202) 429-1600
FAX: (202)463-8497; nss@nss.org - www.nss.org

• **MMM's desktop publication** has received computer hardware and software support from the **Space Frontier Foundation**, 16 First Ave., Nyack NY 10960; 800-78-SPACE - SFF seeks to open the space frontier to human settlement as rapidly as possible.
openfrontier@delphi.com => www.space-frontier.org

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." — Contact information 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**

√ EMAIL to KokhMMM@aol.com (***preferred***)
√ Mac compatible CD / typed hard copy to:
Moon Miners' Manifesto, c/o Peter Kokh,
1630 N. 32nd Street, Milwaukee WI 53208-2040

⇒ IN FOCUS Editorial continued from p. 1.

The "Beijing Declaration" recently signed by the attendees of the ILEWG 8 International Lunar Conference urges nations to coordinate the calibration of the various instruments on their Moonbound orbiters, landers, and impactors, to optimize the development of a truly valuable scientific picture of lunar features, and resources. Now there is no need to do this just to scratch various scientific itches. Clearly, the vision of all nations involved includes human outposts, if not actual settlements.

The point is that robotic exploration supporters and proponents of the establishment of open-ended human presence on the Moon drink from the same well of inspiration. That, of course, does not stop those involved in putting together individual missions, either robotic, or humans with robots, from fighting for all too scare funds.

Both "parties" owe it to themselves and to their common vision of the place of life in the Solar System to fight for a larger ***total NASA budget***, not for increasing one share of a fixed slice of pie versus the other share! "That ain't gonna happen," you say. Perhaps. It is a sad occurrence that the President who brought us the Space Exploration Vision is also the one who "taketh it away," through other adventures (of whose worth it is not our intention to comment.) **<PK>**

Editor's Blog Post Reprinted on Ad Astra Online
"The Solar System becomes a Gated Community"
www.moonsociety.org/blog/index.php?title=the_solar_system_becomes_a_gated_communi&more=1&c=1&tb=1&pb=1
http://www.space.com/adastra/060904_adastra_pluto.html

Attention MMM Readers

MMM is NOT forwarded

so IF your address changes,
and you want your MMM to follow,

You MUST tell LRS or the organization through which you have a subscription.

If your copy of MMM is late,

Please wait two weeks before hitting the panic button. Bulk Mail is not handled like first class, but is delivered on a schedule at your mail carrier's discretion.

The Season of Giving is upon us!
Why not give the gift of MMM?

Budget Hardcopy subscriptions are just $12 US, $20 Canada, $50 Outside North America
Payable to "LRS", PO Box 2102, Milwaukee WI 53201

Moon Society Memberships including MMM
$20 students/seniors, $35 hardcopy to North America and electronic (pdf file) anywhere, Payable The Moon Society, PO Box 940825, Plano, TX 75094
or http://www.moonsociety.org/register/

Technologies Needed to Break Free

Continued from MMM #198

by Peter Kokh

IV: ISRU, In Situ Resource Utilization

NASA's announced intention is to begin a modest program of ISRU, in the form of oxygen production from the regolith. A major problem with the plan has emerged, however: NASA is designing the Lunar Ascent Module to use fuels that do not include oxygen! Yet oxygen is not only needed for life support, if transported to Low Earth Orbit, it can be used on the next run out to the Moon, saving the major expense of getting oxygen-prefuelled vehicles up from Earth into LEO. We hope that NASA is not dissuaded from going ahead with its modest and limited ISRU project, however, as it will be just the beginning, the first step in using "on location" [Latin "in situ"] resources.

First, the basics

We need to begin with basics, such as **cast basalt** and **sintered iron fines collected with a magnet**. These can provide abrasion-resistant chutes and pipes and other items for handling regolith, and low performance metal parts respectively. Then we can handle regolith more effectively to feed additional ISRU projects.

Composite Building & Manufacturing Materials

Long before we can produce iron, aluminum, magnesium, titanium and workable alloy ingredients, we can make useful building materials out of raw regolith and minimally enhanced regolith. processing elements and building materials from the regolith. Using highland regolith with a higher melting point to produce **glass fibers**, and mare regolith with a lower melting point to produce **glass matrix** material, we can produce glass-glass composites on the analogy of fiber reinforced resins (fiberglass). But to make this work we need to bring down the melting point of the mare glass matrix material further by enriching it with sodium and potassium. (A study funded by Space Studies Institute recommended the expensive import of lead as a temperature-reducing dopant!) This gives us an **action item:** *isolating sodium and potassium*, or sodium and potassium rich minerals.

If we can also isolate sulfur, we can experiment (and yes, why not here and now?) with fiberglass-reinforced **sulfur matrix** composites. Simpler yet, we can make many low-performance household items from "dishes" to planters to table tops and floor tiles from crude **raw glass** and **cast basalt**, no processing needed other than some sifting.

We will bet that glass composites, sulfur composites, cast basalt, and raw basalt glass will all find profitable terrestrial applications which may make the predevelopment of these technologies attractive to entrepreneurs, thus putting at least a close analog of technologies needed on the Moon, "on the shelf," in a reverse of the usual "spin-off" sequence. We call this "Spin-up."

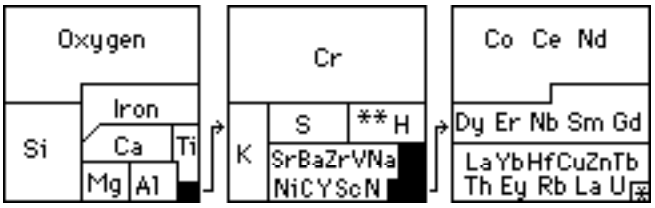
Metal Alloys

Using ilmenite (we can now map ilmenite-rich mare deposits on the moon) we can use this **iron**, **oxygen** and **titanium** mineral to produce all three elements. It is **the first ISRU Suite** to be identified. We need to identify more. Lunans will not live by oxygen alone!

Aluminum, abundant though it is, might be the hardest to produce, magnesium, somewhere in between. The catch is that for all four of these "engineering metals" the elements we regularly combine them with in order to produce workable alloys are rare on the Moon. For iron and steel we need carbon. For aluminum we need copper, and to a lesser extent zinc.

The action item here is for **metallurgists down here on Earth** to dust off old alloy experiment records. Some pathways, while doable, promised less superior results, and may have been abandoned. If they involved alloy ingredients that are economically producible on the Moon, we may have no choice but to go down that route to see where it leads. We need to do **research now** on lunar-feasible alloys that will perform in a "second-best" manner. *Second best is better than nothing.*

At a minimum, we need to be able to isolate, or produce, not only the four engineering metals, present on the Moon in parts per hundred, but all the elements present in parts per 10,000. See middle square below



Read: "Beneficiation" MMM #63, republished in MMM Classic #7, www.lunar-reclamation.org/mmm_classics
Read this NASA page also: http://ares.jsc.nasa.gov/HumanExplore/Exploration/EXLibrary/docs/ISRU/00toc.htm

Agricultural Fertilizers

From past NASA experiments with the Apollo Moon samples, we know that regolith has about half of the nutrients needed for healthy plant growth. Using **gas scavenging equipment** on board all earth moving vehicles (road construction, shielding emplacement, material for processing and manufacturing) we can use the harvested carbon and nitrogen and hydrogen to make fertilizer supplements. Potassium we will find in KREEP-rich deposits around the Mare Imbrium rim. Other elements hard to produce on the Moon can be used to manufacture cannibalizable shipping containers and packaging materials,to "stow away" on a ride to the Moon.

Let there be color!

Combine humidity, likely to be higher in pressurized habitat spaces, with the iron fines in regolith and we get rust for a splash of color. Titanium dioxide produced from ilmenite will give us white. Combine rust and white and we get a pink. Black, many gray shades, white, rust and pink. The rest will be harder. **Metal oxide pigments will be a secondary goal** in our processing experiments.

Using the Slag and Tailings

Slag and Tailings are in themselves "beneficiated" stuffs from which we can probably make many low performance household items and construction elements. Doing so will reduce the "throughput" of our young lunar industrial

complex. By treating these byproducts as resources rather than as waste ("wasources") we reuse the energy that was used to form them. This will work to greatly reduce what the settlement "throws away" – the goal being "nothing!"

Export Potential

Killing two birds with one stone has always been a desirable strategy. ISRU products from oxygen to metal alloy and non-alloy building and manufacturing materials will reduce the need for expensive imports as Lunan pioneers learn to make more of the things they need to expand their settlement and outfit it in a livable manner.

But for long-term economic survival it is essential to go beyond reducing imports. There will always be some things the settlement is no large enough, and its industries not sufficiently diversified to produce. There is a need to pay these imports. We cannot rely on any long-suffering generosity of terrestrial taxpayers. We can pay for our imports with credits from exports. Now in addition to proposed energy exports, and various zero-mass exports ranging from communications relays to broadcasting unique lunar sporting (and dance) events to licensing technologies developed on the Moon, there is an area of real material exports.

As long as one thinks of Earth as the Moon's only trading partner, this prospect seems outrageous. Shipping cost would make lunar products very expensive. On the contrary, it is shipping costs that will be the settlers' trump card, if there are other markets developing side by side in space. For example, while lunar building and construction materials and outfitting products may seem crude and unrefined to us on Earth, if they do the job, we can deliver them to low Earth orbit commercial space stations, orbiting industrial complexes, and orbiting tourist hotel complexes at a definite advantage over any competitive product that has to be boosted up from Earth's surface. It's not the distance, but the gravity well difference. For any product we make, as far as in space markets go, Earth will not be able to compete.

We have to think of the future economy as including not just Earth and the Moon, but other *areas in nearby space that will become areas of human activity.* This market will continue to work to the advantage of the rapidly diversifying lunar economy and growing lunar population as the population in orbit continues to grow, and as Mars begins to open up. It can only get better. But ISRU, not just of oxygen, but of many elements is the key.

ISRU and Rare Elements on the Moon

Dennis Wingo, in his recent book *Moonrush*, sees the Moon as a potential source for platinum needed for fuel cells to make the forecast Hydrogen Economy work. None of the samples returned by the six Apollo landing missions and the two Soviet Lunakhods showed this element to be present in parts per billion. Now you can say that we only sampled eight sites. Not quite true when you consider that at any given location on the Moon, only half the material is native, the other half having arrived as ejecta from impacts elsewhere on the Moon. In that sense the areas of the Moon samples are somewhat representative. Wingo argues that platinum-bearing asteroids had to have bombarded the Moon. We do not quarrel with that. But it is likely that the infinitesimal smithereens are scattered all over the place with no enriched concentrations anywhere. Now we'd be happy to be proven wrong.

Geologist Stephen Gillett, University of Nevada-Reno, and an expert on lunar geology, now thinks that the way to beneficiate (increase the concentration of) scarce elements is to feed regolith to bacteria in vat cultures, the bacteria having been bioengineered to feed preferably on given elements.

Dr. Peter Schubert of Packer Engineering in Naperville, Illinois outside Chicago, has developed an on-paper process, patents pending, that would use shoot regolith into a 50,000 degree (C or F?) laser beam and separate out the various elements and isotopes and direct them to separate catching containers. This is, of course, the ISRU process to end all ISRU processes. We are not qualified to estimate what is involved in development of a working demonstrator, or at what scales this process would operate most efficiently. It does seem to require a considerable energy input, perhaps from solar concentrators. It offers a glimpse of the future, when lunar settlements are shipping megatons of sorted elements for construction projects in space. (L5 revisited.)

Summing Up

√ We cannot thrive on oxygen production alone! We need to concentrate on other ISRU goals, especially **ISRU Suites** or Cascades in which more than one element results.

√ We need to enable with **research now**, early industries that fill needs and defray imports – Building, Construction and Manufacturing materials

√ We need better, **higher resolution global lunar maps**, that show not just where we will find regolith enriched in iron, calcium, thorium, and KREEP (what we have now, at least at poor resolution.) We need orbiting instruments to indicate the richest concentrations of other elements we will surely need. Action item: suggest to NASA in detail, the kind of instruments it should fly on planned orbiters.

√ As this information comes in, keep **reducing the long list of settlement locations to a short list**. What we have noted already, demands, If we truly want lunar industries and industry-based settlement, to look elsewhere than the highland-locked poles. What we need is a Highland Mare Coast, near ilmenite and KREEP deposits. That would give us access to all the major and most of the lesser abundant elements present on the Moon. But we may have to establish a number of settlements, each in differently endowed locations. After all, one settlement does not make a world!

√ We must **research reuse options** for pre-beneficiated tailings as building materials with lesser performance constraints. On Earth, there is no shortage of abandoned piles of tailings with which to experiment. Entrepreneurs, like artists, love free materials.

√ Many experiments are possible with **obvious terrestrial applications** which may prove profitable.

√ We need **an organizational machine** that will

- □ work to identify all these research needs and
- □ attract effective attention to them
- □ serving as a catalyst to get the work done.

√ The goal, if we choose to accept this mission, is to return to the Moon, ready to start building out the first resource-using settlement, so that the NASA Outpost can do science for a while, then retire to become an historic lunar national park site. In short, our goal is "Escape from the NASA Outpost" – returning to the Moon with the tools needed to avoid the "Outpost Trap." **<MMM>**

V: Industrial Diversification Enablers

1. Accepting the dayspan-nightspan energy challenge

It is not enough to develop the technologies needed to turn on location resources into products for domestic use and export. We have a little quirk in the way the Moon does its own business, rotating in and out of sunlight every lunar "day" that presents a considerable challenge. The Moon's "day" is almost 30 times as long as the one we are used to.

The challenge is to find ways to store up as much energy as we can during the 14.75 earthdaylong dayspan as potential energy, to keep us running on a lower but still productive level through the 14.75 earthdaylong nightspan.

Yes, that's why so many lunar advocates a drawn like moths to the eternal sunshine of very limited and rugged areas at the Moon's poles. But if you read the last two pages, you will know that except for water ice, the resources needed to build an industrial lunar civilization lay elsewhere. We will have to ship the ice to the settlements just as we ship the oil from Alaska's north coast to California.

There is no way to avoid taking on the dayspan-nightspan challenge. Turn aside from the challenge and we may be limited forever to tiny ghettos' at the lunar poles. Accept and win the challenge, and the Moon is ours, all of it.

The options for dayspan storage of energy to use during nightspan are treated in other articles. See:
MMM # 126 JUNE '99, p 3. POTENTIATION: A Strategy for Getting through the Nightspan on the Moon's Own Terms - This article has been republished in MMM Classics #13 as a free download pdf file at both:
http://www.lunar-reclamation.org/mmm_classics.
http://www.moonsociety.org/publications/mmm_classics/

2. Accepting the reduced nightspan power challenge

We might think of the pioneers waiting out the two-week long nightspan playing cards, writing their memoirs by candlelight, and making love for want of something else to do. But if we successfully meet the dayspan power storage problem, the pioneers will have enough energy to continue being productive by focusing and concentrating on less energy intensive and perhaps more manpower intensive tasks and chores, leaving manpower light and energy intensive processes for the dayspan. Inventory, scheduled maintenance, product finishing, packaging and shipping, etc.

The challenge is to take every operation and sort it into the two kinds of tasks or steps stated above. Not every industry is going to lend itself easily to an equal "division of scheduled labor." Some will need more man-hours during the dayspan and have few assignments to keep as many people busy during dayspan. Other industries may present the opposite situation. One can see arrangements where some employees work for company A during the dayspan and company B during nightspan.

Can we come to a plan whereby everything evens out and everyone is kept busy all "sunth?" (the Sun appears to revolve around the Moon once every 29.53 days, whereas the Earth does not, i.e. sunrise to sunrise marks the period we know as new moon to new moon, "month" for us, "sunth" for them. I digress. We have stated an ideal a lot of trial and error and the steadily increasing diversification of lunar industry predicts an ever-shifting employment situation. Our purpose is to suggest the process management research that we need to undertake now, industry by industry, business by business if we are to have any hope of making ourselves "at home" in the lunar dayspan-nightspan cycle. At stake is the success of lunar industrial diversification, and the competitive market cost of lunar export products.

3. Accepting the radiation challenge

"The Moon is a Harsh Mistress," blares the title of one of Robert A. Heinlein's best-known science-fiction novels. Part of that harshness comes from seasonal solar flares of great intensity. Part of it comes from incessant cosmic radiation from all quadrants of the sky. Part of it comes from the Moon plowing through space rivers of meteoritic dust left behind by comets.

All of these dangers call for shielding. The most used lunar resource of all is going to be plain regolith, piled up above habitation and working spaces, directly, or indirectly, that is over hanger-type frames with habitat structures and vehicles safely inside.

We understand the challenge, and the many options. We are prepared to meet the challenge for people in place. But what about for people in transit? A solar flare can hit the Moon with insufficient warning to allow vehicles more than a few minutes from base to return in time.

We need to give attention to the architecture and building systems to deploy at the least expense, effective wayside flare shelters at regular intervals along roadways. Whether they are lightly or heavily traveled makes a difference not in the spacing and number of shelters, but in how capacious or large such shelters are.

The Moon, like any new frontier will remain hostile and unforgiving only until we have mastered the ways of dealing with the new environment as if by second nature. The need to quite literally cover our butts from the rare but hard to predict solar flare is one we must take seriously. Lunar industry must anticipate this need.

Working out-vac in spacesuits will be cumbersome and tiring. For routine tasks such as accessing out-vac utility systems or outside storage items needed on a regular basis, it would make sense to place all these items under a shielded unpressurized hanger, shed, or canopy. Then a lightweight pressure suit will do, and that will greatly reduce stress, fatigue, and discomfort. The architectural systems for this everyday out-vac shelter system are the same as those needed in the event of solar flares. We can meet this need now by university-level architectural and engineering competitions, with ease of deployment and of shielding emplacement above the frame all being part of the challenge.

4. First industries first

It will be a challenge in itself, just to decide which industries to deploy first and just which of many possible paths lunar industrial diversification will take. As in picking a college course, one has to give attention to "prerequisite" courses. Likewise, some industries presuppose others in place beforehand, and in turn enable yet additional industries. Some industries will be viable only if developed side by side, step by step. Now there's a doctoral thesis for someone!

We make no pretense of being able to sketch

such a tree of industrial ancestors and descendants, but would like to start with some notes about what we need to break out of the Outpost Trap. Rather than repeat, we ask the reader to take a second look at MMM # 91 Dec. 1995 p 4. "Start Up Industries on the Moon" – reprinted in MMM Classic #10, a free download pdf file at the sites listed above. Also MMM # 191 DEC. 2005, p 7. First Lunar Manufacturing Industries – available as a Moon Society username/password accessed directory of recent MMM pdf files; www.moonsociety.org/members/mmm/

But, first things first!

- □ regolith bagging and other regolith shielding systems enhanced
- □ prioritization of fabrication of furnishings and outfitting needs for inflatable modules
- □ using those same industries to fabricate things for residential quarters.
- □ Some early art and craft media to make ourselves feel at home with art expressed in native materials

5. One Size does not fit all

In last month's installment, MMM #198 page 4, "Modular Transportation" and following, we mentioned that importing modular factory pods and utility pods made sense. That said, a system that works on that scale, say a trailer for a Semi Tractor, may not be the best choice for a smaller installation, nor for a settlement that had grown considerably. We need to base our judgment of system efficiencies and production on scale-dependent guidelines. For a tabletop demonstration, one ISRU device may work fine, but fail utterly on a much larger scale, and vice versa.

6. Attitude is the make-or-break ingredient

If your way of operating causes a problem, you are unlikely to contribute to a solution. At every stage of human advancement, there have been shingle-qualified experts who have said this or that could not be done. A favorite trick in teaching students how to handle such situations is to ask them to jot down all the reasons such and such is impossible to achieve, and then, after they have done so, give them a second assignment: "Now right down all the reasons why we are going to do it anyway."

We have to bypass stuck-in-the present experts and luck for "Young Turks" with an open and aggressively adventurous curiosity, determined to find workarounds and new pathways where none were suspected before.

The Moon will be one hard nut to crack. I am sure a human ancestor in Africa a hundred thousand years ago, suddenly transported to the northern coast of Greenland would have thought the same thing. But we did crack that nut. The Innuit and Eskimo take living under such conditions for granted. They handle the challenges that would be life-threatening to us by second nature.

If we get raised eyebrows along the way, "industrializing the Moon, are you?" let those raised eyebrows encourage us all the more. The epic sweep of the human saga from Africa to continents beyond the shores of their home continent/world runs through our veins. We will do this, because we are humans. And as before, we will become even more human in the doing of it. For the challenge of settling the Moon will bring out new capacities in us, capacities we did not know we had, because we were never challenged before to rise to occasions such as lay before us. **<MMM>**

VI: The Entrepreneurs

1. Launch vehicles, Modules, Services

We are used to thinking of "space entrepreneurs" as involved with startup launch companies. Certainly, those are the most visible. Right now, the markets for enterprise involvement are still few, but the pace of new starts is picking up. NASA is one of the forces involved, determined to replace the Shuttle with Commercial launch companies serving the ISS with cargo and personnel transfers. The agency is also trying to find minor roles for private service providers in the return to the Moon and establishment of a small science outpost.

As the International Space Station and possible other orbital facilities grow and multiply, the market for various kinds of enterprises providing logistics services will grow with it.

2. Space Tourism

But the real glamor is in the infant space tourist industry. Here entrepreneurs are involved in providing man-rated launch vehicles, vehicle operation services (Virgin Galactic), and space destinations (Bigelow Aerospace.) This entrepreneurial area promises to grow continually, with not just orbit in mind, but non-landing loop-the-Moon excursions. Before the first of those, possibly within the next two years, some will start planning how to offer self-contained moon landing sorties.

Some dismiss tourism as a driver. This is a mistake. Discretionary income is rising, and worldwide, tourism is near the top in income-earning sectors. We have believed, that failing a viable Moon-based energy production effort, tourism alone has the capacity to open the Moon. Read MMM #161, Dec. 2002, pp. 4-5 "Tourist Clusters on the Moon." – available as a Moon Society username/password accessed directory of recent MMM pdf files; www.moonsociety.org/members/mmm/

3. Making Money by Laying Foundations

Stating way back in July, 1988, in MMM #16, we began describing a way of doing business that turns "spin-off" on its head. Instead of NASA doing an expensive crash R&D technology project at the expense of unwilling taxpayers, then, later making the technology available free to enterprises, a would-be entrepreneur looks at the technologies NASA needs (or that we need to go beyond NASA and break out of the Outpost Trap) and brainstorms them for potentially profitable terrestrial applications, creates a business plan, and goes ahead with the needed R&D to be ultimately reimbursed by willing consumers, precisely for those identified terrestrial applications. In the process, a technology needed on the frontier, or a close analog thereof, gets put "on the shelf" free of charge to taxpayers.

We have talked about a number of technologies in need of R&D, and the way to get this done in a timely fashion is not a taxpayer-paid crash program, but bu a spin-up enterprise. The options are too many to number, indeed to many to imagine.

So how do we connect potential entrepreneurs in search of a business idea/plan with our laundry list? That is the question, and in a month or two we hope to give you the start of an answer, involving a meta/mega project that will subsume and interrelate all other Moon Society projects and keep us on course on the path to a viable lunar settlement civilization. **<MMM>**

VII: Moonbase Personnel
The most critical moonbase system to success is the human one

There have been many Human Factors Research studies done at the two Mars Analog Research Stations to date, but they all suffer from involving short crew stays. Most anyone can put up with anything for two weeks. Studies aboard submarines and at Antarctic stations are more helpful, but still do not mirror conditions we will find on the Moon and Mars.

Many ordinary human activities, are not modeled because they can be postponed. This includes exercise, sport, many kinds of recreational activities, get-away-from-it-all options, indulging artistic abilities, etc.

A more thorough investigative approach should give clues as to which type of modules and facilities, and the activities that they will enable, should be added, and in what priority. At stake is general crew morale, productivity, and safety as well as general health.

That said, NASA's purposes and our purposes are at loggerheads. NASA would indefinitely man a lunar outpost with crews being regularly rotated, baring events unforeseen. Our goal of breaking out of the outpost trap towards settlement, means finding ways to encourage personnel to willingly re-up, stay for "another tour" without limit, so long as health of the individual and of the crew at large is not an issue. That means providing the kind of **perks** that

1. increase morale and improve performance
2. promote willingness to re-up so as to give the weight allowance for his not-needed replacement to valuable imports of materials and equipment, especially tools and equipment to fabricate and experiment
3. create a plan for outpost expansion of modules, the facilities they house and activities they enable

Providing for a full range of human activities:

- □ getaway "change of scenery" spaces and out-places
- □ a range of customizing options for personal quarters
- □ menu diversity and variety, including fresh salad stuffs and vegetables on occasion
- □ schedule breaks (take advantage of the dayspan/ nightspan cycle for regular changes of pace such as a alternating types of work and recreation
- □ allow fraternization between crew members, without harassment, of course
- □ promote expression of artistic and craftsman instincts using local materials and media
- □ Experiment with lunar sports and other recreational activities. Lunar-unique sports and performing arts - are things that make crew begin to "feel at home".
- □ out-vac sport & recreation on the surface
- □ an indulgent spa and an exercise gym
- □ telecasts to Earth of everything unique and special
- □ "while you are here" opportunities for excursion exploration and "tourist" experienced and memories

□ All this both presupposes and prepares for an orderly expansion beyond the original functional and space limits of the original outpost. But that's what we need to do to "breakout of the Outpost Trap." **<MMM>**

□ **Next month: Part VIII**: Strategies for Societies self-tasked with helping make it happen; **Conclusion** of series.

The Moon as Virgin Territory
"a world without a history"

by Peter Kokh

Apollo's leavings

Yes, "not quite," given the six Apollo landing missions of 1969-72, or if you want to be even more strict, since the first Soviet Luna probe crash landed on the farside in 1959. But the astronauts were only on scientific picnic missions. They did leave some things behind, destined to be revered objects in the first Luna City Museum some day.

But in truth, no one has ever "lived" on the Moon, not even for a short time. The Moon is largely unchanged, pristine, still waiting to be given the life that it could not give birth to on its own.

The first 4,600,000,000 (4.6 billion in U.S. usage) year period of the Moon nurturing the nascent life on Earth through its gentle tidal forces, but not sharing in the epic of life itself, is about to end. Earth Life has reached its reproductive stage, having given rise to an intelligent species capable of sowing that life in places that it could not have sprung up on its own.

Treating a virgin world with "respect"

Will humans treat this world with respect? Will they be a thoughtful caring suitor or a rapist? Many people repeat the common objection that we will only end up trashing the Moon as we have trashed the Earth.

But there is a difference, more than one, in fact. Here on Earth we enjoy life in an immense planetary **biosphere** which included the atmosphere, the hydrosphere (oceans, lakes, rivers, and underground aquifers) the sea bottom oozes, the top soils of the continents. We do the damage we do, because up until recently, we seemed to be able to get away with it. Our ancestors might suffer, but who thinks that far ahead.

On the Moon, and Mars too for that matter, it will be different. There is no planetary biosphere. We will have to create and maintain mini-biospheres within which to reencradle ourselves. And because they will be so small in relative terms,

> *we will find ourselves living immediately downwind and downstream of ourselves.*

Our environmental sins will hurt us immediately. We poison our mini-cradle, we die/ It's as simple as that!

Mining and Manufacturing

The Moon's surface has been "gardened" or tilled over billions of years of meteorite impacts into a top-blanket of pulverized and powdered material from 2 to 10 meters~yards deep. This smashed stone stuff is called the regolith. The composition of the regolith is the same as the upper levels of the lunar crust. In some areas, material from the mantle, below the crust, has been thrust to the surface as a rebound from major blows: the central peaks of large craters, for example.

The point is that mining operations will on the Moon will consist principally of extracting elements from this surface blanket. No ugly strip mines. No deep shaft mines. At least we do not expect a need for deep mining. Our regolith "mining" will not noticeably scar the surface, perhaps not even from fairly close viewpoints, and are most unlikely to cause any changes in the Moon's

appearance from Earth, except possible albedo changes: freshly harvested regolith may cause that terrain to be a slightly darker or slightly lighter gray. At very close range one would notice the absence of any small craters in the 1-2 meters~ yards range, as our equipment rakes them smooth. Larger craters would be avoided, by passed.

All our mining an manufacturing and packaging and unpackaging operations create byproducts not immediately useful. But all these items represent some real amount of energy already spent. It makes sense to warehouse them, sorted by kind, so that when we come up with a plan to use in new ways, they are easy to find and gather. Mine tailings and processing slag might be used for low-performance building products: bricks and blocks and tiles and slabs, etc. or even cast into ceramic like household items. With a proper reuse-friendly warehousing policy, nothing will be discarded to "trash."

Garbage

As to food and biomass wastes and other organic residues, we cannot afford to dispose of them as garbage because they are made of precious hydrogen, nitrogen, and carbon - all present on the Moon but in amounts that count as "traces" when compared with their rich abundance on Earth. All these items must be recycled into the atmosphere, "religiously".

Architectural Visual Impact

The most likely form of settlement architecture will not be the dome-enclosed city popular with science fiction artists, and so structurally impossible.(The air pressure inside, with only vacuum above, would quickly rip the dome off its foundations and blast it into the sky.) Rather, in the near term, we are looking at ever growing mazes of interconnected habitation and activity structures, covered with mounds of regolith shielding. Apart from protruding antennae and heat-rejecting radiators, the view from above will be an orderly maze of mole hills.

Now while such settlements would blend into the landscape reasonably well, at least in color and texture, it need not remain so. Individuals may wish to give their own cozy homestead a special appearance. A dusting of titanium oxide or calcium oxide (lime), both easily made from mare and highland regolith respectively, would put their homestead mound in the "limelight." One covered with iron fines exposed to steam would give a rust hue. Or one could gather moon rocks and breccia and cover the surface of their mound with them. The options are quite a few. The point is, that they all involve lunar materials and are lunar-appropriate treatments.

For more on this topic, read MMM #55, May '92, p.5 "Moon Roofs" - republished in MMM Classic #6, a free download pdf file from either of these locations:
www.lunar-reclamation.org/mmm_classics.
www.moonsociety.org/publications/mmm_classics/

Also read MMM # 137 AUG 2000, p 5. "'Taking-back-the-surface' Architectures" - reprinted in MMM Classic #14, pp 50-54 a free pdf download, locations above

Transportation systems

As additional outposts and settlements and remote mining operations are started, a network of lunar highways will grow to connect them into a marketing network. One of the things we can do now, or fairly soon, given much improved topographic/altitude mapping of the Moon is to determine contiguous areas within which surface transportation encounters no obstacles that need significant cuts, fills, bridging, or tunneling The next task will be to find the easiest to construct routes that link these areas without considerable detouring. Surface roads can be self-paved, i.e. graded, compacted, and sintered with microwaves to "fix" the dust and powder content. Stones and boulders can be simply plowed aside, or to the median strip, to make route identification easy.

We've talked about road building several times, most recently in MMM #169, October 2003, pp. 4-7, "Early Frontier Highways on the Moon" (at the end of this article is a list of related articles in previous issues #s 37, 79, 81, 82, 85, 86 - reprinted in MMM Classics #4, 8, 9.

Of course, we will have small local, and larger regional spaceports. What we won't have is airports! It could very well be that the workhorse of long distance cargo and passenger hauling may be done by lunar railroads. This may seem anachronistic. Railroads on a world of the space age? Why not? Check out
http://www.lunar-reclamation.org/papers/rr_moon.htm
But they will blend into the moonscapes as well

We will need intermittent flare shelters along lunar highways and railroads. These shelters will be covered with regolith, so will blend in also.

Making ourselves "at home" on the Moon

Making ourselves "at home" means using building materials made from lunar materials. It means adapting our life and production schedules, our import and export schedules, and our global travel arrangements to fit in with the grain of the Moon's natural rhythms. the long dayspans and nightspans, a sunth-based calendar. It means adapting to lunar cosmic "weather" and learning to deal with their new homeland's harsh unforgiving aspects as if by second nature, as have all pioneers of the past. It means learning to express their artistic and crafting instincts in lunar materials. It means making do with a lunar-sourceable color pallet. It means creating new sports and new dances to take advantage of light lunar gravity while momentum stays unchanged. It means finding substitutes for familiar terrestrial products made of materials not economically producible on the Moon. It means, in the end, becoming People of the Moon, and no longer People of Earth. The pioneers will end up belonging to the Moon, just as we belong to Earth. And that, we think, means treating the Moon with respect.

In short, the Moon will change those who settle her, every bit as much as they change the Moon. It will of necessity become a symbiosis.

Lunar History to come has already begun

Our robotic probes and human crews have left the first impacts and footprints on the Moon not caused by natural processes. It is **an Overture**.

We had long ago named many features on the Moon, of course, and since Apollo, we have named many more. The pace of naming will continue exponentially, once we are there, to stay, and not just at the end of a telescope. More importantly, there will be places associated with success, with failure; places of desperation, tragedy. conflict. And yes, their will be ruins. Surface features will be put to geologically unforeseen human uses. But all this will be done together, as the Moon and humans face a future intertwined. **<MMM>**

The Moon Society

J O U R N A L

http://www.moonsociety.org

http://www.moonsociety.org/blog/

Please make NEWS submissions to KokhMMM@aol.com

The Moon Society was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for further exploration and utiliza-tion of the Moon in cooperation with other like-focused organizations and groups.

Artemis Society International was formed in August 1994 as a forum for supporters and participants in the **Artemis Project™** quest to establish a commercial Moon base as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of **The Artemis Project™** belong to **The Lunar Resources Company®**

PROJECTS: www.moonsociety.org/projects/

Artemis Project™ - Project LETO™ - Rent-MDRS

Moon Society DUES with ***Moon Miners' Manifesto***

- **Electronic MMM** (pdf) **$35** Students/Seniors: **$20**
- **Hardcopy MMM**: U.S/Canada **$35** Elsewhere: **$60**

Join/Renew Online - www.moonsociety.org/register/

Mail Box Destinations:

□ **Checks, money orders, membership questions**
Moon Society Membership Services:
PO Box 940825, Plano, TX 75094-0825, USA :

□ **Projects, chapters, volunteers, information, etc.**
Moon Society Program Services
PO Box 080395, Milwaukee, WI 53208, USA

OUR LOGO above: the Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as an adopted new human home world. We have work to do!

Moon Society Board Seat Filled

from Peter Kokh

At the Leadership Council meeting on ASI-MOO Wednesday, September 20th, the newly elected Board convened and declared the seat which had been held by David Wetnight vacant, and elected James Gholston of Denton, Texas to the post for the balance of Wetnight's term, one year, making James eligible for election to a full term next year (2007.) James had been runner up in the recent election, by "just a hair," and promises to be a dynamic and active Board member.

Coming Attraction: Our *new* MOON WIKI "LUNARPEDIA"

We aren't ready to introduce it just yet, but a shell is online as we line up a preliminary team of people with loggin and sysop privileges. Dana Carson and Mike Delaney, Teams Director, arranged for the website and put the Wiki online. James Gholston created a draft front page. T he current address is just a place holder.

But content-wise, it is just a shell. Peter Kokh is working on a provisional list of topics and subtopics in which articles are invited. This outline will grow and develop further as needed.

We are still working on permissions, rights, safeguards and other procedural matters before we go public. The working assumption is that the wiki will be open-source, meaning that persons outside the society can contribute to it, and that the contents will always be a work in progress, much as Wikipedia is.

We are discussing the idea of contacting the contributors of articles to the Artemis Data Book for permission to repost their material to the Wiki as is, but allowing those contributors to reedit their items first.

We would not seek to transfer any proprietary material, i.e. key parts of the Artemis Project™ Reference Mission. Instead, we seek all sorts of ideas and options for every step of a "mission," creating a grand sweeping buffet of ideas that any entrepreneurial team with the money to make a mission real, could pick and choose the ideas they wanted, meshing them with their own.

The goal remains the same: the success of a first private enterprise outpost on the Moon. Thus we inherit the fire that burned in the guts of the original Artemis Society team that worked on the Artemis Moonbase Project™. Many long-time members have left, in disappointment at the apparent abandonment of the project. As our Lunarpedia, the Moon Wiki, starts to take shape, we hope many of these enthusiasts will return to work on this wider, less proprietary version.

That the Moon Society was to be a fresh, open start, and that it still listed the Artemis Project™ as its "Flagship Project" seems, and is self-conflicting. By substituting the Moon Wiki project, this legal nomans-land will be avoided. Artemis Society International will remain a Foundation of The Lunar Resources Company.

If any reader, member or not, is interested in joining the Wiki team, contact James Gholston at:

webmaster@dimensionality.com

To subscribe yourself to the mailing list, you can send mail to <majordomo@moonsociety.org> with the following command in the body of your email message:

subscribe lunarpedia **<MSJ>**

Candidate Lunar Analog Station Sites

by Peter Kokh

For the sake of argument, let's pretend that money is not a problem. The Moon Society has decided to find a location for its own Analog Research Station in a more geologically and morphologically appropriate area. What locations might make a short list, if we were constrained by logistical practicalities to the area of the continental U.S., "the lower 48" states?

Our first search turns up four promising areas, all in the Western States, each offering extensive lava flow sheets and attendant lava tubes:

- **El Mapais** National Monument just south of Grants, NM off I-40, air hub Albuquerque, NM at 80 miles
- **Craters of the Moon** National Park in Eastern Idaho, air hub Salt Lake City, UT 270 miles. Boise regional 184 miles. Pocatellofeeder service at 80 miles away.
- **Snow Canyon** Sate Park outside St. George, Utah 121 miles from Las Vegas, 300 from Salt Lake City and 220 miles from the Mars Desert Research Station. Feeder service into Cedar City, 60 miles NE of St. George
- **Bend**, Oregon - in the high desert just east of the Cascades. Closest air hub: Portland 185 miles

EL MAPAIS NATIONAL MONUMENT, NEW MEXICO
www.nps.gov/elma/

Just considering the logistics, accessibility by road, rail, and air the El Mapais site in New Mexico takes the clear edge. And logistics are very important: getting people and supplies in and out easily and inexpensively, and quickly. However, The Moon Society has no current members nearby, though four former members were last listed in Albuquerque. If one of them could be reactivated to assist crew members coming & going, that would help.

First, however, we would have to assemble a small team, 2-4 persons at most, who would have to go to the area, and, equipped with detailed topographic maps, individually check out various spots. We would prefer to be on BLM public land just adjacent to the monument, and have approved access to a lavatube. It would also be desirable to be off any of the regularly used tourist roads, tracks, or trails.

The El Mapais site does have the slight advantage of being within a few hours drive of Spaceport America being built by Virgin Galactic for tourist suborbital hops in the area north of Las Cruces. But then, visitor traffic is _not_ something this writer and former MDRS crew commander sees as a plus. Visitors are a big simulation-distrubing distraction.

CRATERS OF THE MOON NATIONAL PARK, IDAHO
www.nps.gov/crmo/

COM NP is not appreciably further from Salt Lake City than the Mars Society's desert station in Hanksville in south central Utah. It's just a question of going north instead of south. An asset would be personnel on the ground in Salt Lake City, who might be willing to facilitate crew arrivals and departures, and do scout work for sourcing supplies in SLC. By the way, I personally love SLC! Nestled up against the awesome Wasatch Range, it has no rival for scenic setting.

Boise is closer, but may not enjoy as favorable round trip air fares from other points as does Salt Lake City. Seven former members are from the Boise area. There is feeder service into Pocatello Regional Airport, an 80 mile drive from the Park, via SkyWest, serving United and Delta passengers) from both Boise and Salt Lake City.

Again, as with El Mapais, we'd have to spend some time looking for just the right spot, as noted above. William Fung-Schwarz, Artemis Moonbase Sim 1 Health & Safety Officer, who lives in Salt Lake City, has already identified "seven places to start looking" on the basis of aerial maps of the region. Again, as with El Mapais, the area receives appreciable tourist traffic, a plus at the visitor center, a minus if they interfere with out operations or intrude upon our area of operations too closely.

SNOW CANYON STATE PARK, UTAH
www.stateparks.utah.gov/park_pages/scenicparkpage.php?id=scsp
www.stateparks.utah.gov/press/default.php?DateCode=43

A short drive NNW of St. George, Utah, this park does have lavatubes and deserves a visit. St. George is on I-15, 121 miles (2 hrs) from Las Vegas to the south, and 300 miles (5 hrs) from Salt Lake City to the north.

In February 2005, on my way back to SLC from my first tour of duty at the Mars Desert Research Station, I had time to pay a personal visit to one lava field area just west of Fillmore, Utah, 150 miles SSW of SLC on I-15, and just 3 hours from the Mars desert station. But on first inspection, the site did not seem at all suitable and had no lavatubes nearby. The area's terrain is very rugged and "clumpy", difficult to traverse on foot, impossible in a vehicle without first grading a roadway. Plus, it was heavily vegetated with bushes and shrubs.

BEND, OREGON www.oregonl5.org/lbrt/l5ombase.html

Bend was home of the *former* Oregon Moonbase of the Oregon L5 chapter of the National Space Society. There are three great pluses to this location. One, we have a sizable critical mass of very knowledgeable volunteers in the Oregon L5 NSS chapter, based in the Portland metropolitan area. Two, if we were able to re-secure the lease that the Oregon L5 chapter had on the site some 5 miles northeast of Bend on Bend city water works land, that would be great. The pair of lavatubes there has been thoroughly investigated with both geological and engineering reports. I had a personal guided, very thorough tour of both tubes in 1992 as the guest of Bryce Walden and Cheryl York of the Oregon Moonbase team.

If former Oregon Moonbase site outside Bend is no longer available, there are many other lavaflow-lava-tube sites nearby to Bend. With the Oregon Moonbase - Oregon L5 Society team still intact, and actively partnering with the Moon Society, we have ready volunteers to visit the other site options and prepare a report on the basis of which a decision can be made.

But that we have a critical mass of supporters three plus hours away, is the biggest plus, and certainly puts Bend at the top of the list. If and when we decide that the Moon Society needs its own Analog Station in an area geologically and chemically and landform-wise analogous to lunar sites, the Oregon team could have all its ducks in a row. Meanwhile, we'd have to investigate the other two general areas from scratch.

So as of this point in our investigations, the Bend, Oregon area seems the candidate "site to beat." But, pending a field trip to investigate, the handiness of the Snow Canyon site to both Las Vegas and Salt Lake City, as well as to the Mars Desert Research Station, makes that site a potentially strong challenger. Las Vegas has been the preferred site for a Moon Society Vistor Center, and that is a consideration also. See Project Leto:

www.moonsociety.org/projects/leto/

Priority Action Items

1. See if the old Oregon Moonbase site is still available
2. Field trip to Snow Canyon State Park **<MSJ>**

Great Moonscape Computer Wallpaper

Close in Photos snapped by SMART-1 within 48 hours of Impact on 9/03/2006

www.esa.int/esaCP/SEM2N58ZMRE_index_1.html#subhead7

On this page, you will find seven photos, two horizon viewsrange o, the others looking down at the surface, all snapped near the lowest point (perilune) of SMART-1's orbit, before ongoing orbital decay led to an instersection with the lunar surface in Lacus Excellentiae.

There is also a panel of photos of the impact site just before, at, and immediately after the impact, which is clearly visible in a greater than expected flash.

The photos make great wallpaper on a computer for any and all of us who "wish we were there!." They are in the range of 36 to 156 k. **<MSJ>**

Check out our new Slide Show on our moonbase exercise at the Mars Desert Research Station

MDRS Crew #45

Artemis Moonbase Sim 1

From Peter Kokh

Gerry Williams, of the Mars Society's San Diego chapter was one of our volunteer CapComs during our moonbase simulation exercises at MDRS. On his own, he graciously created a PowerPoint Slide Show presentation of our experience. He organized it very well, selecting from available photos carefully.

This is a slide show that individual members can enjoy. More importantly, it becomes a tool in our public outreach efforts.

Downloading the Slide Show in PowerPoint format:
You will find the file at:
www.moonsociety.org/moonbasesim/Artemis_Sim-1b.ppt

For best results:

Unless you have the font Arquitectura in your fonts folder, when you open the presentation, you may well see the text overflowing the slide borders, and partly hidden behind the photos on each slide. Arquitectura, the font with which Gerry composed the presentation, is a narrow font. You can download this font, in either Mac or PC format, from this web page (near the top of page):
http://chapters.marssociety.org/swhab/TMS-SD/
You may have to restart your computer for this font to be available.

Download a free PowerPoint Viewer

If you do not have PowerPoint on your computer, you can download the free PowerPoint Viewer from this Microsoft page: http://www.microsoft.com/downloads/details.aspx?FamilyID=428d5727-43ab-4f24-90b7-a94784af71a4&displaylang=en

Download the Slide Show as a pdf file:

For your convenience, we have created a pdf file of the slide presentation, should you not have PowerPoint and not want to bother downloading the free viewer:
www.moonsociety.org/moonbasesim/Artemis_Sim-1b.ppt

A Mirror Site Project

While we do have our Moonbase Exercise site at:
http://www.moonsociety.org/moonbasesim/

All the day by day reports, photos, and video and audio logs are on the Mars Society's MDRS site in the Crew 45 area of this page:
http://www.marssociety.org/mdrs/fs05/

At Mike Delaney's suggestion, we have begun creating Moon Society pages for all these files. When we have finished doing so, you will find them at:
http://www.moonsociety.org/moonbasesim/

An "Artemis Moonbase Sim 1" DVD

We are in the early stages of writing the script outline and picking all the elements we want included. This is a big project, but our goal is to have a DVD in the registration packet of everyone attending next spring's International Space Development Conference in Dallas on the Memorial Day Weekend. **<MSJ>**

Meet our newest "partner" chapter

Calgary Space Workers Society

http://www.calgaryspaceworkers.com/
[http://www.moonsociety.org/chapters/]
[http://www.moonsociety.org/affiliations/]
from Peter Kokh

Calgary, Alberta, Canada, a city of 150,000 *when I first visited it* on my way tot the Canadian Rockies as a young high school graduate of 17, 51 years ago, is now a bustling metropolis of one million, the largest Canadian city between Vancouver and Toronto. Hopefully, I will get a chance to visit again, this time to meet our new friends in the Calgary Space Workers Society and their affiliated Calgary Space Frontier Society NSS Chapter. I have already met two of the people involved, Paul Swift, Chair of ISDC 1994 Toronto, and John Hadden, at the Moon Society founding Convention, Las Vegas, July 2000.

Mobile Lunar Habitat Program

www.calgaryspaceworkers.com/thehabitat.html

CSWS has purchased a used 31 ft. *Airstream* Travel Trailer, and is reoutfitting it as the core module of their planned modular Lunar analog research station. The added modules may be inflatable structures. This is very similar to the architecture that we are considering for a future Moon Society analog research station outpost.

The advantages are clear. The modules can be outfitted *where there are clusters of people* to do the work, then driven or trucked to the location. En route, they could go on tour. The one story ranch complex profile lends itself to *shielding with sandbags or bags of mulch*, not for radiation protection, as we will need on the Moon, but for the *thermal equilibrium benefits* we will also need on the Moon. This is in contrast to the multi-story Mars Hab architecture, *not so sheilding-friendly.*

A Moonlike location in "Dinosaur Valley"

www.calgaryspaceworkers.com/moononearth.html

CSWS has already scouted out a very moonlike area, less than a 2 hours drive from Calgary to the NE at Drumheller, Alberta. So you can see, this team has its act together. The Moon Society hopes to encourage them and learn from them in the process. **<MSJ>**

Chapters & Outposts

Bay Area Moon Society Outpost

http://www.moonsociety.org/chapters/bams/
Meeting 4th Thurs monthly at Henry Cate's in San Jose

From: Henry Cate <hcate2@offshore.ai>

We are feeling the loss of Jonathan Goff who got the group started, but is now working in Mohave, CA. But we still have a good core group, though we have yet to organize as a chapter.

We are concentrated in the lower San Francisco Bay Area. Area assets: NASA-Ames, Stanford (Stanford on the Moon Project), Silicon Valley in general.

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
From: Keith Wetzel <kawetzel@swbell.net>

We are busy planning our annual presence at the St. Louis area's major Sci-F convention, Archon 30, coming up October 5-8l, 2006. This time we are handicapped by lack of an information table, owing to a planning oversight. BUt we will be giving several presentations and make ourselves visible in other ways. This is our 4th Archon, or is it the 5th. Time flies when you are having fun!

We have also been tossing around ideas for a hands-on science/engineering project. Some of us are getting itchy to *"bend metal."*

Moon Society Phoenix Outpost

Contact: Craig Porter <portercd@msn.com>

Our first outreach opportunity was CopperCon 26, a Sci-Fi convention held in Phoenix, Labor Day weekend, September 1-4. I created a table top display with information about the Moon Society, along with a laptop to show slide shows, and a DVD player to run DVDs.

[See the exhibit photos on page 16, col. 2, this issue]

I am networking with the NSS-Phoenix chapter, whose leader, Veronica Zabala, also belongs to the Mars Society chapter. Veronica and I are very interested in seeing the Moon Society come up with a deal that will make joining the Society attractive for the many Moon-enthusiasts who belong to the National Space Society.

Moon Society Salt Lake City Outpost

Contact: William Fung-Schwarz <william@rewirelife.com>

After learning that Snow Canyon State Park, in the SW corner of Utah outside St. George, had lava tubes, something I had not known, I have begun looking for an opportunity to drive down and check it out. It's a straight shot 300 miles down I-15 from SLC. This may be a good location for a future Moon Society research outpost station, if we can find a suitable BLM (Bureau of Land Management) site handy to the tubes. St. George is just a 2 hour drive from Las Vegas, and 5 hours from MDRS.

GREAT BROWSING !

NASA offers a $250,000 prize for a better glove:
http://www.courant.com/technology/hc-space0425.artapr25,0,666931.story?track=rss

Revolutionary Lokheed-Martin Moon Landers
http://www.nasaspaceflight.com/content/?cid=4810+

http://forum.nasaspaceflight.com/forums/get-attachment-big.asp?action=view&attachmentid=12679

http://forum.nasaspaceflight.com/forums/thumbnail.ashx?file=68921-21E0A019-F80C-4BB5-BC57-79E322A8C3B1&type=image/jpeg

http://forum.nasaspaceflight.com/forums/get-attachment-big.asp?action=view&attachmentid=12681

Top Space Animations (Shuttle, ISS, ISS asembly, etc.)
http://www.tietronix.com/anim/AnimationTop.html

Sex in Space - Space.com article
http://www.space.com/adastra/adastra_sexinspace_060804.html

Pluto Protesting for Fun and Profit
http://www.cafepress.com/buy/pluto/-/cfpt2_/copt_/cfpt_/source_searchBox/x_ 0/y_0

Demote Pluto, or demote "planet"?
http://www.thespacereview.com/article/692/1

Can space tourism really change the space industry?
http://www.thespacereview.com/article/691/1

Potential for Orion Crew Module program to trigger Appolo-like wave of innovation and development
http://www.thespacereview.com/article/701/1

Rights of Humans in Space
http://www.thespacereview.com/article/700/1
Wwill humans wreck the space environment?

http://www.thespacereview.com/article/698/1

Flaws in NASA plans for lunar ISRU
http://www.thespacereview.com/article/697/1

a Japanese vision of humanity's future in space
http://www.thespacereview.com/article/696/1

Names chosesn by NASA for elements in the VSE
http://www.thespacereview.com/article/695/1

Review: Sentinels of the Sun (space weathercasting)
http://www.thespacereview.com/article/693/1

Polynesian Social Skills Key to Opening Mars?
http://www.thespacereview.com/article/707/1

Speech Software finds missing "a" in Neil Armstrong's famous "One Small Step" Moon Quote
http://www.usatoday.com/tech/science/space/2006-09-30-armstrong-quote_x.htm

Branson to create "Astronaut Idol" British TV show
http://www.newkerala.com/news4.php?action=fullnews&id=30170

A look inside SpaceShipTwoCabin (Virgin Galactic)
http://www.thespacereview.com/archive/49f.jpg

Review: Astrobiology: A Brief Introduction
http://www.thespacereview.com/article/704/1

A 2nd Peak of Eternal Light at the Moon's North Pole?

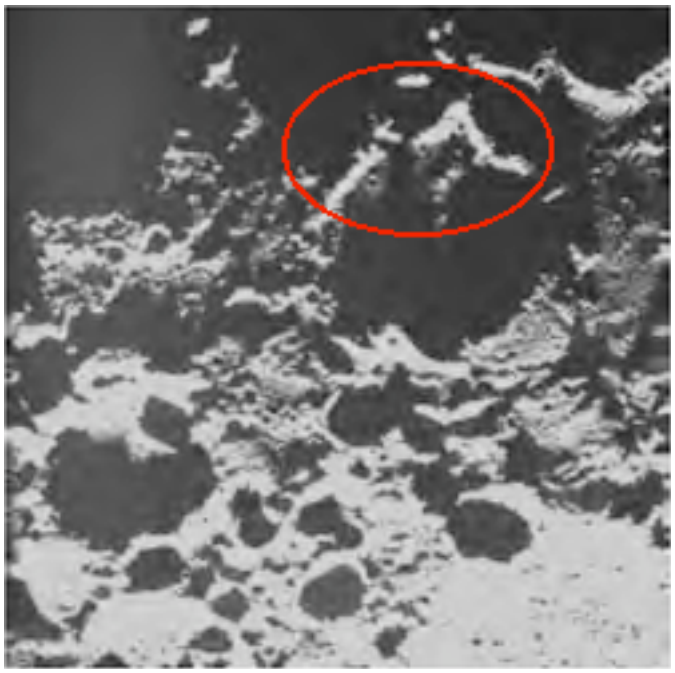
Reference: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=36974

MMM Special Report

We have heard much over the past decade about the so-called "Peak of Eternal Light" at the South Pole. But we need to ask if there is a similarly "advantaged" spot near the North Pole of the Moon. A North Polar site has two advantages, both of which we see as major:

1. Lunar Prospector found indications of twice as much hygrogen, implying water-ice, in the North Polar area as in the South
2. A North Polar location would mean less than half the cross highlands trek to the nearest shore of the Near-side "mare-plex," i.e to the north coast of Mare Frigoris as opposed to the south coast of Mare Humorum.

The European Space Agency's SMART-I orbiter, the first lunar probe since Lunar Prospector in 1998-9, was directed to photograph the North Polar area at different periods of the year when the Moon's axis was tilted towards, and later away from the Sun. The Moon's axis in tilted 1.5° in comparison with Earth's 24° - not much, but enough to make a difference. They were looking for a crater rim area that was lit up under both conditions. The photo below provided the "eureka!"



[from the web page cited above;] "This image was taken by the AMIE camera on board SMART-1 on 19 January 2005 (close to northern winter solstice) from a distance of 5000 km (3100 mi). The image shows an area 250 km (155 mi) wide near the lunar north pole.

"The illuminated part of the crater rim at the top of the image is very close to the lunar north pole and is a candidate for a peak of eternal sunlight."

Credit: ESA/SMART-1/SPACE-X Space Exploration"

The South Pole location includes part of the South Pole-Aitken basis, the Moon's largest, and that attracts some scientists to that location, however. **<MMM>**

Europe's SMART-1 probe impacts Moon
Nearside splashout examined for clues

From Several Sources

Smart-1 successfully completed its lunar mapping mission, and was directed into a crash at 5,000 mph (8,047 km/h) at a very shallow one degree angle. Mission scientists expected a huge cloud of dust more than 12 miles above the surface of the Moon, giving them the chance to analyze the material beneath the surface dust. The impact, in the early hours of September 3, was visible through small telescopes or binoculars to observers in North and South America.

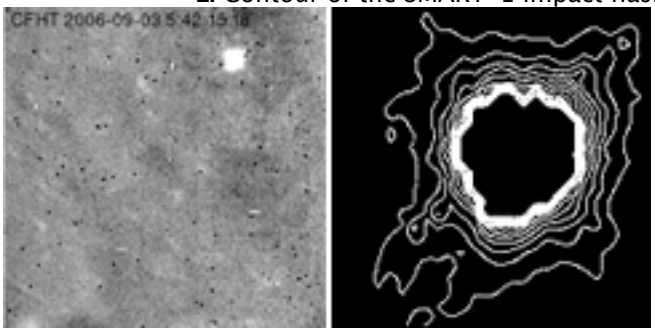
The point of impact was in **Lacus Excellentiae** south of Mare Humorum in the SW quadrant of the Moon's Nearside.

The area was experiencing night at the time, and the splashout plume was lit by "Earthshine" at higher altitudes and was brighter than expected, visible against the black background.

Photo by Canada-France-Hawaii Telescope

R: CFHT Photo of Flash

L: Contour of the SMART-1 impact flash



For more photos, and short movie sequences of the impact from the Canada-France-Hawaii Telescope on Mauna Kea, Hawaii Island, go to:

www.esa.int/SPECIALS/SMART-1/SEMWX03VRRE_0.html

The impact was the final SMART-I experiment, as astronomers studying the splashout plume hoped to learn a few things about the composition of the regolith soil in the area impacted. A similar experiment was planned for the final impact of Lunar Prospector, in which case, astronomers hoped to detect the clear sign of water vapor in the plume, as the impact area was within a permanently shadowed south lunar polar crater, which Lunar Prospector observations hinted held ice deposits. No water vapor was detected. LP may have hit a rock or crater wall protruding above the frozen soil area.

The Future of Impact Splashout Science

In the Beijing Declaration, attendees at the recent International Lunar Conference urged all agencies who send probes to the Moon to design controlled final impacts that would allow splashout composition studies.

NASA'S LCROSS Crater Counting Orbiter to Carry Ice-detecting impact Probe

http://www.nasa.gov/centers/ames/news/releases/2006/06_21AR.html - **RELEASE: 06_21AR**

The Lunar CRater Observation and Sensing Satellite (LCROSS) Mission will identify, with a high probability of success, the presence of water ice at the Moon's South Pole. It provides a 2000kg (2 m-tons) Kinetic Impactor that creates nearly a 1000 m-ton plume of lunar ejecta-*more than 200 times the energy of Lunar Prospector (LP)*-and be visible from a number of Lunar-orbital and Earth-based assets. The powerful impact is achieved by steering the entire launch vehicle's spent **Earth Departure Upper Stage (EDUS)** into a crater at the South Pole.

The impact will excavate a much larger area to deeper depths, and the resultant 70km plume will provide a much longer window of observation than would be possible if limited to a 1000kg Secondary Payload impact. The 1000kg Secondary Payload budget is efficiently used to provide a highly modular, reconfigurable **Shepherding Spacecraft (S-S/C)** to accurately guide the EDUS into the crater. On separation the S-S/C flies through the impact plume, telemetering real-time images and characterizing water ice in the plume with IR cameras and spectrometers. The S-S/C then becomes a 700kg impactor itself, to provide a second opportunity to study the nature of the Lunar Regolith. *LCROSS provides a critical ground-truth for Lunar Prospector and LRO neutron and radar maps,* to allow us to assess total lunar water inventory.

R: LCROSS EDUS heading-in

L: LCROSS plume developing with S-SC looking down

www.nasa.gov/centers/ames/multimedia/images/2006/lunarorbiter.html

Piggybacking on the Lunar Reconnaissance Orbiter

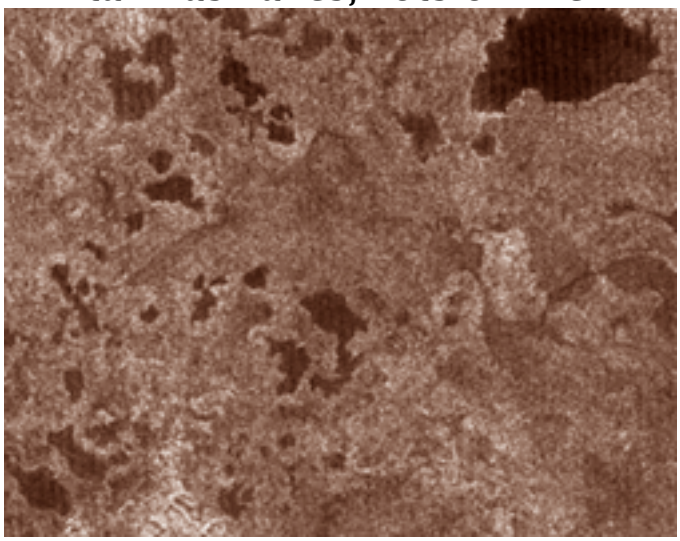
The NASA Ames team proposed the Lunar LCROSS as a secondary payload mission, *to travel with the Lunar Reconnaissance Orbiter (LRO) to the Moon on the same rocket,* the Evolved Expendable Launch Vehicle (EELV), to launched from Kennedy Space Center, Florida.

"We think we have assembled a very creative, highly innovative mission, turning the upper stage of the rocket that brought us to the moon into a substantial impactor on the moon," said Daniel Andrews of NASA Ames, whose team proposed the mission.

After launch, the secondary payload LCROSS spacecraft will arrive in the lunar vicinity independent of the LRO satellite. On the way to the moon, the LCROSS spacecraft's two main parts, the Shepherding Spacecraft (S-S/C) and the Earth Departure Upper Stage (EDUS), will remain coupled. On approach to the designated impact site, the upper stage will separate, and then impact.

"Using all the pig except the oink," as they say! </**MMM**>

Titan has Lakes, Lots of Them!



Crop of a lake-rich area in a B/W radar images taken by the Cassini spacecraft. *False color added by the editor.*
www.astronomy.com/asy/objects/images/titan_landoflakes_900.jpg
www.astronomy.com/asy/default.aspx?c=a&id=4420

These lakes, predicted for some time on the basis of previous knowledge of the makeup of Titan's atmosphere and its temperature range, are apparently filled with liquid methane. Previous photos have revealed river channels and tributaries very much like river systems on Earth. It is far too cold on Titan for liquid water, but just right for liquid methane, CH4, which melts from methane ice at -183°C (-297°F) and boils at -164°C (-263.2°F). Liquid Natural Gas for comparison is 75% CH4, 15% ethane (C2H6), and 5% other hydrocarbons, such as propane (C3H8) and butane (C4H10). No one expects these lakes to contain organisms of any kind, not at these temperatures, well below the most extreme cyro-conditions in which microbes have been found.

So eerily like Earth, so vastly different. Titan is surely one of the most amazing worlds in the solar system.

The interpretation of these areas as lakes is based on their smooth featureless expanses. Several of these lakes appear to show waves, however, and we do know that Titan has its winds. Some are sufficiently oval to suggest that they may lie in volcanic caldera. The similarity to Minnesota lake country has been noted, and there lake basins have been carved by glaciers. The origin of the lake basins on Titans is not yet addressed.

Does lake methane evaporate, then fall later, downwind as rainfall? That is yet to be determined. That this lakes are methane-filled now would indicate that whatever hydrodynamic (used generically) methane cycles are in play, are ongoing. If Titan experiences long-term hotter and cooler cycles (like Earth's ice ages) is yet to be determined. All we know is what we see now.

The lakes found by the synthetic aperture radar range from a few miles to 19 miles (30 km) across. Not all of Titan has yet been mapped by Cassini's radar. We may yet find much larger "Great Lakes" and even "Seas." Then again, what we see here may be all there is, but that is statistically unlikely.

Stay tuned! **</MMM>**

1st Annual University Rover Challenge

http://www.**marssociety**.org/urc

The Challenge: Over this academic year, teams of university students will design and build the next generation of Mars rovers. In May, 2007 the teams and their rovers will face off in the desert of the American west.

The Prize: The winning team will win transportaion, lodging and admission for 5 team members to the 10th Annual International Mars Society Conference at UCLA in September, 2007, and $5000!

September 2, 2006 Announcement:

"The Mars Society is pleased to announce the first annual University Rover Challenge (URC). The international competition for college students will require students to build prototype rovers and operate them remotely in an undeveloped desert area in the American west. Run in conjunction with the Mars Society's **Mars Analog Research Station** program, this unique opportunity will allow college students to take their knowledge and talent from the classroom on to Mars.

"University teams will spend the upcoming academic year designing and constructing robotic vehicles similar to those that will one day work with astronauts on the surface of Mars. Their rovers will be judged on their performance in completing a basic engineering task – deploying a remote radio repeater in the field – and performing scientific field research and analysis. Winning the competition will thus require interdisciplinary teams spanning knowledge in both engineering and the natural sciences.

"The desert face-off competition will occur in late May at a site to be revealed later. The winners of the competition will receive free transportation, hotel and conference admission for up to 5 team members to the 10th International Mars Society Convention, which will be held August 30-September 2, 2007 at the University of California, Los Angeles (UCLA). At the convention banquet they will be presented with a trophy by a top level NASA official, and receive a $5,000 prize as well.

"If you have any questions, comments, or would like more information on the University Rover Challenge, please contact Kevin Sloan (kevin@kfsloan.com)."

Abreviated Notes:

√ The rover shall be a stand-alone, off-the-grid, mobile platform. No tethers will be allowed during its operation for connection to external sources.

√ A radio repeater must be deployed at a remote site.

√ *Scientific Task*: Teams shall be required to tele-investigate a particular region to learn as much as possible about its geology and paleontology. Rovers may use cameras or other passive instruments to investigate the area, and may dig using mechanical methods. No explosives may be used. Samples must be investigated by the rover on-site, and may not be brought back to the crew for investigation.

√ The maximum allowable cash budget to be spent on the project is $10,000, including money spent on parts and components, but not tools, volunteer labor time, or travel expenses. In-kind donations of equipment.will not count against the cash budget. **<MS>**

More at: http://www.marssociety.org/urc/rules.html

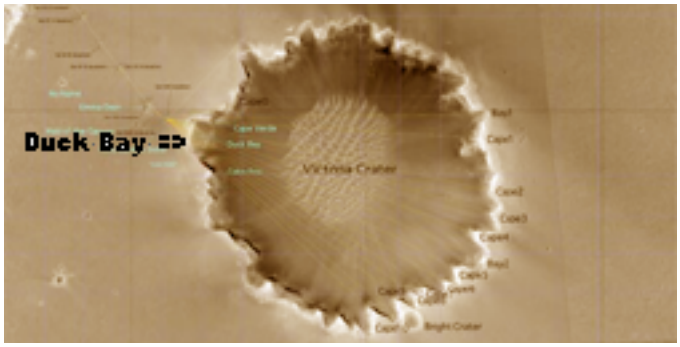
MMM PHOTO GALLERY

Inside Virgin Galactic's SpaceShipTwo Cabin

http://www.thespacereview.com/archive/49f.jpg

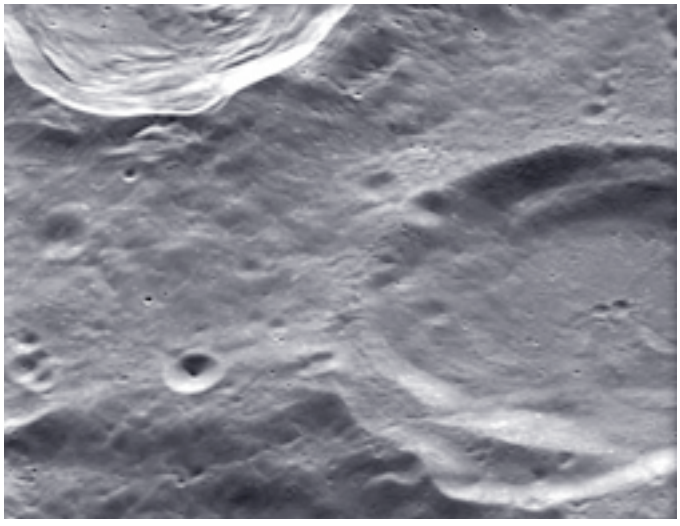
Welcome to Duck Bay, Victoria Crater, Mars

"Wish you were here," love, Opportunity



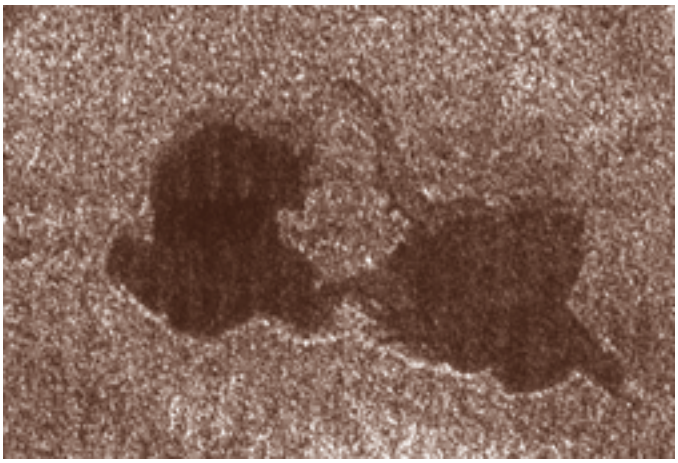
[color added by MMM editor]

"About to die in a crash, but meanwhile, I sure am enjoying the view! Love, SMART-1"



www.esa.int/esaCP/SEM2N58ZMRE_index_0.html#subhead6

Titan's "Kissing Lakes"



www.spaceref.com/news/viewsr.html?pid=22215

[color added by MMM Editor]

Moon Society Phoenix Outpost Displays

created by Craig Porter for CopperCon 26 - 09/1-4/06

View from side of table as you come in the door

Display includes two display boards with information about the Moon Society and pictures on the slide show. Also a Laptop to run the Slide Show and a DVD player

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!

2006 LRS OFFICERS / Contact Information

PRES. / MMM Editor – *Peter Kokh **NSS**
< kokhmmm@aol.com > 414-342-0705
VICE-PRES. Doug Armstong **NSS** 414-273-1126
SECRETARY & Database – James Schroeter **NSS**
< James_Schroeter@excite.com > 262-827-4281
TREASURER – *Robert Bialecki 414-372-9613
Newsletter Mailing – Carol Nelson 414-466-2081
(*Board Members & Ken Paul <kenpaul@cape-mac.org>)

LRS News

• **Planning our 20th Anniversary Gala, December 9th, 1-4 pm at our usual meeting place**: There will be no classic film this year. We want people to mingle! In place of our usual holiday potluck, there will be a catered buffet luncheon. The chapter will pick part of the cost, to keep tickets at $5 per person, no more. Exhibits, special guests, door prizes. More details need to be worked out. These basics were decided at the September 9th meeting.

• **James Schroeter has volunteered to take over maintenance of the membership and MMM mailing database** from Bob Bialecki, who will continue to serve as treasurer. This will better distribute the workload.

• **September 9th meeting:** We looked at the very insulting article about our moon base exercises in Utah Feb. 26-March 12 this year. The writer treated it as a spoof, showing his intelligence to be minimal. There was no attempt by the writer to ask questions. He merely grabbed photos off the web and made jokes about them.

We started making firm plans for our 20th anniversary event in place of our usual holiday party, 12/9.

LRS Upcoming Events

Saturday, Oct. 14th, Nov. 11th, 1-4 pm

LRS Meeting, Mayfair Mall, Garden Suites Room G110
AGENDA: www. lunar-reclamation.org/page4.htm

We will be continuing to focus on planning our 20th anniversary, of both the chapter, (Milwaukee) Lunar Reclamation Society, and Moon Miners' Manifesto. Among the guests will be some of the people from the Minnesota and Chicago chapters who rounded up area L5 Society members along with interested parties at the 2nd annual Triangulum Sci-Fi Con in Milwaukee on Sept. 23, 1986. Former leaders of the chapter will be invited as well as space enthusiasts from all around the state.

And, of course, space news updates.

MMM 7 NSS Chapters Strong

NSS Chapter Events

Space Chapters HUB Website:
[http://nsschapters.org/hub/]

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
October 21st – November 18th – December 16th

ILLINOIS

Chicago Space Frontier L5
610 West 47th Place, Chicago, IL 60609
INFORMATION: Larry Ahearn: 773/373-0349

MINNESOTA

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

Tom Greenwalt (w) 763-784-6244 (h) 763-442-6015
David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: tomg@mnsfs.org
[www.mnsfs.org/]
MN SFS News & Pictures

World Space Week observance, October 4-10: Radio City has scheduled their annual 'Star Quest' for Sat Oct 7th. 10am-5pm and invited MN SFS to participate. We are looking at ouroptions.

Pluto Party pix: (event at Joe's Garage, 1610 Harmon Place, Minneapolis, MN, August 31, 2006.

http://freemars.org/mnfan/MN-Planetarium/2006-Pluto-Party/

[Editor: what a splendid, spontaneous, spur-of-the-moment excuse for a party/networking event!]

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h) <willf@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 Thursday of the month 7-9pm

OCT 20th The Stoelting House, **Kiel**
NOV 16th: UW-Sheboygan, Room 6101, **Sheboygan**
DEC 21st The Stoelting House, **Kiel**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105

c/o Earl Bennett, EarlBennett@erols.com
215/633-0878 (H), 610/640-2345(W)

[http://pasa01.tripod.com/]

[http://www.phillypasa.blogspot.com/]

PASA regular business luncheon/formal meeting from **1-3 pm**, the **3rd Saturday of every month** at the **Liberty One food court** on the second level, **16th and S. Market.** Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St. Call Earl or Mitch 215-625-0670 to verify all meetings.

Next Meetings: Oct. 21st - Nov. 18th* - Dec. 16th
*The **November 18th Meeting** will be at
a location near the Philcon event site.

September 16th Meeting Notes: we had a great meeting due to the presence of a guest from a local business: Alex Howerton of The Nastar Center came to talk about space, business opportunities and the company he works for. There will be centrifuge training on site and other facilities needed to keep proficiencies up for military and civilian professional pilots and space flight candidates. We may be allowed to tour the operation in the near future. Alex, whose title is: Buisness Development Manager, Space Training, comes from the mid west where he was a college instructor in mathematics. he has maintained an interest in space exploration since his youth, has attended a few conventions World- Cons included, and knows a number of space exploration advocates. He is an NSS member and has also been a part of the Planetary Society and more. He and our Mars Society Coordinator, Gary Fisher, shared interest in the operations at the Mars Desert Research Station where Gary will be helping out with the ongoing environmental project, he has worked on it for years, with much other first person discussion of events and projects most of us only read about or look in on. A very good guest appearance from someone who is willing to pitch in: Alex will help Mitch at The United Nations Space Day Event at the Franklin Institute where they will man our table. This will be on October first. Welcome, and thank you, Alex!.

Michelle Baker gave our financial report, we are solvent. Anyone who owes dues should renew so we can do more for public outreach. Happily, much of our awards and bills are supported by generous members but we could improve our offerings and gifts (comment by Earl).

Gary Fisher, as noted above, will be going to Hanksville, Utah, to work. During our extended conversation a number of items where mentioned: at MDRS the crews will be from NASA's Spaceward Bound Program the rest of the year. Gary mentioned "The Wired Nextfest" in New York where neat things will be happening. One of them is the unveiling of Space Ship II. Go to Google to get more.

And speaking of more: because of the visit by Alex our area may be a place to test some concepts and equipment that the Mars Society and Mars Homestead Project group want to test. Comment: lets say you are working on a background project on plant viability in Mars like conditions or the utility of elements of a Mars suit being melded together, or other " real world" verifications of our ideas. The facilities of this local operation, The Nastar Center, could bring this kind of research and testing to our area, not at a university or college, but at a commercial operation where the potential to work on aerospace and space projects for a living can be shown. O.K., back off the soap box.

Mitch Gordon, who wants to arrange a public event wit speakers on space here, was delighted with the appearance of Alex at our meeting. Both have written books and are currently creating new ones. Mitch suggested a space exhibit for entertainment and theme parks and that's when we found out about another division of Environmental Tectonics, the parent company of The Nastar Center, works in this area. If you've gone to a number of theme parks, like Disney Land or Great Adventure, you have probably experienced some of the engineering done by this company. Mitch will try to bring together Alex and Derrick Pitts of the Franklin Institute to discuss possible involvement. On the Philcon front: Mitch has volunteered to be on several panels at this event and urges our members and friends to consider helping or attending.

Hank Smith told us of his trip to the WorldCon science fiction convention. He thought their science fact track was really good. He also talked of the need for panelists and speakers for the Philcon convention in November. He gave us a contact name and several topics that may warrant a spot on the schedule. By the time this is printed it will be "for the record" so, if you want to participate, go to science2006@philcon.org (contact is

Margaret Trebling) when you get this as e-mail Topics so far could be a tour of the solar system and single stage to orbit. I expect that anything to do with recent genetic and nano technologies would be of interest as well. As for Hank himself, he may be at Capclave during our October meeting. November: definitely!

Earl brought material from Analog magazine, which has a good "science track" of its own, on The Interstellar Conspiracy by Lee Johnson and Gregory L. Matloff on what could be used to really go "where no man has gone before". The article talks of this distant future but also notes that we could be in intra-stellar space with current technology. The current objects of interest, in the Kuiper belt, and those at the shores of the solar system, the Oort Cloud, could be surveyed before we go for the great leap. Much good material and references. For current explorations, Nuts and Volts had a really good article on Near Space: "Near Space Booms and Sounds" by L. Paul Verhage. Not only are the topics of interest in themselves, the home brewing of a support boom b using very thin laminates (hobby plywood) and foam board (hardware store) and picking up sound, via launching a camcorder at the time, cooperation with local schools and higher education institutes where shown.

And finally: the latest issue of The AMSAT Journal has the new column by H. Paul Shuch called "The Orbital Classroom- with "1000 C.C. of Science" as the subject this column. As described in previous Pasa reports, this is a program for students at the under grad and graduate level to work on the design and development of experiments and the systems used to support them with a basic level of support for the craft already available, The communications would be handled via ham radio stations which are run by licensed people whose primary interest is communications with a large subgroup enthusiastic about space oriented signals. The article describes how two hams, who where also college teachers, shepherded the idea along for this program. Cliff Buttschardt, who recently passed away, was one of the two and had worked on "amateur" satellites since Oscar One in the early 60s. The other shepherd, Ed English is still active and he and Cliff where responsible for the development of a standard launch accessory called the "P-Pod" to deploy the "Cubesats". And much more about this program. In other articles we see the new frontiers in r.f. engineering with Gallium Nitride devices and the problems of terrestrial based interference with the "birds". A very good issue. Dates: Nuts and Volts: 9/06, Analog: 11/06, and AMSAT Journal: July/August issues respectively.

As before Dorothy Kurtz would like to see more space at the Museum of Science in New York (former site of the Worlds Fair) and asks if the New York NSS might lobby for this with the city.

All for now, finally, from Earl Bennett, President of Pasa. More next month if developments occur.

Vision without action is just a dream
Action without vision is just activity
Vision and Action together
can change the world.

CALI FORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
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/]
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month
Microcosm, 401 Coral Circle, El Segundo.

- **October 21st - November 18th - December 16th**
- Holidays can cause modification of the schedule. Information: OASIS Hotline, 310/364-2290; website.

Upcoming Events

- **Sat. Oct. 7th, 4:30 pm** - First Light: **Presentation** on the **Renovated, Expanded Griffith Observatory**", by Kara Knack (Renovation Communications Officer, Friends of the Observatory (FOTO)) at the Long Beach Public Library, 101 Pacific Avenue, Long Beach. FREE. *This event is not library sponsored.*
- **Sat. Oct. 21st, 3:00 pm** - OASIS **Monthly Business Meeting**, location TBA. Call the *OASIS Hotline,* 310/364-2290, for more information.
- **Fri-Sun. Nov 24-26th -- Loscon 33**, the annual regional science fiction convention of the Los Angeles Science Fantasy Society. OASIS will again be providing science programming and doing public outreach at this event. We also throw a great party!
  Con Info: http://www.loscon.org/

Recuring Events

- **Fridays** -- Mike Hodel's Hour 25 webcast. The world of science fact and fiction with interviews, news, radio dramas, artists, writers, stories, reviews, and much more. Information: http://www.hour25online.com/.

Note to readers: As OASIS does not publicize its events on its website more than a few weeks in advance, we regret that we cannot give you advance "heads up" on upcoming events in the month or two ahead. Do consult the website for the latest information. - The Editor

---

How do be an effective serendipitist!
Keep looking for something else!!!!
and keep finding stuff!!!
- David Dietzler

NAME _____

STREET _____

CITY/ST/ZIP _____

PHONE#S _____

○ **$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

INDEX to #199 October 2006

p 1. In Focus: Protecting Robotic Exploration Budget, PK
p 3. The Outpost Trap, cont. Part IV: In Situ Resources
p 5. Part V: Industrial Diversification Enablers
p 6. Part VI: The Entrepreneurs
p 7. Part VII: Crew Personnel; Moon as Virgin Territory
p 9. Moon Society: Board slot filled; Our new Wiki
p 10. Candidate Lunar Analog Sites
p 11. Our moonbase exercise PowerPoint Slide Show
p 12. Welcome Calgary Space Workers; Outposts Report
p 13. Browsing Links; N. Pole Peak of "Eternal Light"
p 14. SMART-1 Impact: LCROSS Impact Plans
p 15. Titan has Lakes!; University Rover Challenge
p 16. MMM Photo Gallery
p 17. LRS News; MMM NSS Chapters News

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

=> *for those outside participating chapter areas* <=
○ **$12 USA** MMM Subscriptions; ○ US **$20** Canada;
○ US**$50** 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)
○ $12 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)
○ $25 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

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

Moon Miners' MANIFESTO

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

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

Pre-sorted Standard
U.S. Postage Paid
Milwaukee, WI
Permit No. 1275

If Expiration date is highlighted, this is your last copy.
Please renew promptly so as not to miss an issue