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

Moon Miners' Manifesto

& Moon Society Journal

#166 – June 2003

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Guest Editorial: Revive the X-38 or Let our Manned Spacecraft Evolve?

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

Congress is right to question the need and use of the X-38 vehicle. Too narrow in mission capability, too elaborate and expensive for a rescue vehicle system and totally inadequate for shuttle replacement, let alone it's ability to match the current STS versatility.

Has anyone at NASA ever "seriously" considered an evolutionary approach to design of manned vehicles ? In school we teach that complex systems such as submarines, aircraft carriers, computing/telecom networks and indeed the space shuttle system are "evolved", and not built starting from "a clean sheet of paper", as new project and program demands appear on the horizon.

Do the long term program managers truly appreciate that untold billions have been spent on building up the infrastructure and operations/maintenance (IOM) that support the STS ? If they have, then many of the design concepts are flawed because all require substantial investment in IOM, that no one cares to point out.

Can the current fleet of STS evolve to fit the bill? Perhaps. Can we build and engineer into a fleet of brand new orbiters, based largely on currrent STS design, the dramatic technology advancements of the last thirty years?. Yes indeed, we can. Will such a system be safer and more reliable ? Of course, we can do that with good engineering practice, and more importantly, by applying the hard earned engineering data/experience of flying the existing STS fleet over the last three decades.

Will it be cheaper ? Perhaps, since we won't have to reinvent the wheel, in terms of hot structures, mechanical systems, ground support and most importantly, in crew rating. It might easily be designed to carry more people and payload, do more diverse missions, including rescue missions, and since it could be built from heritage we fully understand, it will surely be a much safer system too.

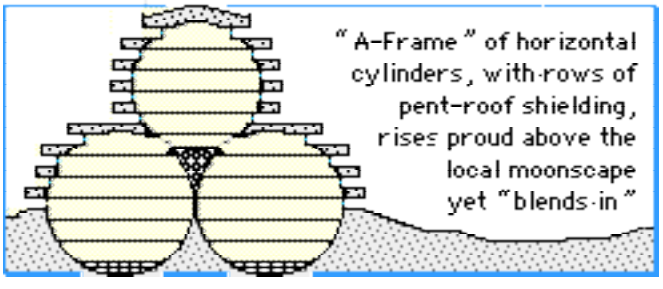
And extending this "use what we have" evolutionary philosophy to the X-38, have we really looked back into our heritage and wondered if we could evolve the tried and tested Apollo Capsule as an architecture to fit the bill? Well, that's another story, I suppose.

In my opinion, for the $8 B price tag suggested for X-38 development and deployment, we might just be able to buy three brand new, state-of-the-art STS orbiters with, with the next generation of "live skin" [➪ p. 2, col. 2]

Building with Pride? Or with Respect?

Not all the structures we build on the Moon will be burrowed into its surface, showing only tell-tale "mole-mounds" of regolith shielding blankets above. Should our above surface presence proudly assert our ability to make ourselves at home? Or should our architecture pay its respects to our adopted world, and seek to "blend in"?

Perhaps we can do both. For more, see pages 6-7.



Moon Miners' Manifesto

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• **MMM** is being reedited for the World Wide Web by members of the Artemis Society International. => www.asi.org/mmm

• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; earliest use of Mars system and asteroidal resources; and the establishment of the permanent settlements necessary to support such an economy.

• **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space/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 over 25,000 members and 80 chapters, dedicated to the creation of a spacefaring civilization.
The National Space Society, 600 Pennsylvania Ave. SE, Suite 201, Washington, DC 20003; Ph: 202-543-1900; FAX: 202-546-4189; 202-543-1995 NSS Space Hotline; nss@nss.org => www.nss.org

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openfrontier@delphi.com => www.space-frontier.org

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges necessary to establish a permanent, self-sustaining human presence on the Moon." — See contact information on page 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.

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fi IN FOCUS Editorial continued from p. 1.

sensors that relay critical structural integrity information in real-time to the flight director's screen, safer liquid flyback boosters and ETs as well as half a dozen Apollo capsule derived crew rescue vehicles. And in 2008, the projected year fro X-38 commissioning, we might even be ready to fly a pallet of three of these capsules on the brand new STS cargo bay, ready to deploy at ISS, all being supported mostly by existing but upgraded infrastructure.

There was a time not so long ago, I recall, when the entire space station program was projected to cost $8 B !

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Editor's Remarks: In our recent In Focus Editorial in MMM issues # 162, we expressed our opinion that the job of delivering people to orbit might best be separated from the job of hauling bulky cargoes to orbit (such as space station elements.) Our reasoning was that cargo could then go on a wholly expendable launcher, and that people, in the X-38 (by whatever name) could do likewise. No need for the shuttle stack, unless to serve as an unmanned heavy lifter. In MMM # 163 we reprinted Bob Zubrin's remarks along similar lines.

This month, for balance' sake, we are happy to print an opposing opinion by a colleague we much respect. We met this "contemplative Indian" in person at a past conference, but were already acquainted with him through his collaboration with David Schrunk in the excellent book: **THE MOON: Resources, Future Development & Colonization**, David Schrunk*, Burton Sharpe, Bonnie Cooper, and Madhu Thangavelu - which masterful forecast I reviewed in MMM # 133, March 2000, p.11. This book, by the way, is available on Amazon.com and I highly recommend it. (I had written: Take your pick of "must buy" or "immediate classic" or "ambitious Primer with Vision and Scope")

It is always good to weigh a spectrum of opinions in the hopes that somewhere in between we may find the seeds of wisdom. Alas, finding the wisest path does not always help, because the final choice is always a political one, and in our opinion, nothing rational ever comes out of the political process. Next time, as last time, we'll be stuck with another committee-designed mule. -- PK]

ISDC – It's on to Next Year's Event

ISDC 2004 – Oklahoma City

May 28–31, 2004 (Memorial Day Weekend)
http://isdc.nss.org/2004/ (*not yet online)*

Reseve these dates on your calendar now!.

A Breakout "Cycling Strategy" For Space Commercial Development, Lunar and Mars Settlement

by Dave Dunlop < dunlop712@yahoo.com >

My reaction to Dave Dietzler's interesting article entitled "The Interlunar Cycling Station: Traveling First Class," is that it contains the seeds of a much broader strategy for opening the space frontier. The need for a major change of strategy could not be better timed than in the aftermath of the loss of Columbia and the renewed debate on the future access to space for the U.S.

The destiny of the International Space Station without the shuttle is a great unexpected hitch in business as usual for NASA. It seems likely that after the appropriate commission reports there will be a judgment that if the insulation problem on the external tank is fixed we can resume use of the Shuttle. To continue with the Shuttle is a political high wire act. Another seventeen years of operation without a catastrophic accident might provide the time for another system to be developed. However, another major accident in the near term would be politically devastating, undercutting the credibility of NASA and make raising political support for major investments very difficult.

Both businesses as usual for the Shuttle and for the International Space Station are at stake. It would seem to be a matter of prudent management to increase the manned options available to support the ISS. The "near term" options may be in advanced development as the Air Force funded X-41 and X-42 "black" projects originally solicited in 1998 as discussed in the May issue of *Popular Mechanics* magazine.

Heavy lift capacity might be developed by Shuttle-derived vehicles with greater cargo capacity than the current shuttle. Such vehicles have long been proposed* and would not require propulsion systems development but qa modified structure capable of lofting a large faring on top of the external tank.

* The Shuttle-C proposal and Bob Zubrin's *Ares* proposal being examples.

The split of manned access, with fast turnaround for frequent flights, from the heavy lift option must be designed in anticipation of the next big thing(s).

However, there is no consensus about what is the next big thing, What is clear is that manned safety and reliability and frequency must be increased while costs are reduced. It is also clear that flexibility and applicability to a variety of mission options is also needed in planning for the post-Shuttle space transportation system [STS].. Buzz Aldrin's Starcraft fly-back booster based launch system might provide both the above mentioned frequency, reliability, safety, and flexibility as well as lower costs.

The "Next Big Thing" options include:

1. Full development and manning of the ISS with broader participation including China and India. Manned vehicles and unmanned cargo options might also result from the political aspirations of China.
2. A Next Generation Rotating Ring station designed as a major research facility, Earth observation platform, destination for limited space tourism, and staging area for lunar and commercial power projects should be considered. Utilization of standard external tank modules would create a market for a large number of such ETs. This station would be built in equatorial orbit.
3. A permanent return to the Moon.
4. Prototype solar power satellites at Lagrange points.
5. Refueling capacity and fuel storage will be needed for a permanent return to the Moon and/or commercial solar power satellite construction. Such tank farms may be needed in LEO / Lagrange sites to support development.
6. A rotating ring Next Generation Space Station at L2.
7. Construction of the Interlunar Cycling Station.
8. Development of R&D equipment on the Lunar surface for the Lunar Power System proposed by David Criswell.
9. A multi-ring rotating space station for Mars orbit.
10. A rotating ring cycling vehicle for Mars Transit.
11. Exploration and settlement of Mars.

The Shuttle External Tank as Key to all these scenarios

Over the next 20-30 years, this list of projects would create a high volume market demand for external tank type units used for habitation, research, and industrial production over a long time for a variety of manned missions. This approach should lower the cost per unit considerably. These developments would be supported by an expanding global economy and a growing number of nations involved in space. These expanded sponsors would target development of space power as a major energy resource for the growth of Earth's economy.

This broad long term view of design options is the development scenario that promises to move from a government subsidized space program to a program that can produce major revenue with a high rate of return on commercial power investment.

The development of rotating stations and transit structures is also a means of addressing the problem of human adaptation to the zero-gravity environment of space. This strategy seems also to address the dead end of zero-gravity space station facilities.

The replication of these structures at various stages of development would begin the routine industrialization and expansion of access to LEO and beyond, for a variety of goals by an expanding number of investors and participants.

Both separation of manned access from shuttle-derived launch systems and the utilization of external tank

scale modules with large volume for multiple purposes are needed to lower costs and increase flexibility for a growing number of nations with a wide variety of space goals.

Our transportation architecture must account for all these options if we are to have a robust expansion that rides a growing global economy to a reliance on space-based resources as a major vehicle for the expansion and sustenance of that economy. We must make no small plans.

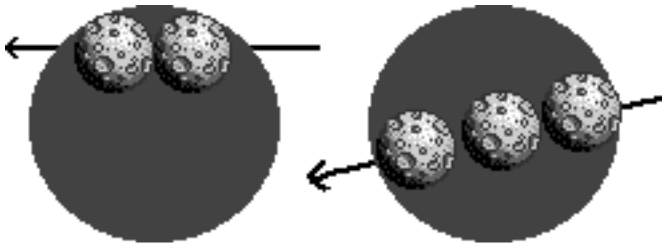
<DAD>

Total Lunar Eclipse Postscript

PHOTO: www.third-wave.com/dembow/forward_002.htm
Remarks (not photo) by Peter Kokh

I *did* get a chance to view the recent total eclipse on the evening of May 15th, but sans binoculars or scope, unfortunately! Taking in the experience, a number of things occurred to me not mentioned (or thought of) in my previous article [MMM #164 APR 2003, pp. 4-5.]

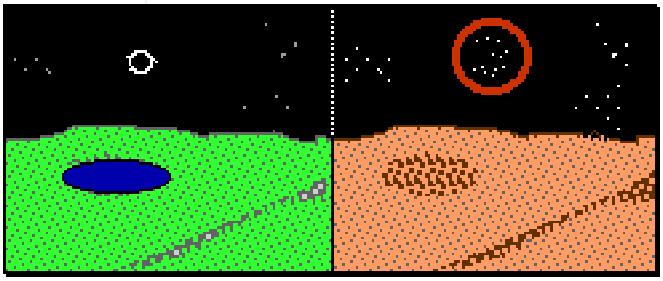
- **Direction and Speed of Advancing Umbra Terminator** - the *regular* terminator of sunrises and sunsets advances from East to West on the Moon (as on Earth) at a speed of 9.5 mph = 15.5 kph (the pace of a 6.3 minute mile or 3.9 minute kilometer run). The Umbra terminator comes out of the west, moving eastward at speeds in excess of 3,700 mph = 6,000 kph! An enormous difference!
- **Umbra-clad moonscapes** - where one is on the Moon will make quite a difference. The albedo (relative brightness) differences of the brighter highlands and darker maria (frozen lave plains or "seas") will be much the same. The red-shifted umbra light may make some areas more prominent, depending on composition.) Shadows will be in reduced contrast with the umbra-lit areas and have softened edges (owing to the 3.5 times greater diameter of Earth's sunrise-sunset ring than the angular size of the sun's disk), but in the same direction.



During a short totality (situation at left, above) such as the recent May 15th-16th eclipse, portions of the Moon nearest the edge of the umbra shadow remained relatively bright, where as portions deeper within the umbra were considerably darker. For the observer on the Moon, the brightness or darkness of the "eclipse twilight" and of the surrounding moonscapes will depend on one's position on the nearside relative to the center of the umbra.

- **Popular vantage points** - The spectacle will be more comfortably viewed the further one is from the center of nearside (and thus the closer to the horizon Earth appears in the lunar "sky." Viewing points that include both mare and highland terrain in the foreground will be more interesting (i.e. "coastal" locations.) "Experts" and Umbra devotees may seek out special vantage points.
- Visiting Tourists - People will come to the Moon from Earth, even from Mars, to experience the brief spec-tacle [SEE p. 5, col. 2]. Because of demand, prices for Lunar Eclipse Excursions may well be higher. The eclipse experience will be the highlight of a longer stay.
- **The Spectacle of Earth's city lights** - In MMM # 69 OCT '93, p 8-9, "7 Wonders of the Moon," I listed my personal picks which included the Nearside Spectacle of Earth in the heavens. But I was thinking of viewing Earth under normal phase conditions - the Bright Blue Marble. I think that the Nearside Umbra experience (*far the best* to view Earth's city lights) should be added to the list, expanding it to eight, or supplanting the Straight Wall. The others: (Nearside) Copernicus (or other major crater), Alpine Valley, Lavatubes, (Farside) Tsiolkovsky, Milky Way splendor in the heavens. **<MMM>**

Total Solar Eclipses on Earth vs. on Moon



During a total solar eclipse seen from Earth, [left] a (Moon-sized) "black hole" shields the disk of the Sun, but the Sun's otherwise invisible corona peeks out brightly with prominences, if any, clearly visible. A few of the brighter stars and planets are visible in the sky.

During a total eclipse of the Sun as seen from the Moon [right, above], a much larger (3 2/3 as wide, covering 13+ times as much sky) Earth-sized black hole obscures the Sun *and its corona.* This black globe is clearly speckled with the night lights of Earth's urban constellations, no solar glare fogging their visibility. During the recent eclipse, the urban concentrations of North and South America and Western Europe were on center stage, at the mercy, of course, of cloud cover. Forest fires, oil field burn off flames, and an unorchestrated scattering of lightning flashes should also be visible. Meanwhile, as Earth's mini-corona of its sunrise-sunset ring is many orders of magnitude dimmer than the solar corona, the heavens seen by Lunan observers will be filled with many more stars shining more brightly.

Board Games for Early Lunans: Mancala or Oware, Anyone?

by Peter Kokh

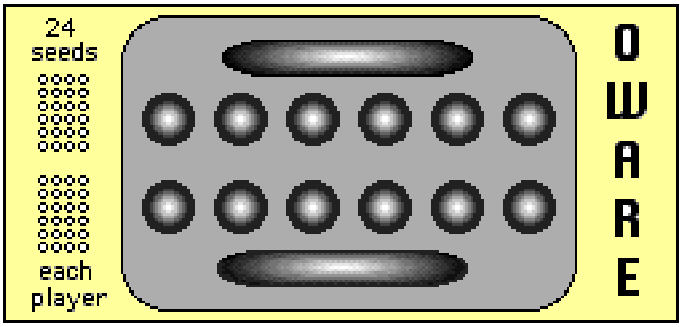
Most would-be Lunan Pioneers probably take for granted that they will have access to most anything they want from Old Earth. Perhaps. Perhaps not. It seems far more likely that the do-or-die struggle to ramp up exports and production for domestic consumption to the point where enough credit is earned to pay for importing those items of necessity that cannot yet be produced on the Moon. Production for domestic consumption and production for export will go opportunistically hand in hand.

Another do-or-die struggle will be to preserve precious volatile elements, hydrogen, carbon, and nitrogen, for use in the biosphere/food production cycles as far as possible, withdrawing these elements from that "bank" on a case justified basis. Fiber for clothing, byproducts to be turned into recyclable children's *art du jour* another.

Game boards wouldn't seem to be a must-have item either imported, or made from biomass bank withdrawals. Not if we can find substitutes. A computer screen can host just about any game board, even if it isn't on-a-table flat or shared by both players. But traditionally printed cardboard games of Monopoly, Sorry, Scrabble, and a myriad of other board games and their 3D game pieces are not likely to show up in frontier stores, or be importable at affordable prices, with or without stiff luxury taxes.

An Ancient African Game to the Rescue

A game played in Africa for thousands of years, under many names, could be a popular, frontier produced substitute, offering many hours of pleasure for all ages, at all skill levels. Ancient Egyptians called it **Mancala**, and to many of today's Africans it is **Oware**, or simply "Pits and Stones." This game is ranked "among the world's best."



Recently, I purchased a hand-crafted Oware set, carved out of wood from some African tree, and found a willing partner. It took less than two games to start experimenting with "strategies" and it was quickly obvious that here was a game, seemingly so simple, that delivered great brain exercise and thrills.

How so? First, the board is carved to contain two rows of six pits, one for each player, plus a pair of special pits for captured pieces. While commonly made of wood, this is a simple game board that could easily be made of materials available in the early lunar frontier. ceramic by frontier potterers or, or glass, or cast basalt. There is no "printing" involved, *only shape.*

Second the game pieces consist of 48 "seeds." nuts, marbles, teeth, pebbles or stones. Anything will do, and these do not need to be individualized. Each piece is playable in turn by each player, so 2-color differentiation is neither needed nor desired. All the seeds can be identical., exactly or crudely. Think of roughly same size lunar stones, raw glass marbles or beads, metal balls.

The Game – The game starts with four seeds in each pit. The first player takes all the seeds in any of his pits and sows them one by one in four pits to the right counter-clockwise, on his side, his opponents side, or both as the location of the opening pit determines. The opponent does the same, again picking as starting pit. You may now have two empty pits, and some pits with more than 4 seeds. The idea is to sow the last seed of your play in an opponent's pit with only one or two seeds, in which case you capture both his, and your own landing seed. And the capture continues clockwise if the second last pit you land on also contains one or two pieces. The idea is to capture 25 seeds (remove them from play to your capture pit) in which case you win. It will take a game or two, clumsily referring back to the instructions, before the cascade of eurekas take over your brain. Then you're off to hours of great fun.

Oware on the Lunar and Martian Frontiers

Perhaps the frontier version of this game will be known as "Craters & Rocks." The game may prove so popular a pastime in the "New Stone Age" that permanent game tables of molded concrete or cast basalt might become a common feature in frontier parks. [www.tradgames.org.uk/images/OlindaKaliyaTable.jpg] On the other end, individually crafted hinged boards folding for portability would be heirloom quality gifts. Since sets could be manufactured in quantity from pressed aluminum sheet, yet hand-crafted in clay, glass, cast basalt or other art media, they would serve all ranges of the market from beginner to devotee. The board and pieces can be easily be scaled up or down in size.

Getting in the Frontier Spirit

Where to find the rules, ready to use sets: Just go online to www.google.com and type in "Oware" and search. You will find all you need. Hobby stores, game stores, and museum shops may have sets for sale.

Let's rename the Lunar Frontier version of this game "Craters & Rocks!" Make your own out of clay, beaten tin or aluminum sheet, mold-poured plaster of Paris, paper maché, or wood. You might find a muffin/cupcake tin that will work. Download game instructions, and start playing.

Craters & Rocks would be great after-meeting fun for local Moon Society, National Space Society, even Mars Society chapters. At least we think so! **<MMM>**

Designing Surface Structures for Moonscapes & Marscapes

by Peter Kokh

Introducing a touchy topic

Not all persons interested in a permanent human presence on the Moon and Mars share the same sensitivities when it comes to design with respect to site context. A bridge is a bridge is a bridge, say some, no matter where you plunk it down. No, say others, any structure should take in mind its visual environment when fine-tuning design details, or even in choosing between major design options.

Living in a 120 year old neighborhood in which a new replacement police station and library have recently been built without any visual allusions to the neighborhood context, as if they were dropped on site by some gigantic helicopter, I tend to side with the latter view. At the same time, to impose a narrow set of allowed styles can be quite suffocating. Variety is the spice of life, and *vive la differance!* So where is a reasonable middle ground? In plain fact, if there is to be a free enterprise economy, there will have to be some latitude in design constraints for structures that are visible on the surface of the Moon and Mars.

Relevant Readings from Past Issues of MMM

MMM # 55 May 1992
- p. 5, "Skyscrapers on the Moon"
- p. 7, "Moon Roofs"

MMM # 111 December 1997
- p 4, "Lunar Skyscrapers: Shattering Low Expectations"

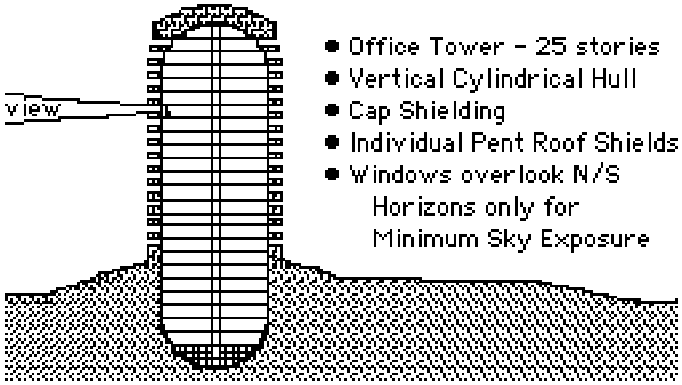
MMM # 137 August 2000
- p 5, "Taking-Back-the-Surface Architectures"

"Blend in" or "Stand Proud?"

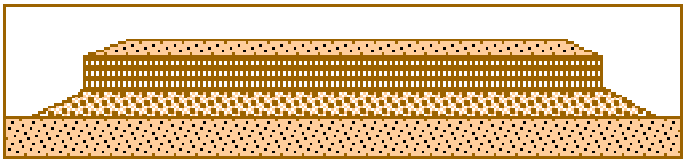
One fight we can expect is between those who will insist that any structures built on the surface of the Moon or Mars - bridges, towers, signage, etc. - be designed to blend into the moonscape or marscape, so as to appear "to rise out of it" so to speak, and those who believe that we should be proud of our achievements, and our surface structures should "stand proud" of the host landscapes. There would seem to be legitimacy to both points of view and we can expect to see examples of both come to being.

In the articles cited above, the very use of locally produced building materials, and the need to preserve radiation shielding integrity for all pressurized structures, does per se confer a language of distinctively lunar or Martian forms, shapes, and color schemes. If we build to address the economic need to work with local materials, and the life-threats of the host alien environments, this level of "blending in" is almost assured.

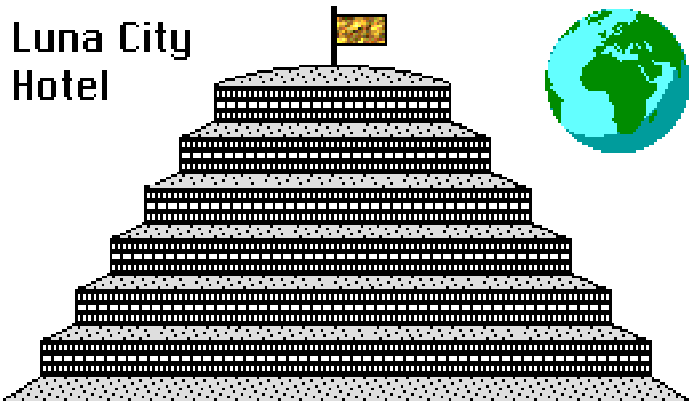
In "Moon Roofs" we detailed a number of ways of "dressing up" the regolith shielding mounds that cover our habitat structures: lime or titanium dioxide whitewashes, rust iron oxide, black ilmenite; cast basalt slabs, molded lunar concrete, etc. In the two articles on skyscrapers, we suggested individually shielded "pentroofs" for each floor, pagoda style, if you will. While such high rises would clearly bust the horizon, they would do so with shapes that would be distinctively appropriate for the planetary context. That, of course, does not address the question of whether or not they should be built at all. But we are sure that they will be, sooner or later. And in our opinion, this will be fine. They won't be towers of stainless steel and glass, Mies van der Rohe style, after all!



Pentroof Skyscraper on the Moon, from MMM # 55, p 5



Shielded building on Mars' surface, from MMM # 137, p. 6



Wedding Cake of cylinder sections from MMM # 137, p. 9

Clearly, when designing habitable structures on the Moon and Mars, the cited considerations will tend to result in buildings that "belong", yet "stand proud," a happy result. But what about other structures: bridges, communications relay towers, tourist observation towers, utility poles, road signs, and, yes, billboards? With no need to pressurize and shield, would not "form follows function" and the "most economic use of available materials" rule? One's first inclination may be to plunge into this debate adrenalin pumping and ready to fight. Let's do some background work *first.*

Just the facts: Available Materials

On the early lunar frontier available metals and alloys will include cast iron, low carbon steels, aluminum, and magnesium. Magnesium may become a favored material of architects and builders, given that in the lunar vacuum, oxidation will not be a problem, and it takes less energy to produce than aluminum. Stainless Steel would seem unlikely. Cast iron, the darling of the early industrial age on Earth in Victorian times, could be a staple for lunar architects and perform quite well in low lunar gravity. No protective paint would be needed. Exposed metals would lose their shine over time from micrometeorite bombardment. Designers will be keeping this in mind. Given these facts and considerations, a "language" of out-vac exposed metal use in bridges and towers may emerge that will be characteristically "lunar."

On Mars, high carbon steels should also be an economic choice, possibly stainless steel as well. Micrometeorite bombardment will be greatly reduced, wind-borne sand and dust abrasion being the greater problem. Here too, oxidation will not be a factor. Steam treated cast iron with rust coating could be used by designers and architects where "blending in" does not compete with a need for high visibility for safety reasons (structures that could become driving/flight hazards if not easily picked out by the eye.)

Sintered regolith and regolith blocks would retain the coloration of host materials on both worlds. Concrete, being based on lime cement, tends to whiten the sand and aggregate also used. Untinted cement would blend in quite well on the Moon, less so on Mars. That would be a safety plus for concrete paved roads on Mars. On the Moon, a row of cleared rocks and breccia along the shoulders, or maybe straight down the median strip, would be enough to clearly mark the route.

Cast basalt will be economically available in many areas of both Moon and Mars and retain the basic coloration of the original materials. Raw (no special formulation) glass or glassified blocks would do likewise. Tinted glass cladding, modern skyscraper style, would seem to be a foolish option, given mircormeteorite rain on the Moon and sand abrasion on Mars. Durable cast basalt tiles, slabs, and sheets may be the best choice when "shine & sheen" is a design goal for the structure in question.

Economic Choices: the Bottom Line

On the Moon and Mars, as on Earth, the "bottom line" is something not to be dismissed. Sometimes designers have a "luxury allowance" for visual impact, especially when designing structures intended to become corporate icons, or urban "signature" edifices such as the Sydney Opera House, the Seatle Space Needle, St, Louis Gateway Arch, and the Milwaukee Art Museum's new Calatrave addition on L. Michigan (www.mam.org/site/photos/images/mam8.jpg) Such icon and signature structures will appear on the Moon and Mars as well, and I, for one, welcome them. Yet even here, among competing designs, economic choices may force solutions that favor use of materials that tend to blend well with the host environment. Form is a different question, and especially for icon and signature structures, "standing proud" is likely to win any battle with "blending in" when both cannot be achieved together, as ideal.

The Mundane and Utilitarian

We will need road and railroad bridges, pipelines, utility poles, and communications relay towers. Economic motives are likely to be paramount. When will it be cheaper, and safer, to bury utility lines than to erect miles of posts? The solutions to those equations on the Moon and Mars, may not always be the same as they are on Earth. One consideration is Right of Way. Mars and the Moon are wide open, and right of way easements are unlikely to pose a problem or to constrain design choices and options.

When utility lines and pipelines follow highways, it would make sense to design each with the other in mind, if not in combination. Doing so might promise better visual results. When they do not follow roadways or passenger rail lines, but traverse seldom visited terrain, spending the extra buck to make them "blend in" will be unlikely.

Another consideration will be to ballance the up front cost of construction alternatives with any lifetime maintenance costs. It has been common on Earth to discount the latter, i.e. for builders to ":take the money and run." Hopefully, building in to up front costs respect for lifetime costs will receive much more attention on the frontier. It will cost so much more on the frontier to build anything, that the need to build right the first time should appear to be paramount to all. Cutting corners and costs are a hard tradition to break!

We intend to do separate articles on Horizon breaking superstructures on the Moon, and out-vac Signage.

Designing with respect for the Moon is not a case of the Moon's sensitivity. It is an inanimate object. Rather it is a case of our own sensitivity and our own inner need to feel connected, of respect too for the adopted world's aloofness and mindless hostility to life. It is out of our desire to belong to the Moon, and to be her children as we were those of Earth. Not all people are sensitive to such things, but we think that the desire for connectivity will be quite common among those who choose to forsake Mother Earth to be pioneers and settlers. The same for Mars.

The Reds, the Grays, and the Greens

Kim Stanley Robinson coined the word "Reds" as a Martian frontier counterpart to our own "Greens." The "Reds" opposed terraforming, and wanted to preserve the character and integrity of Mars while finding ways to live on their new frontier in harmony with it. One can expect that on the Lunar Frontier, there will arise a "Gray Party" similarly concerned with maintaining a human presence on the Moon that pays respect to our new home. **<MMM>**

Luna City Yellow Pages

Art & Craft Supplies

Born Again Hair

- Hair bought and sold
- Hair craft tools and supplies
- Hair Craft Books and Plans
- Hair Craft Courses
- Custom Hair Craft art objects created to order

Browse our Consignment Corner

- Hair Craft jewelry, appliques, wall art

268 Earthrise Lane (residence shop) - **255-4247**

The Potter's *Wheel*

Learn the unique art of Lunar Ceramics

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99 Enterprise Center, Suite 17 - **708-8379**

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We Dye for You!
Or Dye Yourself!

Use our vats to dye your fabrics under supervision

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Visit our Facilities Soon to see what we can do for you.

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Star of Luna

Jewelry making and supplies

- moonrock breccias, crude or precut & polished
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- scrap metal: iron, aluminum, magnesium, titanium
- carveable hardwoods: apple, pear, cherry (all biosphere bank withdrawal fees prepaid) - learn to make wood jewelry and high-end knobs and handles for metal cabinets
- Jewelry Artcrafts books, tools
- Jewelry Making Courses & Instruction
- We also sell tools & plans for chain mail creations

Sell your creations in our Consignment Section!

99 Enterprise Center, Suite 28 - **539-3579**

Recycling Services

Born Again Hair (see our ad under Arts & Crafts)
Hair bought and sold, Hair craft supplies and plans
268 Earthrise Lane (residence shop) - **255-4247**

ENCYCLOBIN INC. ULC

"Any Company's Waste can become Raw Material for a New Enterprise"

ENCYCLOBIN™ is a Computer Databank Service of the University of Luna City [ULC] School of Industry & Enterprise

- Mining and Processing Tailings sorted and characterized by elemental and mineral analysis
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- Chemical wastes sorted by chemical analysis
- Miscellaneous processing and manufacturing byproducts fully characterized and sorted
- Co-import salvage and dunnage
- Packaging and Shipping scrap and waste
- agricultural by products, waste biomass, and recycling residues
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Let us find the materials you need.

Let us help you create an enterprise plan on available scavenged materials

ULC School of Industry & Enterprise personnel offer free consulting and business plan creation consultation

Low Royalty Fees
Make an appointment with our courteous staff
711 University Circle - **852-3492** (UCL-DIVE)

Second Life Fabrics

Scrap & used fabrics bought and sold
Fabric Art supplies & Consignment Fabric Craft Items
99 Enterprise Center, Suite 21 - **322-7127**

Shantytown Import Stuffs

Scrap Metal - Scavengings - Tramp Art & Craft Materials
6700 Spaceport Road - **742-6897**

Sort Rite, LLC.

Sortation Supplies & Management Software
303 Conrad Drive, Suite 33 - **707-8748**

The Moon Society

J O U R N A L

http://www.moonsociety.org

Please make NEWS submissions to
David Wetnight at newsmonger@asi.org
Other submissions: 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 explor-ation and utilization 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®**

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

- $35 USA/Canada + MMM hardcopy
- $60 elsewhere + MMM hardcopy
- $35 anywhere + MMM electronic PDF file

Questions? email: membership@asi.org

The Artemis Project™ http://www.asi.org/

- Artemis Reference Mission
- Artemis Data Book

Project LETO™
http://www.projectleto.org/

Please send all mail related to Memberships to:
The Moon Society Membership Services
PO Box 940825, Plano, TX 75094-0825, USA

How to fix MMM Subscription Errors:
www.asi.org/adb/06/09/04/1999/09/news-19990915.html

Artemis Society, Moon Society, MMM

From Randall Severy Chairman of the Board, Moon Society

Artemis Society: The past few months have been a very busy time in the Moon Society, so it seems that the time is right to send out another one of these periodic updates to all members. To help explain some of the things that have been going on, I need to outline the differences between the Moon Society and Artemis Society International, since you are a member of both organizations. Artemis Society International (ASI) was formed in August 1994 to serve as the meeting ground and educational forum for the Artemis Project. In July 2000 the Moon Society was founded to expand the scope beyond the Artemis Project to all Moon-related projects and organizations.

Due to the heavy overlap in leaders between the two organizations, the effort to get the Moon Society up and running has led some to believe that ASI had ceased to exist. But it's still around, and its mission is just as strong as ever. On May 14, 2003, the Lunar Resources Company appointed Michael Mealling to the ASI Board of Directors, replacing Boise Pearson, who has gone on to other ventures. On May 21, 2003, the ASI Board of Directors elected Michael as Chairman of the Board.

Moon Society: To fulfill the mission of the Moon Society to serve all Moon-related efforts, we have launched two new initiatives to support the Lunar Comm-nity. A new broadcast mailing list, moon-news@moonsociety.org, has been created to distribute news and announcements about the Moon and Moon-related projects. Posting to the list is restricted to authorized contributors, so the list volume will be low. To subscribe to the list, send an e-mail to Moon-news-subscribe@moonsociety.org or go to: http://www.moonsociety.org/teams and scroll down to the Moon News and Announcements section near the bottom.

The Lunar Directory The Moon Society web site is now home to the new Lunar Directory, a web page that consists of a growing list of projects and organizations related to the Moon. John Schrock is working tirelessly to keep the directory up to date as new entries are submitted from all over the Lunar Community. You can visit the new directory at: http://www.moonsociety.org/lunar-directory

MMM: The society newsletter, Moon Miners' Manifesto, has long been available online to members as PDF files. But many members were not aware of where to find the online MMM archives and did not know when new issues were published. That is now no longer a problem with the debut of a new MMM announcement service that most of you saw in action for the first time last week. As soon as a new MMM PDF issue is published on the web site, an e- mail announcement will automatically go to all members who have specified that they wish to receive the MMM newsletter in either hardcopy or electronic form.

Volunteering for the Moon Society!

It will only happen when you make it happen!

http://www.moonsociety.org/volunteer.html

The Moon Society is staffed entirely by volunteers. The willingness of members to contribute their time and effort to supporting and growing the Moon Society is critical to the success of the organization. We are always looking for additional volunteers to help out in critical areas of the Moon Society. If you have a few minutes a week that you can devote to Moon Society activities, and are willing to commit to completing tasks that you take on, we can use your help!

Volunteers are needed to take a lead role in these areas:

- Outreach
- Fundraising
- Conferences
- Liaison Coordinator
- Local and Campus Contacts

How to Volunteer

Send an e-mail to volunteer@moonsociety.org with a description of what area you would like to volunteer in. You will be contacted as soon as possible with instructions on how to get involved.

Guidelines for Volunteers

1. Take on only what tasks you reasonably expect to be able to accomplish in a reasonable period of time.
2. Try to respond promptly to communications regarding tasks that you are working on.
3. If you are unable to complete a task, try to find someone else to take over the task, or contact someone in the Moon Society staff about finding a replacement.
4. Provide regular status reports to your team leader or Society staff about tasks that you are working on.

Moon Society Volunteer Descriptions

Outreach

This is where Moon Society members bring our enthusiasm for lunar science and development to the outside world. Developing flyers, effective displays and strategies for getting interest and recruiting new members, ideas for working with teachers, youth groups, and other venues, and more. We could be doing a million different things here; what's needed is a leader to focus the effort and make sure the few things we can do right now are actually completed and effectively used.

Fundraising

This is really, in a sense, marketing - how do we "sell" the society to the world. Part of it means being effective in our programs; using the money we raise for good purposes should be a major factor in raising more from small donors. The other part of it is finding a few major sponsors for our work. If you think you know anything at all about this, you're ahead of the rest of us - why not volunteer?

Conferences

This has two major components: ensuring our presence and influence at existing space conferences and meetings, and organizing our own meetings or our own program as part of another conference. Fortunately, there are already a wealth of meetings every year that touch on science and development of the Moon; the interest is really there. Unfortunately, there are already a wealth of meetings every year we should be involved in, and one or a few of us as volunteers cannot attend all of them. We need a volunteer to keep track of Moon-related conferences and to coordinate the local chapters and contacts to try to be sure the Moon Society has an effective presence at as many of them as we can.

Liaison Coordinator

This person maintains contacts with other space-related (especially Moon-related) organizations to foster cooperation and coordination of activities, encourage sharing of information, and eliminate duplicated effort.

Local and Campus Contacts

a. A Local Contact agrees to accept, read, and reply to any email inquiries about local activities (actual, planned, or possible) concerning Moon Society goals and Projects (including the Artemis Project)

b. A Local Contact can work with others who contact him/her to plan meetings, parties, and/or public outreach events that may including speaking, displays and exhibits, informational literature, etc. that promote the goals of the Society. Of course, in order to attract new local members, the local Contact can engage in such activities by him/herself in an attempt to get things going, if so motivated. There are many online resources tailor made for Moon Society use to help you engage in such activities at the Space Chapter Hub website: http://nsschapters.org/hub/

c. By agreeing to be a local contact in your community area, you are not committing yourself to be president or any other officer of any future chapter, only to work with others. Elections will pick the officers.

d. In sum, a Local or Campus Contact agrees to be just that. The Society does not expect you to work miracles by yourself.

e. This is a vital position, and the Society has dignified the it with the term Outpost. An Outpost is one or more persons, but short of the number needed for full chapter status (five), who represent the Society on the Outreach Frontier.

f. For more information, contact Chapters Coordinator, Peter Kokh, at chapters-coordinator@moonsociety.org or at kokhmmm@aol.com or by phone at 414-342-0705

Moon Society Challenge – Email Exchange

FROM Rae Yother <RaeYother@aol.com>

I'm really not as experienced with all of this as the rest of you seem to be, just very hopeful that we'll get there. I remember hearing about a campaign for one of the earlier missions, the original lunar mission, I think, where the school children saved their change for NASA. One of the biggest problems is that settling the moon is not something most people think about. It isn't in there faces. Advertising in whatever way we can, to bring attention back to space is desperately needed. If we could start some sort of "Lunar Colony Campaign" in the schools, it would bring in money, as well as bring attention to the cause. Our generation was promised space, and many have given it up as a lost dream. They need to know that it isn't lost, and with their support is possible

FROM Ian Randal Strock

We can continue to gaze into our collective navel all we want, debating which government we need to interfere when and where, how we can measure our forty mules and an acre on the Moon, and on and on, but Rae's got the right of it: none of it will ever happen until we bring together a sufficiently large customer-base (or audience, if you're uncomfortable with those capitalistic terms). I've been spending nearly all my Artemis Project efforts on precisely this goal: publicizing the fact that we can all go. That's why I'm traveling to Columbus this weekend, why I inter-rupt my workday to talk with marketing firms and repor-ters, why I took a day and a half to be in Maryland so that my voice could be dubbed on French television, and so on. Because we need to convince the people out there that something is happening in commercializing the space frontier, and that, even if they don't want to be a part of it, they're definitely going to want to watch it.

But you don't have to wait for anyone else's efforts to reach fruition. You can talk about the Moon and space to your friends who don't think about it; you can write a letter to the editor or an article for your local newspaper, emphasizing any aspect of it all that most interests you (and now is a great time: tie it in to the upcoming 34th anniversary of the Apollo 11 landing; and remember that 2003 is the centennial of powered manned flight); print out Moon Society membership flyers and leave them in appropriate places; subscribe to Artemis Magazine for your local library; get your local outpost of the Moon Society activated (it's easy: send an announcement to the newsletter and to this list, and host a get-together for all the local members).

Sure, a national campaign grabbing all the school-children would be wonderful, but think a little smaller; start with what you, personally, can do. We'll grow it into something that can reach everyone.

[Ian is Editor of Artemis Magazine and is on the Boards of the Moon Society and The Lunar Resources Company.]

FROM Arthur P. Smith, Moon Society Board Member

Hi Rae and Ian,

Having been shanghaied by Dale Amon into publicity efforts for the ISDC this week, I'm beginning to see what publicity really means! We have a non-profit organization, the Moon Society, that is ready to accept contributions, new members and volunteers in the work. We know where we want to go - it's up there pretty visible most nights! We have a variety of companies that are working on getting us there - TransOrbital most particularly is actually sending a mission later this year, and could use all the support it can get, publicity-wise. We also have all those X-prize contenders out there that could use some cheering. We have a huge resource of information about development of the Moon in the Artemis Databook - we need people to be keeping that up to date and adding their contributions.

But, agreeing with both of you, what we really need is people to take this message and get it out in the public - be willing to stand up and be interviewed on radio or TV, about your conviction that people will live in space and on the Moon, and that development of space resources can solve many of Earth's problems, and be a huge economic engine besides. Write those letters to newspapers, offer to talk at local schools or have a presence at a local event, write a press release. Develop connections with reporters at your local papers and radio/TV stations. One useful web site I've found helping out Dale is:

http://www.mondotimes.com/

which lists print media and broadcast TV stations for any location.

If you can help in whatever way to get this message out, you'll have participated in the opening of the space frontier - I think it's the most important work we could be doing right now.

By the way, slashdot just posted another of my stories - that and the other online boards are a great resource too:

http://science.slashdot.org/article.pl?sid=03/05/19/1621234&mode=thread&tid=134&tid=160 (an attempt at linking a recent book release to ISDC...)

Arthur P. Smith

Moon Society Chapters & Outposts — The Outpost Frontier Report

San Diego Chapter Reactivated

www.moonsociety.org/chapters/sandiego/

Several San Diego area Moon Society members are re-activating the San Diego chapter. The Chairman or President is to be Dr. David Schrunk, 14341 Horizon Ct., Poway, CA 91384 (tel: 858/485-0540; fax: 6162; EM: docscilaw@aol.com). Dave was elected at a chapter meeting on April 3, 2003 at the Sea Lodge in LaJolla. Board members include writer and author Phil Harris {see Mail p. 13] and Dennis Laurie, CEO, TransOrbital Corp., 4130 LaJolla Village Drive, Ste 10782, LaJolla, CA 92037 (1-858/455-5900; fax: 5979; www.transorbital.net).

New Outposts for Indiana and Boston

INDIANA: John Schrock, our tireless Moon Society Web-Team leader, responsible for the many new changes to our web site, has volunteered his services as local contact for Indiana. He is also willing to help organize Illinois! Contact John at < schrock@ccrtc.com >

BOSTON, MA: Rob Winchester, of Natick, Mass. has offered to serve as local contact for the Boston area. Contact Rob at < robw911icig@netscape.net >

The Moon Society on Campus : Brigham Young Univ. (Provo) Outpost!

The Moon Society will soon have our first Campus Outpost. Those familiar with the National Space Society may know that student chapters are a viable idea. Many on campus facilities and much assistance is available to student-run groups. It is a fact that most campuses do not welcome outsider-run organizations.

Jonathan Goff, < jongoff@myrealbox.com > our Outpostman for Utah, is now organizing the Moon Society's first campus chapter, the BYU-Provo Outpost. BYU, of course, is Brigham Young University.

Jon will remain contact person for Utah at large, in the hope that he can attract enough people from the general population to spin off a viable non-campus chapter. He is on the lookout for people with leadership potential who can exercise initiative, for both outposts. Set to graduate next year with an engineering degree, Jon intends to stay active in the Utah Outpost, hoping that the BYU-Provo Outpost continues to thrive after he leaves.

This is a model that we hope to replicate elsewhere. University campuses concentrate enormous talents and energies. Campus chapters can be ideal incubators for the Moon Society leaders of tomorrow.

If you are a student, consider voluteering to be Campus Contact for the Moon Society.

Moon Society Mid-Atlantic Chapter

http://www.moonsociety.org/chapters/midatlantic

From Randall Severy < severy@asi.org >

With the aim of rebuilding our chapter, we have sent out a mailing to all current and former members of the Artemis Society and the Moon Society within a 100 mile range of Washington DC. A copy of our letter is available for other chapters and outposts to use as a template:

Download file: mid-atlantic-renewal-letter.pdf
from this directory: http://nsschapters.org/hub/pdf/

Moon Society St.Louis Chapter

http://www.moonsociety.org/chapters/midatlantic

Dave Dietzler < Dietz37@msn.com > writes: It's only a humble beginning, but I have started work on a new website on Yahoo!' http://www.moonminer.com

New Website Template Available for Chapter & Outpost Use

Mike Delaney has produced a nice new chapter/outpost website template. See it at these addresses:

www.moonsociety.org/chapters/sandiego/
www.moonsociety.org/chapters/bams/
www.moonsociety.org/chapters/midatlantic/

Chapter and Outpost local and campus contacts who want to have a website are free to use this template but remain free to design their own, or to use another template, e.g. that used by the Utah and Houston outposts.

www.moonsociety.org/chapters/utah/
www.moonsociety.org/chapters/houston/

[original template below]
nsschapters.org/hub/webtemplates/template_4.htm

Totally free chapter websites are available on the Moon Society server, courtesy of CyberTeams, Inc. Each site includes Wesite Director Express software which makes online editing a breeze. To arrange for your website, contact Peter Kokh at kokhmmm@aol.com

Chapter & Outpost Resources Online

The Moon Society Chapters Coordinator keeps a log (with active links) to resources appropriate for use by Moon Society Chapters and Outposts on the Space Chapters Hub website. This log is online at:

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

Recent Uploads for Moon Society Chapters & Outposts

(Sample Letter to Lapsed ASI and Moon Society Members) mid-atlantic-renewal-letter.pdf

(Moon Society Membership Form) moon-memflyer.pdf

Mail For MMM

"Got Milk?" – Gravity Jugs a Hit in Tennessee

Just wanted to let you and maybe others know how well the idea for a gravity demonstration using bottles worked out for me.

[see >> http://nsschapters.org/hub/gravityjugs.htm]

I used 1/2 gallon milk jugs to reduce the bulk of my exhibit. I filled one jug with water, and the 2nd and 3rd with styrafoam peanuts and then added 1/3 and 1/6 of a gallon of water to simulate Mar's and the Moon's gravity. I then took a 4th empty sealed jug as a demonstration of gravity on Mar's moons and asteroids at ~1/1000 gravity.

This seemed to be an eye opening impression on manyof my Astronomy Day exhibit visitors. I had one child asked what it would feel like on Jupiter, so I have decided to add a 5th bottle filled with sand and then water. This will approximate Jupiter's gravity force of ~2.5 g's at the top of it's atmosphere. I think I'll have to explain this as the gravity force that someone would feel if they were able to stand on Earth's ocean surface. I think even most kids will understand that they would be pulled down faster under the heavier gravity.

Attached is my 1 page demonstration flyer I plan to use next time I display.

[download file < GRAVITYDEMOmilkbottle.pdf > from the directory < http://nsschapters.org/hub/pdf/ >]

Please share this or any part as you like. Thanks for sharing the great idea.

Chuck Schlemm < cschlemm@comcast.net >
President, Middle Tennessee Space Society

"Launch Out" space novel ready to order

Greetings. Colleagues:

The final version of my space novel, LAUNCH OUT, a scenario for lunar development, may be ordered next month from Infinity Publishing at:

info@buybooksontheweb.com
or or tel.1-877/BUY BOOKS.

Since it is semi biographical some of the characters are space buddies - e.g., Arnold, Blair, Criswell, Duke, Finney, and Ross Schrunk are heros in this story of lunar entrepreneurs industrialization on the Moon.

Spread the good word, please. After forty professional books, this is my first effort at fiction and this 77 year-old amateur needs encouragement. Working now on 6th edition of MANAGING CULTURAL DIFFERENCES and a 3rd edition of MULTICULTURAL LAW ENFORCEMENT.

PAX

Phil Harris

Total Lunar Eclipses

UMBRA SCHEDULE for 2003 thru 2030

How Soon Will Someone be there to Experience ian Umbra?

Year/Date – Length of Totality – Part of Earth facing Moon

'03 Nov 09 0h24m Americas, Europe, Africa, c Asia
'04 May 04 1h16m S. America, Europe, Africa, Asia, Aus.
'04 Oct 28 1h21m Americas, Europe, Africa, c Asia
'07 Mar 03 1h14m Americas, Europe, Africa, Asia
'07 Aug 28 1h31m e Asia, Aus., Pacific, Americas
'08 Feb 21 0h51m c Pacific, Americas, Europe, Africa
'10 Dec 21 1h13m e Asia, Aus., Pacific, Americas, Europe
'11 Jun 15 1h41m S.America, Europe, Africa, Asia, Aus.
'11 Dec 10 0h52m Europe, e Africa, Asia, Aus., Pacific, NA
'14 Apr 15 1h19m Aus., Pacific, Americas
'14 Oct 08 1h00m Asia, Aus., Pacific, Americas
'15 Apr 04 0h12m Asia, Aus., Pacific, Americas
'15 Sep 28 1h13m Pacif, Americas, Europe, Africa, w Asia
'18 Jan 31 1h17m Asia, Aus., Pacific, w N.America
'18 Jul 27 1h44m S.America, Europe, Africa, Asia, Aus.
'19 Jan 21 1h03m c Pacific, Americas, Europe, Africa
'21 May 26 0h19m e Asia, Australia, Pacific, Americas
'22 May 16 1h26m Americas, Europe, Africa
'22 Nov 08 1h26m Asia, Australia, Pacific, Americas
'25 Mar 14 1h06m Pacific, Americas, w Europe, w Africa
'25 Sep 07 1h23m Europe, Africa, Asia, Australia
'26 Mar 03 0h59m e Asia, Australia, Pacific, Americas
'28 Dec 31 1h12m Europe, Africa, Asia, Australia, Pacific
'29 Jun 26 1h43m Americas, Europe, Africa, Mid East
'29 Dec 20 0h55m Americas, Europe, Africa, Asia

New Comet Destination for Rosetta

From: science.webmaster@esa.int

Comet-chasing mission Rosetta will now set its sights on Comet Churyumov-Gerasimenko. In its meeting on 13-14th May 2003, ESA's Science Programme Committee decided Rosetta's new mission baseline. The spacecraft will be launched in February 2004 from Kourou, French Guiana, using an Ariane-5 G+ launcher. The rendezvous with the new target comet is expected in November 2014.

Astronomy from Mars

[Thanks to Ben Huset, MN SFS]

The first photos of Earth from Mars have been taken and show amazing detail.

http://www.space.com/
scienceastronomy/earth_from_mars_030522.html

The Earth is in half phase, clearly showing North and South America surrounded by ocean. The Moon also appears in the photo, also in half phase. Photos of Jupiter and some of its moons were also taken by NASA's Mars Global Surveyor and processed by Malin Space Science Systems.

21st Century Announces First Time Publication of

Krafft Ehricke's Vision for a Manned Mars Mission

from TCS@mediasoft.net

The recently discovered 1948 novelette written by space visionary Krafft Ehricke, "**Project Ares: A Saga from the Dawn of Interplanetary Travel**," is featured in the Spring 2003 issue of 21st Century Science & Technology magazine. An excerpt from the story is available on the magazine's website: www.21stcenturysciencetech.com

Written in 1948, when no rocket had yet even circled the Earth, "Project Ares" tells the story of the training, preparation, and mission of an intrepid crew of eight space travelers embarked upon mankind's first mission to Mars in 2050. Krafft Ehricke imagined that by the year 2050, when the mission takes place, space stations would be in Earth orbit, exploration of the Moon would be accomplished, and the science and technology would be developed to make the journey.

Ehricke's story is not just a fairy tale that ends happily ever after. In a scenario eerily similar to the 1970s accident on board the Apollo 13 spacecraft, Ehricke describes how safety measures and redundancy save the crew, and make this failed mission just the first step in mankind's exploration of the Solar System.

Krafft Ehricke, who died in 1984, left for mankind a treasure trove of detailed plans for the industrial development of the Moon, which he described as the "seventh continent" of the Earth. His philosophy of space flight was based on his concept of the extraterrestrial imperative: to defeat the pessimism and economic crisis that is inevitable from the false notion that there are limits to growth.

Press copies of the Spring issue are available for reporters. Requests should be faxed on letterhead to 703-777-8853.

The Virtual International Space Station

http://commercial.hq.nasa.gov/viss/viss.html

VISS is an immersive, three-dimensional model of the station that is installed on your computer. Once installed, you will be able to walk about the interior and fly around the exterior as if you were on a space walk.

System Requirements:

Installation of the VISS requires 130 MB of free storage on your C drive for Windows PC compatibles. The minimum recommended hardware configuration is a 300 MHz processor running Windows 95 or NT. The preferred configuration is a 500+ MHz processor running Windows 98 with a D3D compatible graphics card. The VISS also runs well on Windows 2000 and Windows Millennium operating systems in software rendering mode, or Direct 3DD or OpenGL mode if you have a compatible 3D accelerator

Planetary Society News – May 2003

from tps.mbl@planetary.org

YOUR NAME FLIES TO MARS IN JUNE: As part of our Red Rover Goes to Mars program, the names of all Planetary Society members, as of December 1, 2002, are included in the 3,551,645 names flying to Mars this June on the Mars Exploration Rovers scheduled to land in January 2004.. The names were encoded on a small DVD attached to the lander. As they rest on the Martian surface, the rovers will photograph and return to Earth an image of each DVD.

http://www.planetary.org/rrgtm/index.html

MARS WATCH 2003: On August 27, '03, Mars will be closer to Earth than it has been for more than 50,000 years. To celebrate this rare occasion, TPS is organizing Mars Watch 2003 - a series of events such as star parties, sci-fi film festivals and Mars talks at sites all over the world.

Mars Watch 2003 will culminate at Planetfest '04 Jan. 2-4, 2004, when thousands will gather in Pasadena, CA to witness the 1st Mars Exploration Rover's arrival at Mars.

TPS will notify members of events in their area.

http://www.planetary.org/marswatch2003

SETI@HOME STELLAR COUNTDOWN UPDATE: It has been two months since SETI@home's crew went down to Arecibo to have a second look at the best signals discovered by the project so far. Now they are set to send these reobservation work units to users. Scattered among the work units sent out for processing in the coming weeks are some special ones recorded during SETI@home's historic **Stellar Countdown**. The release of these work units is imminent.

SETI@home users can keep checking our website for updates on how to tell which units you are processing:

http://www.planetary.org/stellarcountdown/index.html

SOLAR SAIL: Hardware is on the move. The engineering model of our Cosmos 1 solar sail project, has traveled from Moscow to Miass, home to Makeev Rocket Design Bureau, builder of the Volna launch vehicle. There, the engineering model will be tested with the Volna's payload separation system to sever the craft from the booster after launch., a critical milestone in certification of flight readiness.

http://www.planetary.org/solarsail/Media.htm

GOBBSS EXPERIMENT RECOVERED: In May we retrieved our astrobiology experiment samples from a payload package that survived the catastrophic breakup of the Columbia shuttle. TPS's Growth of Bacterial Biofilm on Surfaces during Spaceflight (GOBBSS) experiment will be examined by Arab and Palestinian students and advisors to see how well the bacteria grew on the material, if at all, comparing results from a parallel experiment done on the ground.

http://www.planetary.org/gobbss/gobbss_recovered.html

PLANETARY RADIO: Each week, Planetary Radio visits with a scientist, engineer, project manager, advocate or writer.

http://planetary.org/audio/planetaryradio.html

GREAT BROWSING !

"Contact Light"

A Personal Retrospective of Project Apollo

by Kipp Teague

www.retroweb.com/apollo_retrospective.html

Eagle Lander 3D

www.wright-flyer.net/
desertactivation/eagle/eagle.3d.html

Space Library

www.spacelibrary.com

SciJinks

www.scijinks.nasa.gov

Space Education Initiatives

www.spaceed.org

A Fresh Look at Venus

http://www.funkyscience.net/
David Grinspoon - Venus

http://www.popsci.com/exclusive/Venus Poll

Lunar Solar Power & David Criswell

From this quarter's U. of Houston magazine, Collegium
www.uh.edu/collegium/print/spr03/pages/moon.html

"the world—at about six billion people as of 2002—needs 2-3 times more commercial thermal power than the 14 terawatts now provided by current energy sources."

"The Failure of NASA & a Way Out"

www.spacedaily.com/news/oped-03zn1.html

"In 1969, we landed on the Moon, but now we cannot leave low Earth orbit (LEO). NASA claimed that the shuttle would be fifteen times cheaper to fly (per pound of payload) than the Saturn vehicles used in Apollo, but it is actually three times more expensive.

[snip] "The purpose of human spaceflight is to open the solar system to all of us, not just to civil servants. The appeal of the program depends on the perception that it is opening a new frontier where people can escape the increasing regulation of life on Earth. A centrally-planned, government-run program is incompatible with that vision. It cannot survive, because it contradicts a principal reason for popular support.

[snip] "Transfer to the private sector can make human spaceflight a source rather than a sink for tax revenues." - Philip K. Chapman (Apollo Scientist-Astronaut)

Mars Society Convention 2003

Eugene, Oregon – August 14th–17th

Eugene Hilton Hotel

[Use Convention code MAR when booking your rooms for special discounted rates.]

www.marssociety.org/convention/2003/index.asp

Theme: *The End of One Trail, the Beginning of Another* (based on the Lewis and Clark expedition, marking the bicentennial anniversary of the venture's beginning.) Check the great theme artwork on the convention page above, by Oregon L5 Soc.'s R.D."Gus" Frederick, based on "Lewis and Clark at Three Forks" by Edgar S. Paxson.

Getting There by Road: Eugene is on 1-5, 109 miles south of Portland, Oregon's major gateway city.

Getting There by Rail: Eugene is served by Amtrak on the Seatle, Portland, San Francisco, Los Angeles line.

Getting There by Air: The city's Mahlon Sweet airport is served by three air carriers: America West Express, Horizon Air, and United Express with non-stops to and from: Denver, Las Vegas, Los Angeles, Phoenix, Portland, San Francisco, and Seattle. Coach service from Portland airport is available for $35 per person each way with a minimum of 20 passengers

Planned Tours: The trips to Lava River State Park and Newberry National Volcanic Monument on August 13th (tentative) and the trip to Pine Mountain Observatory on August 18 (tentative) are $100. We estimate a minimum of 10 hours for both of these. We need a minimum of 30 persons. Contact Tours@nw.net for sign-ups or more information. For additional tours go to www.marssociety.org/convention/2003/tourinfo.asp

Convention Registration Fee:

- **$190** - Regular or Lifetime Member, incl. 1 Banquet ticket
- **$280** - Non-Member, incl. 1 Banquet ticket

Special à la carte prices

- **$35** - Student or Senior Member
- **$80** - Student or Senior Non-Member
- **$50** - Banquet Ticket, per person

"It is less expensive to become a member, then buy your conference tickets, than to pay the non-member rate."

Special Features:

- Teacher workshops
- A Student Symposium On Mars Studies
- Sessions on 2003 field seasons at MDRS and FMARS
- Report on development of the "Mars Mobile".

Speakers Announced:

Nebula award-winning author Greg Bear
Dr. Bill Hartmann

First Alpha Centauri TeleProbe Results

by Peter Kokh

No, the age of "interstellar" probes journeying to distant stars has not begun. Yet an interstellar "teleprobe" of the Alpha Centauri System has "returned" a revealing "picture" of the two sun-like stars orbiting each another.

"Interstellar teleprobe?" Yes, by use of a Very Large Earth-bound Telescope Interferometer, combining the images of two smaller telescopes at a distance from one another, astronomers have achieved a high resolution look at the two stars of this system good enough to pin down their diameters, and, in the process, confirm the validity of the current theory of the structure, internal dynamics, and evolution of sunlike stars. As a result Alpha Centauri A and B are now, quit fittingly, the two best-known stars, besides the Sun, of course. [1]

Background: Our closest Neighbor(s)

Alpha Centauri is itself a binary system with two sunlike stars. Along with the fainter, smaller red dwarf named Proxima Centauri because it is slightly closer to us, they constitute a triple star system some 4.36 light years away. As stars go, that's very close. The average distance from one star to its closest neighbor in our part of the galaxy is about 6.3 light years [author's calculation], so we can count ourselves lucky to have not one, but three stars closer than that.

Yet that 4.36 light years amounts to some 270 thousand times the distance from Earth of our own home star, the Sun, or 9 thousand times farther from us than Neptune. Voyager I, our fastest and furthest scout is now only about 3 times as far out as Neptune. Three vs. nine thousand. A long way to go! And we have not yet achieved even "interstellar drift speed" - stars drift with respect to one another at speeds up to 30 miles per second, some one ten thousandth of the speed of light, or less. We can really speak of interstellar travel when we are talking about velocities an order of magnitude greater than that, say one-thousandth of the speed of light.

The "System" – Just the Facts!

A and B, which I had suggested [2] be named **Ixion** and **Nephthele**, respectively, after the two best known Centaurs of Greek Mythology, have sun like spectra, a yellow G2V for A (similar to the Sun) and K1V for B, a bit cooler and more orange. Proxima is about 10,000 A.U. [1 A.U. is the mean distance of the Earth from the Sun]. closer to us than the A-B pair about which it revolves once every million years or so (thus it will be closer to us for hundreds of millennia to come.)

A and B orbit one another at a mean distance that compares with Uranus' distance from the Sun. But the orbit is eccentric, varying from a minimum of 12.4 AU apart, about 25% greater than the Sun-Saturn distance to a maximum separation of more than 39 AU which compares with the mean Sun-Pluto distance. This eccentric orbital proximity of these two suns may seem to be a hostile environment for planets. But simulations show that planets in inner system type orbits out to as far as Jupiter's distance (5 AU) would be stable around either.

What more could one want? Well, don't get carried away. For many years on an otherwise life-friendly planet around either sun, both suns would be in the daytime sky, and for decades, one would be in the night sky as bright as 350 of our full Moons, and at least as bright as 75. Life on Earth has evolved according to predictable light cycles and seasons. On any planet around Ixion or Nephthele, predictability comes in eight decade long cycles, quite a hurdle!

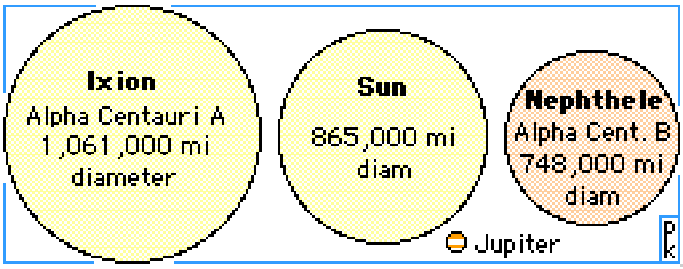
For a fuller account, see the previous article. [2]

Teleprobing the Stars

Voyager I, our fastest probe to date, is but one 3 thousandth of the way to the Alpha Centauri system, after more than a quarter century en route - and in the wrong direction. While there are probes "on the sketch board" that would get our instruments to interstellar targets, like the late Robert Forward's Star Wisp sail probe powered by gigawatt microwave beams, and other even more remote engineering coups, for the foreseeable future we have to do our interstellar exploration from the vicinity of Earth: telescope arrays on Earth itself, in orbit, or on the Moon.

The European Southern Observatory (ESO) in Chile has used its the Very Large Telescope Interferometer (VLTI) make the first-ever direct determination of the angular sizes of the disks of Alpha Centauri A and B. Together with previous photometric and asteroseismic observations, the experiment with the VLTI makes possible a complete characterization of the Alpha Centauri twin suns. An analysis of the results has raised confidence in the current model for the evolution of sun-like stars. (ESO had previously looked at Proxima Centauri with the VLTI.)

These measurements provided high-quality angular diameter values, that with the distance measured earlier by ESA's Hipparcos satellite, showed the true radii to be 854,000 km and 602,000 km, or 1.227 and 0.865 times that of the Sun, respectively.



Footnotes:

[1] A Family Portrait of the Alpha Centauri System: VLT Interferometer Studies the Nearest Stars, *March 22, '03* http://www.spaceref.com/news/viewpr.html?pid=11016

[2] MMM# 43 MAR '91 p 8 "Alpha Centauri" **</MMM>**

The Lunar Reclamation Society, Inc.

PO Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

• **May Meeting Report:** We showed the Sciene Fiction film "**Plymouth**". and chatted about space events and the upcoming total lunar eclipse of May 15th.

• **LRS & Moon Soc. Milwaukee Outpost** had a booth at the Rockets for Schools event in Sheboygan, May 16-17th. Featured was the new Artemis Project display, as we have no way to transport the table top Moonbase.

LRS JUNE Events

Saturday, JUNE 14 th1-4 pm

LRS Meeting, Mayfair Mall, Garden Suites **Room G110**
NOTE; NO MEETINGS IN JULY & AUGUST.
The next regular meeting will be on Saturday, SEPT. 13th.

Collaborating Milwaukee Area Space Groups

Moon Society Milwaukee Outpost
c/o Peter Kokh 414-342-0705 - kokhmmm@aol.com
http://www.moonsociety.org/chapters/milwaukee/
MSMO currently meets jointly with LRS

Wisconsin Mars Society c/o Matthew Giovanelli
7133 West Wells Street, Milwaukee, WI 53213
414-774-8952 - marsmatt@wi.rr.com
http://chapters.marssociety.org/usa/wi/
WMS usually meets at address above on 3rd Sat. 1pm

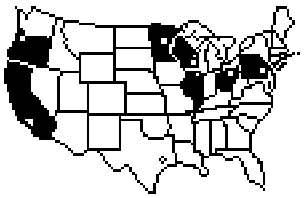
Solar System Ambassadors

PASA - Princeton, NJ/Philadelphia, PA
Michelle Baker - chaos@cybernet.net

CSFS - Chicago,IL
Bill Higgins - higgins@fnal.gov

SSS - Sheboygan, WI
Harald Schenk - hschenk@excel.net

U.S. CHAPTERS



NSS Chapter Events
MMM
8 Chapters Strong

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

MINNESOTA

Minnestoa 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/]

MEETNGS: 3rd Saturday of the month from **1-4 pm**
at the: **St. Anthony Park Library**'s Meeting Room
2245 Como Ave. St. Paul, MN

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@excel.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 Tuesday** of the month at **7-9pm**

JUNE 17: Stoelting House, **Kiel**
JULY 15: Foerster Academy of Dance, **Sheboygan**

• SSS fieled itgs new ISS Display at the annual Rockets for Schools event in Sheboygan, May 16-17th. Will (L) built the Earth in Space diorama, Brian Hastings (R) the magnificent Lego model of the International Space Station. Photo: www.brickshelf.com/cgi-bingallery.cgi?i=403728

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement

P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine: (310) 364-2290
Odyssey Ed: Craig Ward - cew@acm.org
E-mail: oasis-leaders@netcom.com

Our Website has Moved. NOTE NEW ADDRESS

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

- **June 21, 3:00 p.m.** -- OASIS Monthly Business Meeting, location: Microcosm, 401 Coral Circle, El Segundo. Info: OASIS Hotline, 310/364-2290.
- **July 19, 3:00 p.m.** -- OASIS Monthly Business Meeting, location Long Beach. (Time may change.)
- **July 19, 6:00 p.m. -- OASIS 25th Anniversary Banquet**! Come celebrate 25 years of grassroots space education, outreach & activism. *The Proud Bird Restaurant*, 11022 Aviation Blvd., El Segundo. Reservations ASAP.

Recurring Events

- **The Griffith Observatory** is undergoing renovations and upgrades to reopen in 2003. - www.griffithobs.org/
- **Fridays, 7 pm** "Night Sky Show." -- **8 pm** Guest lectures. Santa Monica College John Drescher Planetarium, 2nd Floor Technology Bldg, 1900 Pico Blvd. $4 per show or $7 for both. 310/452-9223 www.smc.edu/events/weeklyeven.
- **Fridays -** "Mike Hodel's Hour 25" webcast. The world of science fact/fiction: interviews, news, radio dramas, artists, writers, stories, reviews. www.hour25online.com/

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252

c/o George F. Cooper III, Phone 216-749-0017

E-Mail: geocooper3@aol.com

OREGON

Oregon L5 Society, Inc.

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@attbi.com>
(LBRT - Oregon Moonbase) moonbase@attbi.com

☞ Meetings **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
NEXT MEETINGS: **JUN 21st, JUL 19th**

Oregon L5 Meeting Minutes, 12 April 2003

Present: Dick, Gus, Bryce, Cheryl and newcommer Jason. Meeting called to order at approximately 17:15 by our Treasurer, Bryce Walden. The April meeting was at this later time, and on the second rather than third Saturday, so that we could celebrate Yuri's Night afterward. Gus brought with him an announcement for our Yuri's Night Party printed in the Willamette Week newspaper.

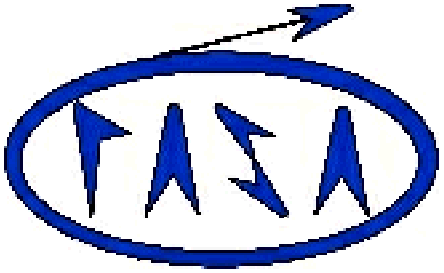
- President's Report: Allen is a conference in Berkeley.
- Secretary's Report (Cheryl): Minutes of the previous meeting were approved as emailed and corrected.
- Treasurer's Report (Bryce): Finances unchanged.
- LBRT (Bryce & Cheryl): The Lunar Base Research Team has been meeting in the office on Tuesday evenings, working primarily on our lunar lavatube model.
- MIST: Gus Frederick will represent our Mars Instruments and Science Team, along with the Oregon Chapter of The Mars Society, at the Oregon Gardens' Earth Day event next weekend. He will display his CEMSS unit (Closed Ecological Mouse Support System.) Also Dick Steffens has been in touch with bus rental and tour operator people in preparing tours for this summer's Mars Society Conf. in Eugene, OR. At Gus' request, Bryce & Cheryl took some conference flyers and associated student call for papers flyers to Norwescon.

Bryce & Cheryl will be at Norwescon next weekend. Bryce will be a program participant, and both will represent Oregon L5 at a table shared with Seattle NSS/Mars Soc.

Mail: Current MMM issue; "NASA chooses two robot landing sites for next year" (email); email about the current expedition to the Mars Desert Research Station; info on shuttle tiles from the internet; Announcement of Opportunity for Challenger Center program; current issue of JGR (Journal of Geophysical Research.)

Meeting adjourned at 17:40... followed by the Yuri's Night party!!! Tom B., Rea, Bob & Dareth and several additional newcomers arrived for the party after the meeting.

Cheryl Lynn York, Secretary



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.triipod.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.

Meeting Dates: June 21, July 20th *in New York* (A Sunday, Landing Day for Apollo). Call Earl or Mitch 215-625-0670 to verify all meetings

• **May Meeting Notes:** Meeting Location: As previous for June (Liberty One Food Court), But for July we will gather on July 20th in New York. This Landing Day Anniversary will be an event rather than a meeting.

Meeting Notes: We had a well-attended meeting in the sense that fruitful discussions took place both on ongoing projects and subgroup activities. **Independence Mars:** Gary Fisher may step down soon as head of the organization with Simon Koumjian 3rd taking his place. This does not mean Gary will not work on Society projects. In fact he is going to Hanksville again! This is to add-in improvements to the **Greenhab** System for water recycling (among other purposes). And, due to fortuitous timing, Simon will be there to help, with installation and ....? I expect there is plenty to occupy anyone who comes out. In addition; the part of the Greenhab to be taken out to the **Mars Desert Research Station** near Hanksville requires construction, assembly, inspection, then disassembly for transport to the site (no pressure tests yet!). Contact Gary for when and where to show up to help achieve this in June.

Simon and Mitch Gordon are working together on revising the PASA handout. We discussed using a modified version of the Futurefest logo which Gary Fisher helped with and has graphics for. This effort continues; especially in the light of increased opportunities for outreach that Mitch is working on. This will be a space oriented program most likely in the Fall. Simon is also working on this outreach problem.

Hank Smith gave us a report on upcoming events he was attending which included a Science Fiction Convention (**Baycon**) and the **ISDC** held in the same area. Since Hank is also an activist, he worked with members of the Con group at the event, was to help with the NSS suite and, of course, visit talks! And then go to theISDC for more lectures. We should get a report in June. Added Note: I have received a report by Dennis Pearson about the ISDC which I will pass on with his permission to interested members.

Due to time constraints Earl Bennett gave a report on **Seticon 03** held at the College of New Jersey located in Ewing (just outside of Trenton) from April 25 through 27th. This is a group of people interested in the science of finding out if societies exist, have existed, or have visited us. They include people with their own radio and, as an additional growing technique, optical telescopes. In addition to direct search team members and individuals using instruments for multiple purposes (S.E.T.I. and satellite signal recovery, or interstellar plasma composition studies, or...) there are signal and statistical analysis interests represented. Sifting for historical markers and possible "guest" interactions (via the net) are also examined. Note the word "examined". Those of you familiar with science and engineering practices will understand this but I will amplify this for others. When someone says "these are my results" they are not taken on faith in such circles unless they also have back up evidence or, in the case of research in the sciences where new work is done and old work is revisited, the experimental results are independently achievable by other experimentalists following the published work. "Trust Me" requires a body of work to be meaningful here, and it depends on how far the subject under discussion is relative to the main stream. In the instance of possible signal reception, multiple receiving site verification and other conditions must be met before an event is announced. This is a "protocol" that would also be used for other possible evidence.

At this time there are over one hundred stations set up for signal reception (a paper at the conference was on availability), a small array is coming on line soon (eight dishes for search and as a source of a standard calibration signal via the Moon) and a number of group and individual efforts as noted in Proceedings of Seticon 03. Contact: setileague.org which has visitor and member areas. The conference for next year will be later in the year (August), see site for details.

Added notes: We had reports from Dottie on the Planetary Report discussed last month, and on the website by Larry (low visits) as well as: The book signing for "Viable Utopian Ideas" was a great success, with eight contributors in attendance (thanks Mitch!) Gary's work on the Greenhab Project contributed to an award for the project at Penn State University in April. This was for environmental applications with such a system being usable anywhere that resources are hard to get or waste could prove "wasteful" or mission-jeopardizing (space, deep oceans).

Report submitted by Earl Bennett.

NAME _____.

STREET _____.

CITY/ST/ZIP _____.

PHONE #S _____.

❍ **$38 NATIONAL SPACE SOC.** dues includes *Ad Astra*
❍ **$20** NSS dues if under 22 / over 64. *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

Join **The Moon Society** - dues address on page 9

- **For members residing in the U.S & Canada:**
  Printed **MMM** delivered by postal mail: **$35**
  Electronic (pdf) **MMM** available on website: **$35**
- **For members residing in other locations:**
  Printed **MMM** delivered by postal mail: **$60**
  Electronic (pdf) **MMM** available on website: **$35**

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

=>for those outside participating chapter areas <=
❍ $18 Individual Subscriptions to MMM/MMR: Outside North America ❍ $50 Surface Mail -- Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CUYAHOGA VALLEY SPACE SOC. (Cleveland, OH)
❍ $15

CHICAGO SPACE FRONTIER L5
❍ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
❍ $18 reg. ❍ $24 family ❍ $15 student/senior

MINNESOTA SPACE FRONTIER SOCIETY
❍ $20 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 $20, due in March or $5 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY (WI)
❍ $15 regular, ❍ $10 student, ❍ $1/extra family memb
"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.

==> *Mail Carrier, Time Sensitive Material* <==

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