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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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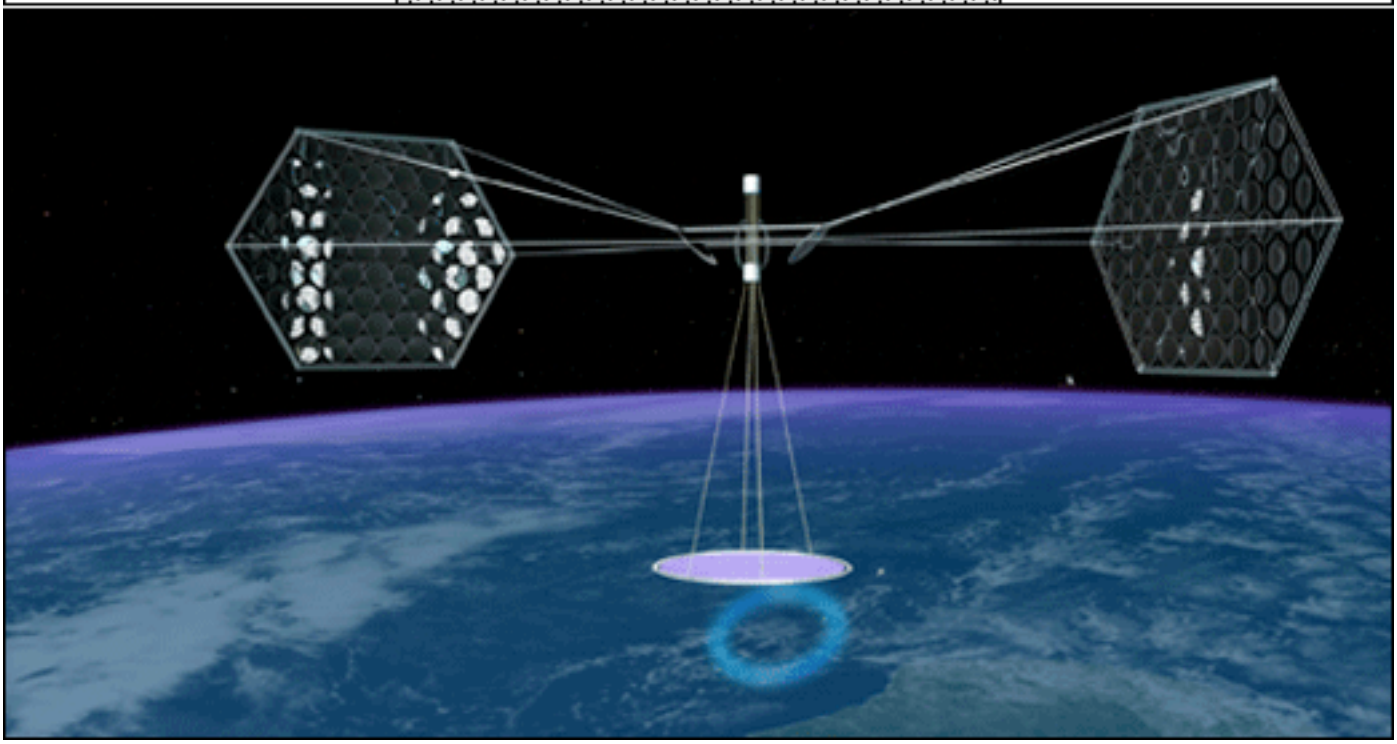

Above: **One Current Design for a Solar Power Satellite, the inspiration for the Moon Society's desktop demo unveiled at ISDC 2008, pp. 10-11**

Feature Articles in This Issue

Teleoperators on Earth: Shadow Pioneers >>

Until the lunar domestic economy is so well established that most products needed for consumption are produced locally, and until settlements are producing enough exports to pay for what they must still import, the "wages" of lunar pioneers will be counted in terrestrial monetary units, as "astronomical" - e.g. c.$100,000 per hour. It makes sense to reserve people on the Moon for those things only they can do, and teleoperate all assisting operations from Earth. In See pp. 4-6.

IN FOCUS Reauthorizing the Vision for Space Exploration

On May 7, 2008, George Whitesides, Executive Director of our affiliate organization, The National Space Society, read a prepared comprehensive and in depth presentation on the future goals of the American Space Program before Congress.

His audience was a US Senate Subcommittee - the Subcommittee on Space, Aeronautics, and Related Sciences Committee on Commerce, Science, and Transportation, which was having a special hearing on the subject. [=> p. 2, col. 2]

Moon Miners' Manifesto

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 worldwide.

• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first eighteen years have been re-edited, reillustrated, and republished in 15 PDF format volumes, 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" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
• **MMM retains its editorial independence.** MMM serves 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.
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• **The Lunar Reclamation Society** is an independently incorporated nonprofit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. LRS serves as 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 - www.NSS.org
• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.
• **NSS chapter**s and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.
• **Publication Deadline:** Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, *Sooner is better!* - ***No compensation is paid.***

• **Submissions by email** to KokhMMM@aol.com - Email message body text or MS Word or PDF file attachments
√ Mac compatible CD / or typed hard copy must be mailed to:
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⇒ In Focus Editorial continued from p. 1.

As we all know, or should know, none of the three remaining candidates for the Presidency of the United States shares our vision in more than part. The VSE, originally dubbed "Moon, Mars, and Beyond" is a vision in jeopardy.

It is a problem because neither of the candidates, or their science advisor teams, has made space a top level priority, though all three proclaim strong support for the Space Program.

A twofold problem

On the one hand, partially because of the current war, partly because of the state of the economy which is not as strong and vigorous as it was four years ago, Congress and the Administration are facing a dire need to cut expenditures.

On the other hand, this constant squabble over diminishing slices of a diminishing pie, pits those who should be allies in opposing positions. In our case, that means robotic planetary exploration and manned space programs.

The hard facts are that different programs which should be funded separately are mischievously put into competition by the committees and subcommittees under which they are funded.

Not only has it long been a mischievous tactic to pit NASA against HUD etc., it is mischievous to pit robotic exploration against manned space programs.

Is there a way out? We think so, but it would be a hard sell.

Divide NASA programs into two parts, robotic space exploration and manned space programs, under two different agencies, not one. Currently, even if Congress supports funding for both programs, the NASA Administrator has the power to pick and choose, for example, cutting planned robotic exploration so that the Moon program can continue, or vice versa.

One thing many space advocates have been pushing for more than two decades is to make NASA a customer for space transportation services, not a provider. If we did that, the Constellation-Orion-Ares programs would be canceled, to the great advantage of commercial COTS type programs to create incentives for the Commercial Launch Services Industry to provide superior vehicles at lower launch costs. Competition alone can reduce outrageous space transportation costs.

Then, even as NASA put out a call for proposals for providing crew and cargo transportation to the International Space Station for the period between the mothballing of the remaining Space Shuttle fleet and the debut of service to the space station by commercial providers, the Agency could put out a call for moon base design, construction, and build out services to be provided commercially, and then, looking at the proposals, pick the best two for initial funding.

No matter how highly we regard NASA on the basis of past achievements, the very way NASA works escalates costs and makes all space programs much more expensive than they would have to be. One of those cost factors is satisfying Congress and the population at large on safety. Both Congress and the American people at large are becoming increasingly risk averse in a way that betrays the pioneering frontier spirit of our ancestors. This development is not something of which to be proud. Commercial contractors can be more realistic.

There has hardly been a major skyscraper or major bridge built without fatalities.

We cannot continue to keep the space program hostage to the feint of heart. The timid who believe it is a God-given right of every person to die of old age must not be allowed to constrain the hopes and aspirations of our nation. Most of our leaders know that, of course, and that gives us hope that Space will not fall victim to those who would cease all this progress stuff, a problem addressed in the classic 1936 science fiction film, "The Shape of Things to Come."

In the long haul, the only way we can assure our vision for Space, is to free it from the veto power of those for whom it is not a top level priority, that is, American taxpayers, NASA, for all its tremendous accomplishments, remains a socialized space program.

Our number one legislative initiatives should be to continue in the fine tradition established by space enthusiasts in recent times to dissolve unnecessary roadblocks for commercial space enterprises. We have made progress. We need to make more.

An incentive program on the order of a national X-prize program, might be established to give extra incentives to the commercial sector.

And we should start creating incentives for power production companies (fossil fuel, and electrical power both) to develop space-based solutions and sources.

National support for Space Tourism initiatives would also help.

Now that would be the American Way!

Do read George Whitesdes' very comprehensive presentation! The Moon Society (and NSS-Milwaukee – The Lunar Reclamation Society) lauds and supports this statement, and we have posted it, a 78k pdf file, at:

http://www.moonsociety.org/publications/papers/GW-ReauhtorizingVSE.pdf

We must all realize that just as NASA invests in redundancy to avoid systems failures, it is in our best interests to invest in redundancy at a higher level, so that if NASA fails, whether on its own or for lack of support in Congress and in the Administration, that our future in space will not fail with it.

Putting all ones eggs in one basket has never been a good idea. Too many of us, I fear, have put all our vision eggs in the basket of NASA. We owe it to ourselves to invest in alternative options. We cannot and must not let the veto power of the public to decide the fate of our goals and aspirations. This is not an anti-NASA statement, it is an anti-"one-basket-only" statement. – **PK**

No July issue

MMM #217 will be published in August.

MMM is published ten times a year,

Monthly, except in January and July.

To give the editor

A "burnout-prevention" break,

And time to regenerate and refresh.

Model of a Station Designed for L1

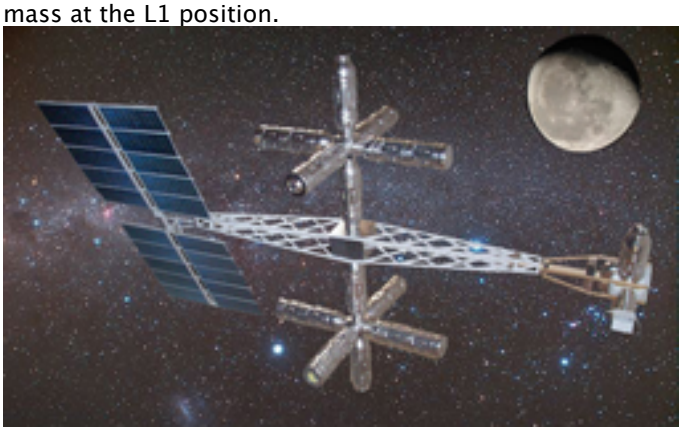
by Chuck Lesher

My BS degree is in Engineering Mechanics/Aerospace and was heavy on Dynamics. The design of this station makes sense from a mathematical perspective and requires no reaction mass (fuel) to keep it aligned to the Sun. Station keeping is another story and will expend fuel. Just how much depends on the overall mass of the station but again, my gut tells me that if you catch the drift soon enough, a small amount of thrust will do the job. High efficiency VASIMR engines should do the trick.

Lagrange One:

Lagrange point L1 is the perfect location for man's next major space station, the natural gateway to the moon. This one-of-a-kind point in space is located on the direct line between Earth and Luna about 200,000 miles from Earth, or conversely, a mere 39,000 miles above the geometric center of Luna's nearside.

The quasi-stable nature of the gravity field surrounding L1 is analogous to putting a mass on the summit of a frictionless hill. The slightest nudge will start the mass sliding down the hills flank. This means that active station keeping will be necessary to maintain any mass at the L1 position.



Similar to the ISS, Lagrange One Space Station will be a simple affair constructed of cylindrical modules whose size will depend upon the heavy-lift capability of our biggest cargo launchers. The Central Hub and Truss will be the largest assembly job to date in space. Designed to leverage against the mass of the modules, the entire Truss rotates as do the Solar Array and the Solar Furnace at each end. Constructed in LEO, the finished station will be gently moved to L1 using VASIMR electromagnetic thrusters.

The design of this station requires no reaction mass (fuel) to keep the solar elements aligned to the Sun. Station keeping is another story and will require the expenditure of fuel. Just how much depends on the overall mass of the station but again, if you catch the drift soon enough, a small amount of thrust will do the job. High efficiency VASIMR engines should do the trick.

During normal operations, L1 revolves slowly like a precision timepiece, completing a single cycle once every 27.3 days. It happens so slowly that most people cannot even tell its taking place. It is this intricate dance, worthy of the finest Swiss watchmaker, that keeps the Solar Array and Solar Furnace always pointed at the Sun even as 1 orbits the Earth, which in turn, orbits the Sun.

NB. Chuck is a core member of Moon Society Phoenix and the new Moon Society Secretary. A hobby of his is making large space models such as the one above.

SHADOW PIONEERS

By Peter Kokh

You won't have to move to the Moon
To become a Lunar Pioneer!

Until the lunar domestic economy is so well established that most products needed for consumption are produced locally, and until the settlements are producing enough exports to pay for what they must still import, the "wages" of lunar pioneers will be counted in terrestrial monetary units, as "astronomical" – e.g. $100,000 per hour.

The best way to bring that figure down to size in the interim, will be to reserve for pioneers on location, what only someone on site can do. Conversely, a partnering crew on Earth, paid more down-to-Earth wages and salaries, will strive to push the limits of tele-operation and telepresence as far as possible so that the lion's share of routine chores on the Moon, including the lion's share of the most dangerous chores, will be done by machines under their control, with on site supervision.

Even in the Apollo days, mission crews on Earth magnified the efforts of the six pairs of moonwalkers, by monitoring their activities, analyzing problems and glitches, and brainstorming ways to survive unexpected emergencies. Having mockups on Earth of equipment on the Moon helped considerably, notably in getting the Apollo 13 crew home safely, against considerable odds.

It would not be misleading to say that the actual number of people on the Moon during each of those missions, counting virtual presence on a par with actual presence, was considerably larger than two! In that respect, these "shadow pioneers' have been somewhat underappreciated. To say that the moonwalker duos stood on the shoulders of large teams on Earth would be an understatement.

This ratio of shadow pioneers to on site pioneers will continue, if not grow much larger and more varied in type of support offered, as we return to the Moon to set up a quasi-permanent hostel that can be revisited and eventually "built out" to a more fully functional size, as the seed of a first settlement.

In time, the first lunar settlement historians will recognize Earth-bound shadow pioneers as true Lunan pioneers. Those who go to the Moon and stay, and in time raise families there, will be just the frontline of a much greater population that should be revered as pioneers as well.

Many ways to help

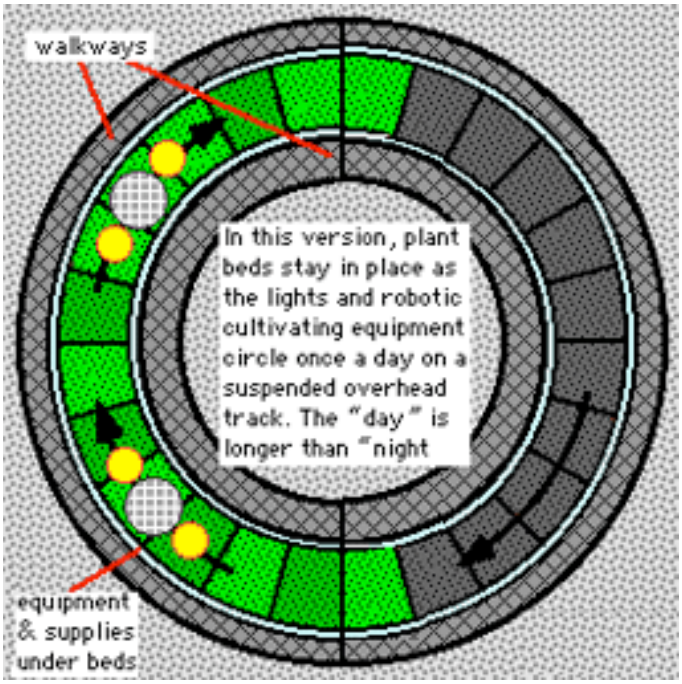
Equipment operators

Perhaps a considerable portion of road construction, site preparation, and mining chores can be done remotely by teleoperators on Earth. The less than 3 second time delay in sensing a response to one's moves takes some getting used to, and some will master the trick much better than others. Indeed, if there was a legitimate place for child labor (*without* the long hours and low pay) this might be it. Young people have much more manual dexterity than adults, can more quickly and more easily master the game of anticipation needed to handle that time delay. To be fair, adults with a long history of electronic game playing going back to their youths, will score well to. It will help that in the kind of regolith-moving operations listed above, we can afford the slower pace of operating under the conditions of that time delay.

Agricultural Chores

Given an automation-friendly design, such as the torus-shaped greenhouse layout sketched below, where cultivating equipment circles around and around at any pace desired, much of that equipment could be robotic. But supervisiory intervention from Earth could make any such system even more efficient, clearing jams, repairing or replacing components, etc. Yet the on location supervision needed should be minor.

By contrast, one of the badly designed aspects of the original Biosphere II experiment was that the 8 biosphereians had to spend most of their waking hours nurturing crops to harvest, without much time for anything else, much less time for recreation. Even so, they still all lost weight, manifesting all the signs of malnourishment. On the Moon, we need to avoid such labor intensive operations. It will be more important to reserve actual on location manpower in the production of products for export. Exports, to facilities and instillations in GEO and LEO and other in-space markets, as well as to Earth's surface, will bring home the lunar bacon.



Teaching, tutoring, advanced education

Long before the arrival of the first native-born lunans, settler-pioneers will need to be continually up-grading their education, as needs evolve, and methods change. It wil be far more efficient in the early years, to have the teachers, tutors, and trainers on Earth. A person on Earth can be supported (food, health, etc.) much more cheaply than individuals on the Moon, in the early years.

In time, as the settlements evolve with an ever growing portion of both youngsters and seniors, these things will change. Older people needing to slow down physically, may take on ever more educational duties. If Lunans retire to "half-time" instead of 100% free time, they could take on the lions share of parenting operations to free young parents for export-production chores. We already see, though for different reasons, the growing percentage of "grandparents raising grand-

children." In the case of the lunar settlers, this will develop not as a result of more parents coming under the influence of drugs, etc. that for just plain economic sense. But we can expect that a significant amount of educating and tutoring will still be by telepresence, with on location assistants handling questions and problems.

Healthcare, nursing, medicine in general

This is one area where a high portion of work will be done by those on location. At the same time, ever more of diagnostic tasks will be done by compu-ters. Interviewing patients, and channeling them to the right departments and many other preparatory work chores, can be more efficiently done by tele-presence.

Recycling

Sorting recyclable materials into the proper bins can be done by machines. Disassembly of products comprised of materials that need to be recycled separately is an area where computerized equipment can relieve a lot of people for other assignments. This presumes that all products will be assembled in a disassembly-friendly way (not with super bonding adhesives that leat to cross-contamination of dissimilar materials, a method that is "in" today.) Recycling equipment can be monitored from Earth, with a minimum of personel on location on the Moon ready to intervene when needed.

Research and Development Facilities

When the mass of material being analyzed or used for experimentation is minor in comparison to the equipment needed, it will be cheaper to ship sample material "down the gravity well" to Earthside or orbiting facilities than to send all that equipment to the Moon. That may be the case early on, but as the population on the Moon grows, it will make more sense to do such research on location.

Field work: science and prospecting

It would seem to make sense that robotic or tele-operated equipment did the bulk of the scouting chores, while humans on location gave their attention to samples identified by the robotic equipment or terrestrial tele-operators as deserving special investigation. The final filter in what is significant and needs to be investigated further, is the human one. Artificial intelligence will probably always have its blind spots.

Other tasks done by people operating in settings less expensive to support

Automated stations would monitor the Sun for signs of approaching sunspots, flares, and coronal mass ejections. Humans on Earth would make the final judgments and alert pioneers on the Moon to take any special measures needed.

One could cite many more examples. The message here is that when some supporting task can be done on Earth without significant clumsiness due to the three second time delay, it will make economic sense to apportion tasks in that manner.

Many people on Earth will be involved in supporting roles in the epic drama of lunar settlement. To many of them, their contribution may be "just a job," and they'd prefer collecting a pay check to accolades. But if Lunar pioneers are to be honest with themselves, they will be forever grateful to these cadres of assorted stay-at-home shadow pioneers.

Beyond the Moon

Will there be a similar Earthbound support group for the first waves of Martian Pioneers? Maybe, maybe not. Unlike the Moon which orbits the Earth in a fairly circular orbit, Mars and Earth both orb it the Sun each in their own orbits, with the distance between them varying from as little as 35,000,000 miles (140 times the Earth-Moon distance) to as much as 248,000,000 miles (a thousand times farther than the Moon.) As a result, the communications loop between the two planets varies from about 6 minutes to about 40 minutes – quite a bit longer than the less than 3 seconds separation between Moon and Earth.

We can teleoperate on Mars, but it is an excruciatingly slow process. If Mars was as close as the Moon, we could have driven Spirt and Opportunity over the same paths in weeks as opposed to years. So basically, we cannot really have the same kind of homeplanet – frontier teamwork as we expect to have on the Moon.

However, there is a way. If we were to set up logistical forward camps on Phobos and or on Deimos, crews there could teleoperate whole armies of small exploratory and prospecting probes in a relatively short time. Of course, such advance location crews would be vastly more expensive to maintain than the shadow pioneer crews on Earth.

This is a drawback and major impediment that confronts those who would settle Mars, that the more impatient Mars advocates (e.g. Robert Zubrin) want to push under the rug, if they consider it at all.

You can sum it up in three words: the Moon will develop a pioneer economy much faster than Mars, even though the latter world is blessed with more resources, because the Moon has the three most significant resources of all: "Location, location, location." The Moon can be settled at the end of an umbilical cord. Not Mars.

Mars will need to a different plan, a mass assault by a very large and diversified contingent so that we have as many people on the ground as soon as possible. And with no possibility or umbilical cordlike resupply or rescue, they would have to bring with them along with a yolk sac of resources and supplies.

The unworkably long communications lags, and the very infrequent launch windows, 25+ months apart (vs. virtually anytime for the Moon), will require an all out effort right from the start, with little in the way of realistic exports worth the transport cost back to Earth for income. Solar Sail freighters can blow away the infrequency obstacle and luxurious cycling spaceships will make enjoyable the very long journeys either way. At ISDC 1994 in Toronto, this writer warned that despite all Mars' many plusses, all attempts to develop an economic case for Mars (Zubrin's rare gems, and special pharmaceuticals growing in Mars soil) are grasping at imaginary straws. A case can be made, but only by developing Mars and the Moon apace with three way trade. But we drift from our topic.

While many want in their impatience to bypass little Phobos and Deimos, they only cut their own throats. Patience pays off. Impatience usually backfires. Developing Phobos and Deimos in synch with the development of Mars surface settlements is the only rational plan. But irregardless of how those frontiers are

opened, there will not be the same amount or scale of significant shadow pioneer contributions.

Productivity costs are not the only consideration

Safety is important also, and even further into the frontier future, when, as the lunar domestic economy grows to the point where labor costs are a lunar domestic matter and comparison with terrestrial labor costs have become meaningless, we will still be employing a high ratio of automated robotic and teleoperated devices on the Moon, for safety reasons.

NASA's experience with EVA (Extra Vehicular Activities), i.e. showed activities by personnel wearing spacesuits incur significant safety and fatigue risks. Mistakes that on Earth would be easy to dismiss in space and in vacuum in general, can easily become fatal or life-threatening. We will always want to minimize the number of suited individuals doing field- work of various kinds. There will be a difference, of course. Teleoperation will then be done locally, by pioneers inside pressurized environments, at whatever distance, without felt time delays.

Safety is not the only challenge**.** If we do not succeed in developing space/pressure suits that are more user-friendly, fatigue which is a definite factor in EVAs at the International Space Station, will continue to be an issue on the Moon. NASA and several contractors had been working on alternative suit designs, but funding for this work has been cut. Unfunded research continues at a low priority pace.

Will "Shadow Pioneers" appreciate their role?

It has been said that only 15% of people are fortunate enough to get paid for doing something that they really love to do. The other 85% do what they do because they have to earn money somehow. "It's just a job!" Undoubtedly, to many "shadow pioneers" their work will indeed be just another job, and many will care less how much their work may be appreciated by on location lunar pioneers. But in fact, it will not just another job, and we predict that the ratio of personnel involve who get extra satisfaction from the realization of how important their work is, will be on the high side.

Pioneers on the lunar frontier, however, may well better appreciate the efforts of shadow pioneers. Indeed, it would not be surprising if future frontier calendars listed a "Shadow Pioneer Day" with possible holiday status. So why don't we in America have a day of appreciation for all the pioneers who helped lay the foundations for the freedom and prosperity we all enjoy? Maybe that is a separate issue to pursue.

Conclusion

Teleoperation and telepresence will play significant roles in the opening of the lunar frontier and the spread of a global human presence there. On Mars they could play a role, but a less important one. After the Moon, the most promise lies in teleoperating equipment landed on Earth-approaching asteroids.

Teleoperators will be shadow pioneers, doing invaluable service. They will allow fewer people actually on the Moon to get more work done at less cost, and just as importantly, at less risk. They will be true lunar pioneers, even though they may remain out of the public eye. But if the frontier effort is successful in establishing a viable Earth-Moon economy, their work should be long remembered. **<MMM>**

Article Sequel: A Similar Problem

The Limits of Delayed Conversational Response

By Peter Kokh

We ran an article about the limits to effective time delay conversation in MMM #131, Dec 1999, p. 6

"**The Colloquipause***: the end of conversational space."

[Reprinted in MMM Classic #14, pp. 4-6, a free download from www.moonsociety.org/publications/mmm_classics/

or from www.lunar-reclamation.org/mmm_classics/

[* "colloquipause": the distance over which *fluent* conversartion becomes *impractical – our coinage & definition*]

In this article, we called for a pair of simulation exercises: one series would start with the Moon's three second delay and gradually lengthen it, until most experimenters became weary or frustrated with the growing length of the time delay.

> " "At some point individual speakers will, upon receiving the response, start having trouble remembering what they said to which the reply is a response. Different people have different attention spans, and differing susceptibilities to distraction. The point is to find at what level of delay each person says 'enough! this no longer feels like conversation!'"

In the other series, volunteers would experiment teleoperatiing using the 40 minute time delay, gradually shortening until they reached a point were it seemed to become manageable, started to feel "live." It would be interesting to see how far apart the maximum tolerable and minimum tolerable time delays might be for the two crews. We don't really have any idea!

Not Quite the Same Game

But is this relevant to teleoperation? **Delayed conversational response is not the same as delayed teleoperation feedback.** We need to do a similar set of tests, not with conversation, but with teleoperation using increasing/decreasing physical feedback delay times.

Such experiments could let us know what the practical range is for teleoperating equipment on an Earth-approaching asteroid. 500,000 miles? 3,000,000 miles? The equipment cost involved would not be great. Experiments aimed at determing the practicality of teleoperating equipment on the Moon have already been done using Radio Shack toy cars with a programmed 3-second time delay for joystick feedback. A Moon Society or NSS chapter or a school class could undertake the experiment.

To give this research validity, such experiments should be tried by several groups to identify a mean figure and a +/- variance. Thus a common report center must be identified. If there is substantial variance, we need to find out what was special about the group or groups that did best.

Of course, trying to teleoperate machinery that can do a variety of chores will require more than a simple joystick, as well as more than just manual reflexes. In fact, we do not know what the limits are to the kinds of chores that can be effectively teleoperated. **Pushing the limits of teleoperation could be a major focus for a future Lunar Analog Research Station.**

While this research seems rudimentary and low level, the results could be of major importance. **<MMM>**

MAINSTREAM SPACE

By Madhu Thangavelu <thangavelu-girardey@cox.net>

It is now more than 50 years since the dawn of the space age, and even today much of space activity remains the monopoly of governments and their sensitive defense establishments. Space exploration budgets are closely tied to defense and intelligence pursuits, and are all linked in some way, shape or form. Indeed, it is correct to say that space activity is a niche human endeavor and not yet fully integrated into the mainstream of peaceful, sustainable, progressive human activities.

Commerce, the lifeblood of modern civilization and a chief agent of transformation, continually creates, evolves and sustains mainstream activities. Transportation infrastructures, housing, factories, and manufacturing and energy production and distribution are clearly mainstream activities. The recent proliferation of Internet technology and associated business developments, which continue to spur its growth at a stunning pace in arenas as diverse as education, telemedicine and gaming, make it an ubiquitous and mainstream activity.

Energy production and distribution, with the petroleum industry playing a significant role, is a mainstream activity. While the media these days tends to highlight our addiction to fossil fuels and its effects on the biosphere, we rarely pay attention to the fact that petroleum by-product utilization, like polymer technology, have entered the mainstream and become an integral part of daily life for all of modern civilization.

Space exploration programs, both manned and robotic, are not mainstream activities. The allotted budgets for space exploration across the entire world pales in comparison to the resources oil companies bring to bear just for prospecting – exploring for new oil fields.

However, even while shackled to national security, space activity has managed to grow roots into modern society and continues to engage our noblest aspirations and uplift the human spirit.

A ringing success story of space entering the mainstream is telecommunications. Ten years after the birth of the space age, satellites were beaming TV pictures around the world and people were watching Neil Armstrong and Buzz Aldrin set foot on the Moon. Twenty years later, geosynchronous communications networks made the world smaller by hooking up the financial and commerce hubs of the world and transporting data in ways and rates that terrestrial systems find hard to compete with, even in the age of the Internet and surplus dark fiber. Space telecommunications is now a sturdy and lucrative industry, which is constantly evolving to meet the needs of the mainstream customer in the world of commerce and media while supporting the all-around needs of the defense establishment as well.

What are the other areas of mainstream human pursuits where space can play a significant role? The production of clean, environmentally friendly power from solar energy in space and its transmission and distribution globally could be a very lucrative industry. Such a vision was first proposed in the 1960s, and after many iterations and reincarnations at various think tanks and conferences, it now again is becoming a strategic interest of both our nation and all the exponentially growing economies around the world.

Wireless transmission of energy, also known as power beaming, has inherent implications for environmental modification as well. This nascent technology, which would allow us to control weather by design to ameliorate the effects of hurricanes and precipitation that cause deluges and droughts, could become a beneficial offshoot of space-based energy production. Power beaming, when trained outwards into space also could provide energy for spacecraft. Some concepts even propose using such beams to mitigate rogue asteroids that might endanger Earth.

Transportation is a vital infrastructure where the need is growing, ratcheting up the technologies for quicker access to the various metropolitan cities all over the world. Los Angeles, New York, London, Paris and Frankfurt now compete on equal footing with Shanghai, Dubai, Mumbai, Singapore and Tokyo. In this flat world model, quick, efficient worldwide transportation plays an even more crucial role. Transatmospheric vehicles, based on crafts like the space shuttle, could usher us into a new era in mainstream global transportation.

If space activity can do for energy production, power distribution (with potential for environment modification technologies) and transport infrastructure in the next three decades what it did for telecommu-nications in the last three, the ramifications for modern society are truly staggering. Cheap and clean power in space and on Earth, and the ability to move goods and people swiftly around the world in a fraction of the time that it takes today, would make the world smaller and perhaps a much more tightly knit community.

The emerging private space companies, with little or no government support, are helping to mainstream space. Virgin Galactic and Burt Rutan's SpaceShip series are quite close to carrying people to the edge of space while ground support infrastructure is being created in parallel. Bigelow Aerospace, with hard data trickling down from test articles in orbit now, is getting ready to commission its luxury hotels. Teaming with SpaceDev, Bigelow also is planning tourist missions to the lunar surface. The Falcon series of launchers by Space Exploration Technologies Corp. will soon bring competitive pricing to the market. The X Prize Foun-dation, which successfully administered the first comple-tely private suborbital spaceflight, now has teamed with Google Inc. to offer a prize for the first nongovernmental lunar surface mission. Other companies are working on spacesuits and related products and some have their eyes on the Moon, asteroids and beyond.

All these activities will contribute to a progressive and self-sustaining industry, catering to a wide range of economic interests. Just as the petroleum industry and the Internet now pervade every aspect of mainstream society, the space industry has the potential to transform modern civilization.

While many of us are wary of actions that might lead to an arms race in the orbital regime and weapons in space, the leaders of nations also know that space activity is the ultimate international arena for collaboration. When commerce between nations grows, so do bonds, and history tells us that goodwill and peace dividends follow. There is no doubt in my mind that mainstream space activity holds the key for a peaceful and vibrant, pluralistic and multicultural modern civilization in this 21st century.

Madhu Thangavelu *conducts the Graduate Space Concepts Studio in the Department of Astronautics and School of Architecture at USC, and is co-author of "The Moon: Resources, Future Development and Settlement."*

Zubrin's Challenge: "it takes more fuel to land on the Moon than it does on Mars" – *Maybe, but we can cheat too!*

By Peter Kokh

Let's begin by admitting that I am not a "rocket scientist!" Not even close. One glance through the topic's I've written about over the years in MMM, will show that I am more interested in what we can and will do "once we get there" than in "how we will get there."

But I can spot a flaw in an argument a mile away. Zubrin's case is that since Mars has an atmosphere, a spacecraft can use balloons or aerobrakes to save fuel on coming in for a landing. Quite true. However, only an aerobrake will be effective in shedding most of the craft's momentum. And here is what he doesn't tell us.

(1) Because of Mars substantially deeper gravity well, an incoming craft will build up more momentum that needs to be shed.

(2) An aerobrake will add to the craft's weight and require both more fuel to set out from Earth to Mars (which will require more fuel than needed to set it on a translunar trajectory even without an aerobrake!)

Now we will not put numbers on those penalties, but it is enough to show that those penalties exist. That said, we admit that there may still be some advantage, although much less if any at all. We want to talk about what devices spacecraft bound for the Moon, where an aerobraked descent is out of the question, can use to bring down the fuel cost of landing, narrowing the cost of landing gap between destination Moon and destination Mars, if not eliminating it altogether.

Taking along landing fuel, but not the oxydizer

In a cryogenic system, using liquid hydrogen fuel and liquid oxygen oxydizer, the oxygen weighs eight times as much as the hydrogen, even though the liquid hydrogen tank is the more massive. With other liquid fuels, the fuel tank need not be so big because the fuels will be more dense. But the oxygen is likely to still be the weightier component. What if we could do without it?

Beam-powered propulsion

http://en.wikipedia.org/wiki/Beam-powered_propulsion

"Beam-powered propulsion is a class of space-craft propulsion mechanisms that use energy beamed to the spacecraft from a remote power plant. Most designs are rocket engines where the energy is provided by the beam, and is used to superheat propellant that then provides propulsion, although some obtain propulsion directly from light pressure acting on a light sail structure."

This is no more cheating than the use of an aerobrake. Both are appropriately applied ingenuity! Either microwaves or laser beams could be used for this purpose, but I suspect, given the relatively small area of the propellant-containing bell, a laser beam would be by far the better choice. Now what various fuels would work for this application are not something we are prepared to talk about.

To be fair with our fellow Mars enthusiasts, we admit that the Mars aerobrake can land anywhere, the lunar ablative ferry can only land at laser beam locations, i.e. at properly-outfitted spaceports.

Other ways to use less fuel in landing on the Moon

"Crashportation"

In the late 1980s, Chicago inventor Ed Marwick put forth an elaborate proposal in which guided payloads enter a sloping chute dug into the surface and encounter ever denser sprays of regolith dust, slowing the capsule down to a halt. Such a facility would have to be as long as a mass driver per level of Gs to be tolerated.I doubt if this scheme would work.

"Harenodynamics"

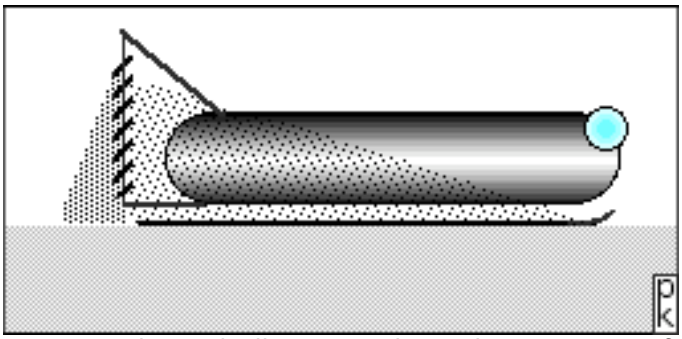
Famed rocket scientist, **Krafft A. Ehricke**, in his paper "Lunar Industrialization and Development – Birth of Polyglobal Civilization, included in Lunar Bases and Space Activities of the 21st Century, W. W. Mendell, Editor, Lunar & Planetary Institute, Houston, © 1985, pp. 828-55, wrote (pp. 848-850) about his concept of a **Lunar Slide Lander**. Most of the velocity an incoming craft needs to shed is horizontal velocity relative to the lunar surface. Ehricke proposed an 80 km (50 mile) landing strip. The surface would be raked free of boulders and stone to a depth of 20-50 cm (8-20 inches) leaving just compacted moondust. The Slide Lander could touch down at velocities as high as 5500 km/hr (3,400 mi/hr) gradually transferring its momentum to the landing strip over the 80 kilometer stretch. The slide or skids would have to bear up under considerable heat from friction. But Ehricke thinks this is a doable engineering challenge.

Now on Mars, you couldn't land at such speeds even though the atmosphere is very thin. In the cited paper, Ehricke does not offer an illustration of the slide lander, but only of the runway sweeper. Ehricke called his concept *harenodynamics* [from Latin hareno = sandy.]

By the way, if you do not have this hefty volume, you owe it to yourself to add it to your library. It is the classic, and even 23 years after its publication, it is full of valuable information, concepts, and inspiration.

"Harenobraking"

In the May 1992 issue of MMM #55, fellow Lunar Reclamation Society (NSS-Milwaukee) member Doug Armstong and I published a short article on the subject under the title "Enhanced Harenabraking."



In the crude illustration above, the incoming craft kicks up a spray of moon dust upon making surface contact on a prepared runway. The dust hits breaking louvers to the rear and falls back to the surface, its energy spent, as the craft continues to slow down. Even if this method is practical only below a thousand km/hr, it would help save retro-rocket fuel. Making this real is a matter of exploring engineering options and suitable materials. Readers are welcome to come up with their answers to Zubrin's Challenge. Send your ideas, and illustrations, to MMM, c/o kokhmmm@ aol.com

The Mars advantage does not hold up! <**MMM**>

The Moon Society www.moonsociety.org

An international nonprofit 501(c)3 educational and scientific organization formed to further the creation of communities on the Moon involving large scale industrialization and private enterprise

Objectives of the Moon Society

include, but are not limited to:

- Creation of a spacefaring civilization which will establish communities on the Moon
- Promotion of large-scale industrialization and private enterprise on the Moon
- Promotion of interest in the exploration, research, development, and habitation of the Moon, through the media of conferences, the press, library and museum exhibits, and other literary and educational means
- Support, by funding or otherwise, of scholarships, libraries, museums and other means of encouraging the study of the Moon and related technologies
- Stimulation of the advancement and development of applications of space and related technologies and encouragement their entrepreneurial development
- Bringing together persons from government, industry, educational institutions, the press, and other walks of life for the exchange of information about the Moon
- Promoting collaboration between various societies and groups interested in developing & utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to indivi-duals and organizations which have contributed to the advancement of the exploration, research, develop-ment, and habitation of the Moon, as well as scientific and technological developments related thereto.

Our Vision says Who We Are

We envision a future in which the free enterprise human economy has expanded to include settlements on the Moon and elsewhere, contributing products and services that will foster a better life for all humanity on Earth and beyond, inspiring our youth, and fostering hope in an open-ended positive future for humankind.

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

The Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as their adopted second human home world. We have work to do!

Masthead Design: Charles F. Radley, Society Vice-president\

Chuck Lesher appointed Secretary

By Peter Kokh, President

At the May 7th Management Council Meeting, we finalized the 2008 elections ballot as reported last month – *except for one position* for which we did not have a nominee that met the minimum requirements of the bylaws, one full year of continuous membership as of the date of the election, nominally August 1st.

However, we did have an otherwise qualified and willing volunteer in Moon Society Phoenix member Chuck Lesher. Chuck's first year of membership will be complete as of August 13th, two weeks too late.

There seemed to be no legal way around this except that the bylaws do not make such a requirement for appointees to a vacant office. So we called a special meeting of the Board, and since all the board members were willing to meet the following Monday, May 12th in a special session, we did so and appointed Chuck to the office for the balance of the current term, which ends August 1st. At that time, since we still have no nominee to elect, we will appoint him again for the full term to end in 2010. Sometimes you just have to be creative.

Making a tedious job easier

The Management Council will take this opportu-nity to develop procedures to ensure that the Secretary's reports, such as meeting minutes, follow a standardized template and that they are then preserved online for future reference. Since the Society was founded in July 2000, there have been several gaps in which we were without a secretary. So we have gaps in the record. Our new provisions will address handling such situations in the future. Not a sexy job, (like developing exciting new projects) but one that must not be neglected.

As President for the past four years, I take full responsibility for allowing this situation to develop, though I did personally recruit the last three secretaries, including Chuck Lesher. We all have our strengths and preoccupations. Mine are editing, writing, programs and projects. Team management organization has not one of my practiced skills, but we are now doing what we must to address this need.

Several times recently, we discussed something that had come up previously, but were not able to easily find out the outcome of those earlier discussions without tediously rereading two hour long meeting logs for many months and years past.

Lesson learned! It is one thing to write the bylaws and list job description duties for specific officers, and quite another to develop procedures that will facilitate those duties being conducted in a uniform and reportable way, preserved online. (Of what use are paper records in some dusty closet, attic, or garage, anyway?) This is something that the Management Council must oversee.

Moon Society Officers pose before completed unit:
L>R: Dave Dunlop, Fred Hills, Peter Kokh, Dana Carson

We did it!

Society's Solar Power Beaming Desk-Top Demonstration Unit a big Hit at ISDC 2008 in Washington DC

By Peter Kokh

ISDC 2008 opened on Thursday morning, May 29 with no sign of the Demo unit. Paul Blasé (Transorbital) who lives in the area, had collected the various parts as they came in, literally from around the world. Because of work duties, he was not able to bring everything to the conference hotel until Saturday afternoon. But finally he arrived, soaken wet from the rainstorm outside, with two big suitcases. After an hour he had the delicate and complex unit all assembled, and stood proudly (right).

Many people, particularly the NSS Board and SPS Committee, had been waiting patiently. They all looked in amazement and our efforts were greeted with appreciation and congratulations.

Especially impressed was Lt. Col. (USAF) Peter Garretson, who first suggested creating such a "desk-top" working model and provided the illustration previously showcased in MMM, which we used as a guide.

http://www.moonsociety.org/projects/images/End-to-End_Roadshow_Model.jpg

Because of power restrictions by the FCC, we had to be content with lighting up a trio of diodes, rather than the suggested, "model train-size city with multiple lights and a working Maglev and space port."

In fact, as the FCC's final approval did not arrive until almost a week later, we were not able to turn the unit on at all. But people understood, and we earned a lot of respect as "the little engine that could."

In large measure because of this addition to our otherwise static display, six persons signed up as Moon Society members on the spot, and more may have taken advantage of our "first *two* years for first year's dues" offer if postmarked by June 30, 2008. We did not get the chance to do a "Hospitality Event" however.

Above: Peter Kokh and Lt. Col. Peter Garretson (USAF) discuss the Solar Power Beaming Demo. Kokh thanked Garretson for his inspirational design. Garretson was a prominent member of the National Space Security Office team of some 200 persons who prepared the paper on Solar Power Satellites, built with lunar materials, as the only chance the US had to gain real energy independence.

This was a Team Effort

Our own Charles F. Radley, TMS Vice-President, and Dr. Peter J. Schubert, board member, were on this NSSO team. Charles showed Garretson's illustration to the Leadership Council and said, "Let's us build this unit!" It appeared that between Charles and Chairman of the Board R. Scotty Gammenthaler, that we had most of the necessary knowledge and expertise in the area of microwave power transmission, and knew others who could help where needed.

Once we were convinced we had the necessary information to build a unit that would meet FCC's strict regulations, aimed at preventing any possibility of harmful exposure to observers and bystanders, Charles set about finding those who could help in areas where we did not have the needed expertise.

Igor Radutnuy (Portland, Oregon area near Charles) signed on as our electrical contractor. 1) Igor purchased all the components for the circuit board and transmitter: 2) he built the rectifier, i.e. stuffed the board and verified that it worked; 3) he performed integrated tests to verify the rectifier worked properly; 4) finally, he built the transmitter, using VCO and PA he purchased for us, and the Patch antenna purchased by Scotty.

Phil Mills (UK, stationed at an Air Force Base in Saudi Arabia) built the gossamer solar panels and other apparatus that concentrated sunlight feeding the transmitter. He also built the wood base that holds the unit in the air above the tabletop. Painted flat black, this frame work is almost unnoticeable.

All the various parts were then shipped to **Paul Blasé** in the DC Virginia Suburbs, who saw to it that everything fit together. Paul would keep the unit until ISDC, bring it to the conference and put it together, then take it home until it could be shipped to a permanent "Keeper of the Demo."

The only hitch was in getting final TCC approval to operate it at the Capital Hilton. Preliminary agreement was rescinded, pending clarification of the unit's power, frequency, and safety, which came a week too late.

Where do we go from here?

The whole idea was to produce a first model that could lead to a multiplicity of such units around the country and around the world. After all, the goal of this project is to educate people about the possibility of transmitting power at a distance. This is needed to reduce the "giggle factor" when discussing something so out of the ordinary as Solar Power Satellites.

The Moon Society's intention from the outset was both to pave the way with this first unit for ISDC, and to produce a "kit" which would consist of illustrations, parts list, sources, regulations and procedures, etc. We would make this "kit" – let's call it "Kit #1" available online for others so that they could more easily build their own.

One unit can hardly make the rounds to all the space conferences, energy conferences, science-fiction conferences and wherever else people gathered. The more units, the greater the number of people would come to understand the concepts involved, and hopefully express their support to their congressmen, etc.

As for *our* unit, we do now have the FCC blessing to demonstrate its operation at the upcoming Denvention 3, the 66th Annual World Science Fiction Convention, in Denver, Colorado, August 6th–10th, 2008. Moon Society Treasurer, Dana Carson will be on hand and in charge.

We will be looking for more opportunities – the unit does us no good collecting dust in a closet! On the other hand, FCC permission must be gained for each new location and opportunity, at a cost of $60. And we will incur shipping costs to and from each showing. So this project will be an ongoing one.

At ISDC, two persons asked that we build one for them: Eric Anderson, CEO of Space Adventures, the company that arranges for tourists to be trained in Russia and get a ride on Soyus to ISS. Eric told me that he wanted a unit for his office. Then Gary Barnhard, Chair of NSS Executive Committee, said he'd like one too for the NSS Washington DC HQ Office.

This poses some problems. FCC forbids making such transmitters for sale. We are currently working on ideas of how we can proceed nonetheless. After all, we are the little engine *that "can!"*

How about an Encore Project?

This unit cost us about $800, not including labor, paid and donated, and first time expenses. While we will be following up for some time, the Leadership Council has been energized by this "hands on" success and is starting to consider a follow-on project.

One idea that came to mind is to build a "Hitchhiker" thingamajig that could ride to the Moon on a Google X-Prize Lander. But that won't fly, because all the entrants are charging big bucks for any such cargo as a way of raising money for their efforts. The idea of a free ride turns out to be naïve, going nowhere.

So let's hear from you! What do you think we could do next in the $1K range (more, if there is a way to effectively attract corporate sponsors)? Please do share with us any ideas you may have, even the wild ones!

The Moon Society is on the move, and we all want to keep it that way! **PK**

The Moon Society Chapters & Outposts Frontier Report

Chapters & Outposts

Moon Society St. Louis Chapter

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

Meetings **2nd Thursday** monthly, Buder Branch Library 4401 S. Hampton, in the basement conference room

Next meetings June 12th, July 11th, August 8th

Future Events: We are beginning to prepare for Archcon.

Moon Society Phoenix Chapter

http://www.moonsocphx.blogspot.com/
Contact: Craig Porter <portercd@msn.com>

Meeting the 3rd Saturday of the month

Saturday June 21st - Meeting & Pot-luck luncheon at Charles & Peggy Lesher's home, 3pm, 1982 N Iowa, off of Warner & Arizona Ave, in Chandler.

Star Party June 28th at Mike Marron's in Carefree. Chip in for Pizza, BYOB. Topic: Stars, astrophysical history.

May 17th Meeting Report:

We had eight chapter members present, six Moon Society members, and one visitor. Chuck shared with us the presentation he gave at Yuri's Night Party and at the LepreCon 34 convention. He has already taken his post as the new Secretary of the Moon Society.

CopperCon 28, is August 29, 30 and 31, 2008. It will be held at the Embassy Suites Scottsdale

Moon Society Houston Chapter

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

Next Meeting Place & Time

Monday July 21, 7 pm, Freeman Branch Library, Clear Lake (16616 Diana Ln, Houston 77062, 281-488-1906) We hope to have a full report from our members who attended ISDC 2008 in.

May 19t Meeting Report: Eight members and two guests attended. Meagan Crawford, an MBA student at Rice U., spoke on "Starting a Business: Specifics for Space Related and NASA Based Technologies."

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/

Moon Society 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

Bay Area Moon Society Outpost

http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates <hcate2@pacbell.net>

Meeting the 4th Thursday of the Month at Henry's

Moon Society Tucson Outpost

Contact: Ben Nault bnault@comcast.net

Mid-Atlantic Outpost to Revive?

Contact: Dana Carson dana@thecarsonfamily.com

We welcome four new Moon Society members who joined us at ISDC 2008, two from northern Virginia, two from Maryland. This gives us hope that our long dormant chapter will reform once again.

For news of our NSS Partner Chapters

in Portland, Milwaukee, Minneapolis/St. Paul,
see pp. 17ff.

Moon Society Chapter Photo Gallery

Phoenix chapter member Chuck Lesher built this model of a Space Station to stimulate young people.

Why not start a Moon Society Outpost in our area?

All it takes is one person - you!

write: chapters-coordinator@moonsociety.org

< End Moon Society Journal Section

GREAT BROWSING

New Details on Venus' Clouds Revealed
www.esa.int/esaSC/SEM49DNKRGF_index_0.htm

India's Moon Probe nears Readiness
//spaceflightnow.com/news/n0805/28chandrayaan1/

Mars Phoenix: NASA's 1st successful rocket-powered landing since the 1976 Viking missions
www.msnbc.msn.com/id/3033063/

Article on Early Apollo Mission Patches
www.collectspace.com/news/news-052008a.html

When, where, how often the Moon gets hit
http://science.nasa.gov/headlines/y2008/21may_100explosions.htm?list1094208

Forging telescope mirrors out of lunar concrete?
www.space.com/scienceastronomy/080604-lunar-concrete.html

Study on a Space Manufacturing Enterprise
www.nas.nasa.gov/About/Education/SpaceSettlement/spaceres/II-2.html

The International Liquid Mirror Telescope
space.newscientist.com/article/dn14030-liquidmirror-telescopes-are-a-reality-at-last.html?DCMP=ILC-hmts&nsref=news7_head_dn14030

More "Earthlike" Rocky Planets found
http://space.newscientist.com/article/mg19826583.400-huge-haul-of-earthlike-planets-found.html

2008 Space VidVision Contest ($2,000)
http://www.thespacereview.com/article/1134/1

Point-to-point suborbital transportation?
http://www.thespacereview.com/article/1118/1

Brits argue about Manned Space for UK
http://www.thespacereview.com/article/1117/1

Fuel Depots in Orbit: is it time yet?
http://www.thespacereview.com/article/1127/1

Converting ESA's ATV for Crew Use is a challenge
http://www.thespacereview.com/article/1132/1

Reassessing Scramjets and Spaceplanes
http://www.thespacereview.com/article/1129/1

Stephen Hawking: colonies on Moon & Mars
http://space.newscientist.com/article/dn13748-stephen-hawking-calls-for-moon-and-mars-colonies.html?feedId=online-news_rss20

Lidar to build 3D Roadmaps of Moon and Planets
www.spacemart.com/reports/LIDAR_Detector_Will_Build_Three_Dimensional_Super_Roadmaps_Of_Planets_And_Moons_999.html

Hawking: Unintelligent life likely on other planets
http://www.physorg.com/news128057557.html

Mars too cold for liquid ground water, geothermal
www.marsdaily.com/reports/Mars_Reconnaissance_Orbiter_Finds_Interior_Of_Mars_Is_Colder_999.html

Will ET Phone home with neutrinos, not photons?
http://arxivblog.com/?p=426

Russians to stop tourist flights for lack of seats
http://arxivblog.com/?p=426

GREAT SPACE VIDEOS

MOON COLONY VIDEOS – The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.
http://www.moonsociety.org/video/
or at:
http://www.mooncolony.tv/
http://www.stickymedia.com/

ASSORTED SPACE VIDEOS

Constellation Program Video
http://youtube.com:80/watch?v=OhpIS3NriHs

Reflections on Fermi's Paradox
http://www.space.com/php/video/player.php?video_id=b011031_sp_fermi2

New Space Race: Compete or Get Grounded *****
www.space.com/php/multimedia/newspacerace/

ISS: Japan's Kibo module opens for business
http://www.space.com/php/video/player.php?video_id=080606-kibo-ingress

The future becomes history through the extrusion of individual acts. Each of us makes a difference, one way or the other.

Help us put MMM in a Library near You!

Whether you are a member of an NSS Chapter or of a Moon Society Chapter or Outpost, or a Moon Society member at large, you all get Moon Miners' Manifesto as a membership benefit.

A library subscription to a library in your community will help spread the word, whether about local or national or international Moon-focused programs and projects.

For chapters and outposts such subscriptions will be good advertising for your local efforts.

For Moon Society members, as all copies of MMM include the Moon Society Journal centerfold section, community library or school library copies of MMM will help grow name recognition and invite readers to join.

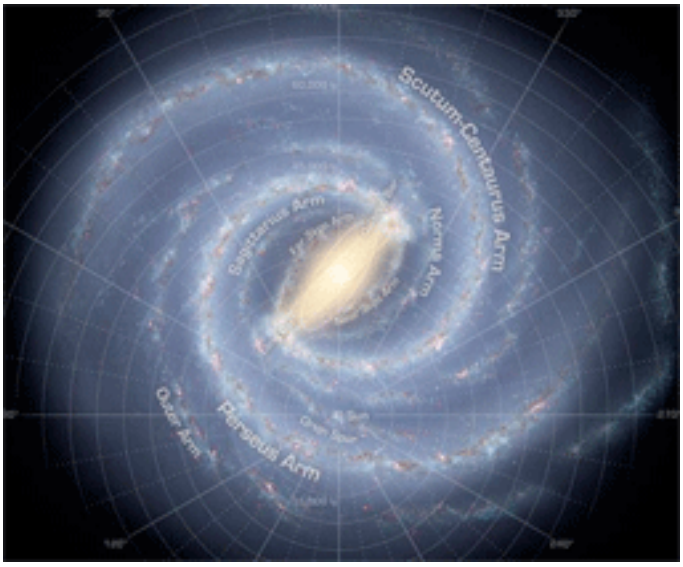
As no membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a cost-minus rate of $10 a year, available for libraries only.

How to participate in this program

- Send *by postal mail only*
- Your check of money order for $10.00/per year
- With the complete name and address of the Library,
- Made out to

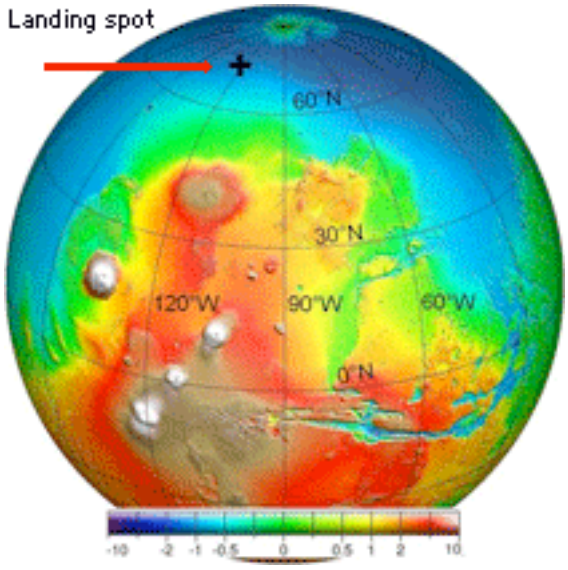
"Lunar Reclamation Society"
Attn: Library Subscriptions
PO Box 2102
Milwaukee, WI 53201

MMM PHOTO GALLERY



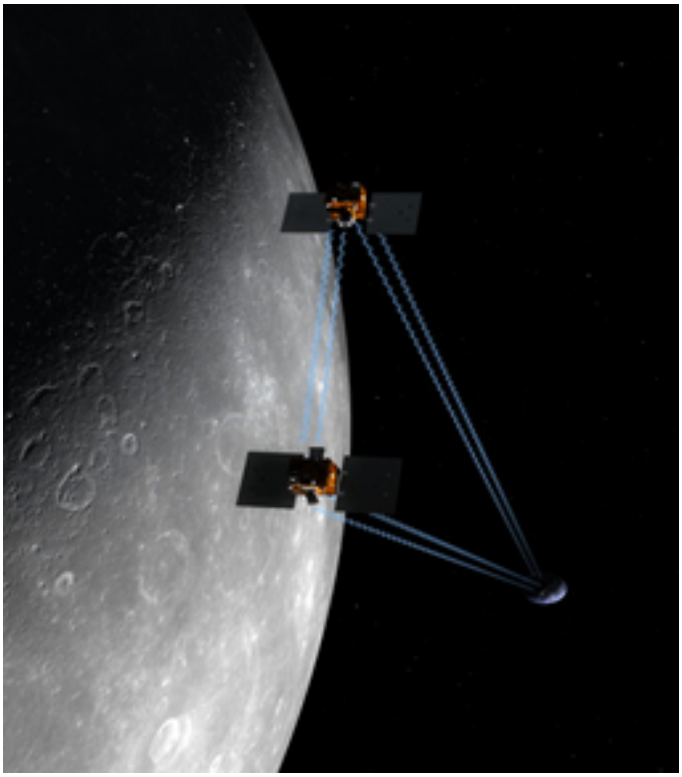
Data from the Spitzer Infrared Space Telescope shows the Milky Way Galaxy to have two main arms, not four.
http://space.newscientist.com/article/dn14057-two-of-the-milky-ways-spiral-arms-may-be-demoted.html

Mars Phoenix is the first craft in 32 years to land on Mars using retro rockets, a feat previously done by the two Viking probes in 1976.



Earth-Moon System seen from Mars, 88 M miles away

Artist Illustration: **WhitKnightTwo with SpaceShipTwo** (center). WK2 rollout in July, Ist flight September 08



Artist concept of $375 **Grail Discovery mission** - twin craft in tandem orbits around the Moon for several months to measure its gravity field in great detail. NASA/JPL/LockheedMartin

[From the Space Calendar June 8-15, 2008, Space Age Publishing: Credit, Jason Ventura and Steve Durst, International story editors]

International Space Agencies Recruiting Next Generation Of Moonwalkers

If you think you have what it takes to be the next human on the Moon, time is running out. The USA (NASA), China (CNSA), Europe (ESA), Canada (CSA), Japan (JAXA) and India (ISRO) space agencies are currently recruiting new astronauts whose missions could include humanity's return to the Moon as early as 2015. The deadlines to apply are fast approaching, with ESA closing its registration on Jun 15, JAXA on Jun 20, and NASA on Jul 1. Canada is seeking 2 new astronauts this year. CSA (TL) currently has only 5 active explorers in its corps (Dave Williams-TC retired in Mar), with an average age of 53 years old. ESA's corps (C), too, are aging, with only 8 remaining astronauts with an average age of over 50 years old. ESA is adding 4 new space explorers, ideally aged 27-37 with backgrounds in science and engineering. JAXA also has 8 active astronauts (B), and will be recruiting new members for the 1st time in 10 years. NASA, which has close to 100 active astronauts, has been accepting astronaut applications since last Sep for its 2009 astronaut class. China, which has successfully placed 3 humans (TR) in space, is actively recruiting female yuhangyuan, or astronauts, from the nation's robust female air force pilot corps. CNSA plans to send a female into space in the next 3-5 years, and its accelerating Shenzhou program could produce the next human footsteps on the Moon. India, too, has declared its intent to indigenously send a human into space in the coming decade, as well as on to the Moon. If humanity's lunar return is indeed international, many other nations, including Russia, Malaysia and South Korea, as well as several independent European nations such as Italy, Germany and the UK, may also see their citizens exploring Earth's natural satellite before the end of the next decade. (Credit: CSA, ESA, JAXA, CNSA)

Moses Lake To Serve As Analog Site For Moon Exploration Field Tests

America's new Lunar Chariot (T) is getting a test run in a lunar-like environment this week as part of NASA's lunar exploration simulations taking place at Moses Lake WA from Jun 3 to 15. Robotic exploration, site surveys and outpost construction will be conducted in the sandy surface, while spacesuit-clad astronauts and engineers simulate scientific work. The activities are meant to inspire new areas of development in the lunar vehicles and equipment, and to help engineers identify design challenges not evident in laboratory situations. A media day is planned for Jun 10 to allow reporters to observe the field tests. The capabilities that are being demonstrated were developed by the Exploration Systems Mission Directorate's Exploration Technology Development Program, based at Langley Research Center in Hampton VA. All of the activities being tested are believed to be critical to successful future lunar exploration as being planned by NASA's Lunar Architecture Team and Constellation Program. The field tests involve NASA Ames, Glenn, JPL, Johnson, Kennedy and Langley centers, and are in preparation for a larger set of experiments scheduled for the fall as part of the Desert Research and Technology Studies (RATS) project. Moses Lake is among such lunar analog sites as Cinder Lake AZ (B) and Haughton Crater in Devon Island, Canada where NASA's Desert RATS conduct lunar simulations. (Credit: NASA)

From Larry J. Friesen, Houston

I have just been reading through Moon Miners' Manifesto # 214, and I have a few comments and questions.

Zubrin's Guest Editorial on Arthur C. Clarke

Like Robert Zubrin, I was fortunate enough to be slightly acquainted with Arthur C. Clarke (in addition to being an avid reader of his writing, especially his non-fiction and essays). I first met him in 1966 while I was an undergraduate at the University of Kansas at Lawrence. The University was holding its centennial, and Arthur C. Clarke was one of the invited guest speakers. I was fortunate enough to encounter him again in the early 1970's while I was a graduate student at Rice, for he spoke on campus once then. In between, while I was in the U.S. Army, he was kind enough to correspond with me a few times. As Zubrin has said, he was generous. Not e-mail of course, at that time. Remember those old blue foldup air mail envelopes?

I do have one dash of cold water to throw. Zubrin's article seems to say that astronauts have walked at Aristarchus. I beg to differ. No human foot has yet been set in the Aristarchus crater, nor on the Aristarchus plateau. That was not one of the Apollo landing sites.

We've flown over Aristarchus with Lunar Orbiters, Apollo command modules, Clementine, and Lunar Prospector, and looked at it with cameras and instruments. But no person has walked its surface yet. There's plenty of us who'd like to; Aristarchus and its surroundings make up some of the most interesting terrain on the Moon, from a variety of perspectives. But sorry, not yet.

Has our memory of these events become so flawed since that time? Just the thing to provide fuel to the conspiracy theorists, who are quick to pick up on errors of detail (whether they are substantial or not) to claim we've never been to the Moon).

[**Editor:** I did catch the erroneous mention of Aristarchus immediately. However, as it did not in any way detract from Zubrin's message, I let it stand. To be fair, prior to the cancellation of the last three planned Apollo missions #s 18, 19, and 2o, I believe Artistarchus was on the early short list for sites to be visitied.]

Fred Hills' Science Fiction Story "Nubium Pool":

That was a pretty good fiction story you ran. Question: will the Exofiction site be a paying market for fiction? I've been trying to get some science fiction published, to earn some money.

[**Editor:** Short answer is "no." By the way, we are looking for an Editor to handle contributions.]

Tom Heidel's article on 2nd Careers for Probes:

If a probe is just hopping from asteroid to asteroid, once you're in the belt, you don't really need to target a major planet or large moon for a gravity slingshot. Speaking as an orbital dynamicist, if you're flying past, or orbiting, one asteroid, one can nearly always find another asteroid which can be reached from there with only modest delta-V, to select as the next target. Flight times may sometimes be long, but delta-velocities need not be high. In that scenario, trying for a slingshot via a major planet is a time waster and a delta-V waster. ###

MAIL FOR MMM

From Geoffrey A. Landis
http://www.sff.net/people/geoffrey.landis

Dear editor,

The article on making Solar Power Satellites from lunar material in the April 2008 Moon Miner's Manifesto concluded "Solar power satelite products are not something we can produce, or ship economically, from either lunar pole."

I'd like to register a dissenting opinion here. It is way too early to make that assessment, unless you've already done an detail design study of the proposed manufacturing plant and the supply chain. If, in fact, materials for solar panel can be fabricated from lunar materials, then the regions around the lunar poles will be extremely power rich. With access to nearly continuous sunlight, the poles are likely to be the best spot for energy-intensive manufacture.

The poles also feature all the resources of more equatorial landing sites, as well as additional resources not found in equatorial sites-- most notably hydrogen, but in principle many other volatiles as well, not merely in the form of ice in permanently shadowed craters, but also in the form of enhanced volatile content in regolith.

And the delta-V penalty for lunar polar launches is trivial, particularly with the use of lunar oxygen; it is simply incorrect to state that we cannot ship economically from either lunar pole. We can ship to anywhere in the solar system from both lunar poles as needed, and we can aim mass drivers to any desired orbital azimuth, including Lagrange points and geosynchronous orbit.

There may indeed be advantages in near-equatorial sites, but the inability to make solar power satellite components at the poles is not one of them.

[Editor: There followed an exchange of emails between the editor and Landis, seeking clarification of the claims above.

To most long-time MMM readers, his claim that all the materials needed for manufacturing solar power satellite components were available in the polar regions will seem absurd. Iron and titanium are much more abundant in the mare areas, for example. But Landis discounts the usefulness of both these elements. His response follows:

Landis: I've never seen much of a use for ilmenite. Can't think why it's useful as a source for most important materials, and it's not as good as almost anything else; it has no aluminum, it has no calcium or magnesium. If all you want out of the soil is oxygen, and the only process you're considering is hydrogen reduction, it's good stuff, but not if you want other materials.

So since you're refining other materials, then, what's the ilmenite useful for? Titanium, I suppose, but that's just not all that important a material. It's not a tenth as useful as aluminum; you don't use it in glass making, you don't use it for wires, and it's a hard substance to work with in structural applications. So, no, I don't see ilmenite availability as a major consideration either way.

I agree that leaded glass is not useful stuff in space applications. You want a borosilicate, for low expansion coefficient. Unfortunately that's hard, too.

Most of my older thinking on materials availability is here: http://gltrs.grc.nasa.gov/cgi-bin/GLTRS/browse.pl?2005/TM-2005-214014.html

In near polar locations, it's relatively easy to get 100% power availability. You're correct that storage is possible, but do some numbers. Examine where, on Earth, aluminum smelting is done.

I don't see that putting a base and manufacturing facility at the pole is going to mean that we are "stuck" at the poles "unable to go anywhere else". That's silly. If you're looking for historical analogies, well, the first colonies anywhere are always in the place where water is available. That doesn't mean that once you get a facility in place that you can't expand elsewhere. **GAL**

Editor: I have a number of problems with these claims. Ilmenite is a superior source of iron, titanium *and* oxygen. Further, it has been cited as most useful in the manufacture of solar panels.

Landis also dismisses iron (and steel) as useless for production of solar power satellites.

He talks about the need for borosilicates to produce useful glass. Guess what? No borosilicates on the Moon. Boron is quite rare in the regolith.

Yes, on Earth, aluminum production plants are located at major hydroelectric installations. But on the Moon, while there is as much aluminum, especially in the highlands, as on Earth, it is not present in the same Al-rich ores we use here.

Further, aluminum on Earth is most commonly alloyed with copper and/or zinc. Guess what? Both copper and zinc are present on the Moon in trace parts per million or billion amounts. In fact, we have a lot of metallurgical experimentation and research to do here on Earth before we can identify useful alloys of all four engineering metals: aluminum, magnesium, iron and titanium.

I also discount the claim about how much solar power is available at the poles or in their surroundings. The so-called "Peak of Eternal Light" is a rocky, uneven expanse about as large as the Mall in Washington DC. The sunlight comes in parallel to the surface, making collection a real challenge. We will have to put solar collectors all over the place and the mass of the cables needed to create a usable system may dwarf the mass needed for a solar power storage system that would let us produce and use full time limitless power elsewhere.

I am as strong believer in pushing all the technology options, and this includes both energy production and storage as well as useful metal alloys, *and* glass-glass composites.

Until it is demonstrated that a lunar-producible aluminum alloy is a more feasible than any other lunar-producible alloy option, and until it is demonstrated that more energy can be produced for less imported mass at the poles than elsewhere, I see no sense in writing off highland/mare coastal areas where everything that might be useful is available.

Circumpolar railroads have been cited as a way to tap solar power from all vectors to feed into the polar grid. But both poles are extremely crater-saturated, and even the best routes are going to involve steep grades, something railroads on Earth endeavor to avoid. Yes, gravity on the Moon is only a sixth that on Earth and it would seem that railroads on the Moon could manage grades six times as steep. But that assumption ignores the fact that traction is also reduced by a factor of six, pretty much neutralizing that advantage.

A polar decision is premature. **PK**

Plan now for next year's Encore!

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May 7-10, 2009 in Orlando, Florida
http://isdc.nss.org/2009/

National Space Society

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hosted by the NSS Florida Space Coast chapter at the Omni Orlando Resort at ChampionsGate.

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www.omnihotels.com/FindAHotel/OrlandoChampionsGate/MeetingFacilities/NationalSpaceSociety28thAnnualMeeting5.aspx

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Online Conference Registration
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For inquiries please contact **nssflorida(at)gmail.com**

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P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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To the Stars through our own hard work!

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TREAS./ Database – *Robert Bialecki
<bobriverwest@yahoo.com>..... 414-372-9613

LRS News

● **ISDC 2008:** In Washington DC this year, May 28-June 1, the weekend *after* the usual Memorial Day Weekend schedule. Peter Kokh and Dave Dunlop attended. Our chapter received a certificate in recognition of 21 plus years of continuous publication of MMM. We cosponsored the Moon Society's **Solar Power Beaming Demonstration unit** on display at ISDC. It won a lot of kudos.

● **May 10th LRS meeting:** Ken Paul showed the DVD "**In The Shadow of the Moon**" (2007) in which astronauts recount their inner experiences on the Moon. (www.imdb.com/title/tt0925248/). Plus a video on **Night time City Lights around the world** seen from space

LRS Upcoming Events – June
Saturdays: June 14th, 1-4 pm

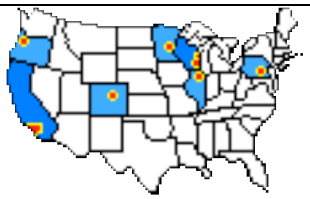
LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: www. lunar-reclamation.org/page4.htm

No events or meetings in July and August

September 13th meeting next after June 14th

MMM 8 NSS Chapters Strong



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

ILLINOIS

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

OREGON

Oregon L5 Society

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

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

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

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

* **Meetings 3rd Sat. each month at 2 p.m.**

Bourne Plaza, 1441 SE 122nd, Portland, downstairs
Next meetings June 21 – July 19 – August 16

MINNESOTA

Minnesota Space Frontier Society
c/o Dave Buth 433 South 7th St. #1808
Minneapolis, MN 55415
David Buth (w) (612) 333-1872, (h) (612) 529-9871
Email: info@mnsfs.org
[www.mnsfs.org/]

MN SFS News & Pictures

Info: our ISS-17 Display
www.freemars.org/mnfan/MNSFS/2008-06-STS-124-Display/

Pix MNSFS Mars Phoenix Landing Party
www.freemars.org/mnfan/MNSFS/2008-05-Phoenix-Landing-Party/

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**

June 19th: The Stoelting House, **Kiel**
July 17th UW-Sheboygan, Sheboygan, @room 6101
August 21st: The Stoelting House, **Kiel**

COLORADO

Denver Space Society
(formerly Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113

http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings, every 2nd Monday, 7 PM
Next: June 9th, July 14 th, August 11 th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

Chapter News: Eric Boethin and Robert Eagan attended ISDC 2008 in Washington DC, May 28-June 1.

Robert brought MMM Editor Peter Kokh up to date on the chapter's meeting schedule and his resolve to push James Barnhard's Space Education Resolution (See MMM #212, December 2007, p.15) wherever he could. He also attended the Chapters Assembly session on Saturday evening.

Eric explained the chapter's collaboration with the Mars Society, a natural given that the latter's Headquarters are in Denver.

CALIFORNIA

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/wordpress/]
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month
Next Meetings June 21 – July 19 – August 16

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

SAT June 21, 7:30 PM- Lecture/General Meeting: "To Be Announced" by Jim Traweek, Observatory Director - San Diego Astronomical. Cossentine Hall, La Sierra U., 4500 Riverwalk Pkwy, Riverside, CA 92515

SAT July 12, Sunset (8:07 pm PST)
EVENT: Public Star Party - LAAS has an active calendar of Public Star Parties in front of **Griffith Observatory** Satellite on average, once a month, with additional activities, whenever special events occur. Griffith Observatory, 2800 East Observatory Road, Los Angeles, CA 90027
http://www.laas.org/Events_StarParties-Public.htm

SAT July 21st, 7:30 PM- Lecture/General Meeting: "To Be Announced" Peterson, San Diego State U. Cossentine Hall, La Sierra U., 4500 Riverwalk Pkwy, Riverside, CA 92515

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://phillypasa.blogspot.com]

• **PASA regular business luncheon/formal meeting 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/Mitch 215-625-0670 to verify all meetings.

June 21 – July 19 – August 16

Meeting notes: We didn't have a formal meeting in May. Instead, we did public outreach at two fun events by invitation: The Franklin Institute for Astronomy Day on May 10, and The New Jersey State Museum, Trenton for Super Science Weekend on the 17th and 18th. Thanks to the work of Mitch Gordon we where invited to speak to the public on space exploration and science. We have been repeatedly been invited to Super Science Weekend to talk to the families there on these subjects.

This year, we where able to add an interesting display and talk on Lunar Lava Tubes as shelter, due to the work of Michelle and Earl. We built the display over several months, going back and forth on the details of what to use in construction and housing for transport. Michelle came up with a number of ideas to solve the problems of fabrication and housing the display we came up with and gathering material we used in it. And when we discussed what to say about living this way and what exactly where Lava Tubes, we found Peter Kokh providing the information! This was via Google query. The result was great information that we put together and gave out. The public was really interested in the concept and the children liked the toys. Michelle did a major part of the work on making this happen

We also redid the Space Bricks Game and Michelle restored the Cubesat Game that we used at Super Science Weekend. At both events I brought the CubeSat "model" I use to explain the satel-lites the visitors could support and even help load with experiments.

For the Franklin Institute we had the Lava Tube Diorama, the Space Bricks and a number of other items including: The Mars Globe in natural light, that Gary Fisher lent for the event, a number of talking point items, including an ionization display I used to discuss why we would do radio astronomy from the Moon, and display literature and hand outs. Mitch Gordon brought his display book with many Ad Astra covers and space pictures, primarily. Mitch's main focus was on the Mars globe and several locations, that Gary marked with figurines, for Spirit and Opportunity's locations and the site the Mars Society thinks would be a good first base. At this, and later at Super Science, the reason for site selection and the plan to use in situ resources where described. . Towards the end of the event Dennis Pearson arrived to help with talks and then tear down. We also had interest from volunteers and staff at the Institute Thanks, Derrick!It was a fun event.

As noted above, our next event was at The Museum of New Jersey in Trenton and this had a great crowd. On Saturday we had Mitch Gordon and Dennis Pearson giving the public a lot of information. In addition to Mitch's' book, Dennis brought his display on returning to the Moon and on the resources there. We had it near the Space Bricks and the Lava tube diorama with Dennis handling these and the Mars Globe, at various times, as we traded off between these and the CubeSat Game, primarily handled by Michelle. Mitch again spoke of Mars and also the tourist and product possibilities of space. Michelle and I both talked on the Lava tube as habitat concept and Michelle's information sheet was a hit.

On the Sunday we had rain and only Michelle and I attended. The public had cleaned out our CubeSat display on Saturday, showing how really interested these people are. After Michelle arrived, I was able to move a small solar panel I was using as a talking point item, over for the display of the Mars Globe and new material Michelle brought. Due to the arrival of The Phoenix Lander during Memorial Day weekend she was able to create a very timely hand out from NASA material. This, and the Globe, where great for informing the public. Several were surprised, even aggravated, that this landing was not being heavily announced and reported.

We also had old material that I had not given out before but included pictures of the Mars Desert Research Station. The picture of "the real thing" (as some people asked if it was on Mars!) was a good take away.

Both of us did the main displays at various times, while I gave the reasons we could build Power Sats from Lunar resources and how we had been contemplating this when we had the first "Gas Crisis" in the 1970s. The visitors liked the idea of using the off planet resources, especially when I pointed out that much of the waste energy (heat) would not cause global warming. Since the sky was sunny then cloud covered it was easy to show the advantage of "orbital solar power". I had a small "Mass Driver" demo unit that I used to explain getting material to where it was needed.

And lastly, I built a simple model of a Lunar Far Side Radio Telescope that I sometimes referred to as one of the reasons we would go to the Moon: science that would be easier to do from there. I mentioned that people didn't have to build it, that we could use rovers and robotic devices. This allowed entry into talk of the Lunar Rover X-Prize contest and future possibilities for youth participation. And we talked on much more!

Thanks to our members who came and those who gave there material for this event and our people who where there in spirit.

Submitted by Earl Bennett.

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

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

Moon Miners' MANIFESTO

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