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

Moon Miners' Manifesto

& Moon Society Journal

#164 – April 2003

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

In FOCUS: Space Settlement Goal:

In early March, a group of space enthusiasts, meeting by invitation only, produced this statement:

Why Space Settlement

The human settlement of space is a noble cause that deserves the attention and support of people throughout the world for the following reasons:

- To enhance prosperity for all people and make use of the abundant resources of outer space;
- To fulfill the drive for discovery and exploration, which is an innate human quality at the core of progress and thriving civilizations;
- To ensure the survival of human civilization and the biosphere, and protect them from natural and man-made disasters.

Expanding boundaries to this new frontier is a pursuit of freedom, a fundamental element of progress essential to the fulfillment of human potential."

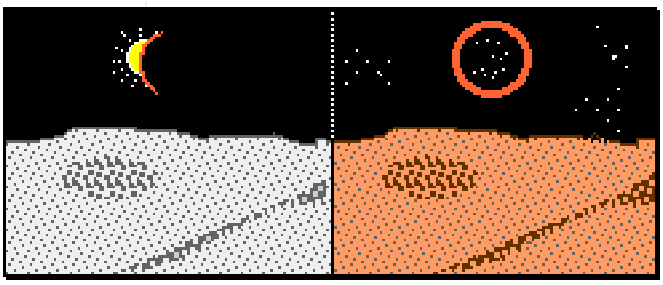
Principals at the Los Angeles meeting were co-chairs Buzz Aldrin, Dennis Tito, and Rick Tumlinson, and moderator John Lewis. Among the participants were author Vanna Bonta, JPL engineer Mike Eastwood, former Skylab crew systems manager Lt. Col. USAF (ret.) Bill Haynes, Space Frontier Foundation Secretary and longtime activist Brook Mantia, space activist Theresa Theiler and space frontier movement philosopher, Jon Carter McKnight.

Represented were the Space Frontier Foundation, the Planetary Society (which did not endorse the "humans in space" focused results), and the Mars Society. The Press release, however, was that of the group alone, and not immediately endorsed by any of these societies. However, the Moon Society Board, not represented at the meeting, did endorse the statement in a press release March 23rd.

The space leadership's media and public outreach team was not able to produce a companion consensus document, which is no surprise given the wide diversity of "how to get from here to there" strategies that guide individual space enthusiasts. And this is the crux of the problem.

Let's Put the Horse before the Cart!

In itself, the Space Settlement Statement does provide a rallying cry for those of us *manned* space supporters. But beyond that, it may be of little use. Our point is that this document is not a something we can use to enthuse the public, the media, or congress. [➪ p. 2, col. 2]



Experiencing Eclipses on the Moon

Every now and then, Earth-facing moonscapes take on the hues of a dimly lit Mars. But there will be no mistaking where you are. In the sky in place of Earth will be a black hole outlined with a ring of orange tones with only one ten thousandth the brilliance of sunlight. And in that black hole, clusters of lights, Earth's cities and fires, dotting otherwise dark continents. It is Umbra. ➪ pp. 4.-5.

Moon Miners' Manifesto

Moon Miners' MANIFESTO/ Moon Soc. Journal is published every month except in January and July, by the Lunar Reclamation Society. In January and July, all members and subscribers recieve **Moon Miners' REVIEW** instead.

• **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

• **MMM's desktop publication** has received ongoing support (computer hardware and software) from the **Space Frontier Foundation**, 16 First Ave., Nyack NY 10960; 800-78-SPACE - SFF seeks to open the space frontier to human exploration and settlement as rapidly as possible.

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

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges 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.

• **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.

÷ **EMAIL** to KokhMMM@aol.com (*preferred*)

÷ **Mac diskette** or **typed hard copy** to:

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

fi IN FOCUS Editorial continued from p. 1.,

Putting the Horse before the Cart

Holding up the Settlement of Space as a Goal, to anyone but the already converted, "the choir," risks ridicule and contempt. Why? Because it seems outlandish on its face. Everyone "knows" that neither the Moon or Mars, or anywhere else in the solar system, has breathable air, flowing water, and edible plant life. The very idea of trying to live out there is patently rediculous to the uninitiated.

Of course, the choir is in on the secret that we can (or, more honestly, *think we can*) create livable minibiospheres out there, that we can produce air and water and food and building materials from raw materials on location, and that *we think we can* use resources out there to produce not only goods needed by settlers, but exports to Earth that will more than pay for the bill. And if Settling Space is the "Cart," these "think we cans" are the horse.

But how can we parade "think we cans" before the uninitiated and gain their support? We can't! Clearly, without considerable more homework on these "enabling technologies," we don't have much to excite the public, to show them the "feasibility" of our bold visions for future human space frontier settlements, to give them exciting glimpses of how satisfying and fulfilling life on such a frontier might be. Our horse is still but a glimmer in our eyes.

There is valuable work being done on a number of worthy projects, by the Space Studies Institute, the Mars Society, and by the Artemis Project™ business partners. The Planetary Society, with its Cosmos I Solar Sail project is also helping to pave the Technic Way to the Milky Way.

From the very first issue way back in December '87, MMM has concentrated on illustrating the possibilities and highlighting the research and development that needs to be tackled to make our vision of a thriving frontier settlement on the Moon a reality. And we'll continue to do that so long as we can continue to publish.

But how do we, a collection of societies with little to leverage except member dues, help tackle this backlog of orphaned R&D projects? We can work to identify / itemize what needs to be done, and help brainstorm business plans to develop needed technologies for profits here and now, on the basis of possible terrestrial applications. This is our "Spin-up" answer to the NASA "spin-off" dead end. - PK.

The Space Settlement Statement Online

- http://www.spacedaily.com/news/oped-03y.html
- http://www.space-frontier.org/Projects/Spacefaring/

Lunar Rocket & Rover Co. has Moved

New street address but same contact information.

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The Interlunar Cycling Station: Traveling First Class

by Dave Dietzler <Dietz37@msn.com>

There's a right way and a wrong way to do everything. Traveling to the Moon in small ships made from external tanks with spartan accommodations will be okay with adventurous travelers in the early decades, but some day we are going to need something better. Those E.T. ships are rocket fuel guzzlers. Nuclear electric propulsion with ion or VASIMR drives looks like the answer.

Well, that's the wrong way. The Moon has plenty of magnesium for electric drives; however, the problem is the low thrust of electric drives. It will take weeks, perhaps months to spiral out of LEO and reach the L1 point or lunar orbit. The crew and passengers will die due to Van Allen Belt (VAB) radiation unless the ship is shielded to an absurd degree. If we use a bigger power plant we can get more thrust out of those electric drives and get through the VABs in a few days, but we will still need heavy shielding and our travelers will endure some minor radiation exposure. This will be very bad for the crew that must endure repeated passages through the belts and accumulated cellular damage.

The best power plant would be a vapor core reactor with MHD that produces two, even three, kilowatts per kilogram of total system mass-that includes radiators, pumps, etc. Research into this type of system has been done at the Innovative Nuclear Space Power Institute of the University of Florida [1]. Even so, the power plant must be enormous to produce the energies needed to push a ship carrying about 500 passengers through the VABs in just a few days. When you add up the shield mass and the power plant mass there's only enough left for rather spartan accommodations in the ship like sleeping closets instead of cabins, no "artificial gravity," shared bathroom facilities, less volume per passenger than was on the MIR and general cramped, less than luxurious conditions. The ship mass becomes so great that the use of efficient NEP doesn't reduce propellant demands very much. NEP is ideal for ships bound for Mars that accelerate slowly out of GEO or the L1 port because they don't need so much shielding-just a solar flare shelter, and they can take weeks to escape from Earth orbit and leave the drive on continuously for weeks to reach high speeds and shorten travel time to Mars. For interlunar luxury liners we need something entirely different -- the cycling station.

The cycling station will be very large. It will be propelled onto its orbit once and never again need but a tiny bit of propellant to make course corrections. "There ain't no such thing as a free lunch," but the cycling station comes close. Taxis will be necessary to reach the cycler. Since these vessels will be small and only capable of carrying passengers for a few hours at most, they won't guzzle much rocket fuel and oxidizer. A cycling station that swings around Earth at an altitude of 500 km. (310 mi.) and rides out to 469,526 km. (292,000 mi.) will have a period of 13.66 days or half the Moon's sidereal period of 27.32 days. Twice a month it will swing around Earth at 10.689 kps. (23,900 mph) and at apogee roughly 470,000 km. (292,000 mi.) out it will be creeping along at only 0.1545 kps (345 mph). Once a month, on every other orbit, it will enter the vicinity of the Moon. When it rounds the Earth, taxis in LEO will fire their motors and catch up with the cycler. The taxi will dock with the cycler and passengers will transfer to the cycler. At or near apogee they will return to the taxi and ride over to the L2 spaceport station. From there they will descend to the surface of the Moon in rocket powered shuttles. Several cyclers could allow Moon travel at various times of the month. The ride will take about a week.

Aboard the Cycling Station

The station will rotate to provide "artificial gravity" and have roomy cabins with private bathrooms rather than just bunks or sleeping cubicles and unpleasant vacuum toilets. Passengers will sit down to normal meals eaten with a knife and fork. Cooks will enjoy their art with the benefit of weight. Space sickness will be averted. Medical emergencies will be easier to handle with patients who don't float off the operating table. The station will hurtle through the VABs in just hours. Nobody will endure even the slightest increased risk of cancer. There will be no complex nuclear power plant that requires costly uranium and extensive maintenance. Environmentalists will not go on the warpath and tie the company up in law suits lasting years because of nuclear reactors in LEO. In a country where juries award $45 million settlements to people who spill coffee in their laps, this is a real problem.

The cycling stations could be made of [Space Shuttle] External Tanks connected to form a rotating ring. There will be dining rooms, game rooms with ping-pong and pool tables, coffee rooms, bars with beer on tap, dance floors, maybe even a small swimming pool and garden. There will also be weightless rooms in the hub and a small observatory. Cabins will have king sized Murphy beds, flat panel TVs, and other features common to terrestrial or lunar hotels including a bath with running water. A system of antennas throughout the station linked by coaxial cable that connects with a comsat linking radio transceiver will allow cell phone usage aboard the cycler.

Propulsion of the cycler into its orbit will be done with efficient solar electric drives over the course of several months, and at most, a year. Some small aluminum and LUNOX (lunar oxygen) rockets will also be used. After the cycler is situated in its orbit, it will use the solar electric drives and Aluminum/LUNOX rockets to make minor orbital adjustments. Lunar flyby will affect the cycler's trajectory in ways that I cannot predict, thus course

corrections will be needed from time to time.

The taxis will consist of single E.T.s fitted with rocket motors, LSS, etc. Basically, they will be interlunar ships like those described in the January, 2003, Moon Miner's Review #32, refitted with couches for about 400 people. There's a lot of room in one of those E.T.s. It may be possible to cram more people in there, but I tend to be conservative. A taxi will use about 600 tons of Al/LUNOX to rendezvous with the cycler and transfer to L2. Another 600 tons will be needed to leave L2 and retrorocket into LEO on the return flight. Retro-rocketing into LEO seems safer than aerobraking. Three tons of fuel and oxidizer will be needed for each of the 400 passengers. Since it will take about fifty cents worth of electricity to launch a pound from the Moon with mass drivers, it will only cost each passenger $3,000 for propellant alone -- much less than the cost of propellant for a trip aboard one of those old spartan 50 passenger ships that are now taxis.

When everything is added up the round trip might cost an individual as little as $100,000! Call it wishful thinking! If the cycling station consists of two rings of 12 E.T.s each and four E.T.s in the hub, for a total of 28 tanks, there will be about 56,000 cubic meters of volume or 140 cubic meters per person with 400 people aboard. The Skylab had 100 cubic meters per occupant. A nuclear submarine has about 70 cubic meters per person and the Salyut station had 50 cubic meters per person [2]. Cycling stations will truly be space luxury liners.

FOOTNOTES:

[1] http://www.inspi.ufl.edu/index.html and www.highway2space.com/ast/presentations/7g_knigh.pdf

[2] Marshall Savage. The Millennial Project. Little, Brown & Co. 1994.

NOTE: I used the Quick Orbits program from delta-utec to determine orbital velocities, etc. Also, 28 ETs would amass 925 metric tons, so a guesstimate for the station's mass would be about 2000 tons at most. That's lighter than the NEP liner I tried to design (in MMM #) with its massive radiation shield and power plant. The taxis could use much less than 1200 tons of propellant also with just a small increase in Isp from 250 sec. to 280 sec., but I try to estimate conservatively. **<DD>**

P.S.: For a previous design study of what an Earth–Moon Cruise Hotel Shiip might look like, see the "The Frontier Builder: An Earth-Moon Hotel Cruise Ship: a Definition & Design Exercise" © 1992 Doug Armstrong & Peter Kokh. The authors concentrate on ship design and architecture after discussing the activities that should be accommodated. They also discuss ways to keep the ticket price down. I chose to concentrate on the propulsion question, the one aspect they did not address. Well illustrated. See:

http://www.lunar-reclamation.org/transitel.htm

Eclipses: the Lunar Experience

by Peter Kokh

Thursday, May 15th, there will be a total eclipse of the Moon, visible from all of the Continental United States and Hawaii, and from most of the rest of the world except Asia and Australia. For information about this event, go to:

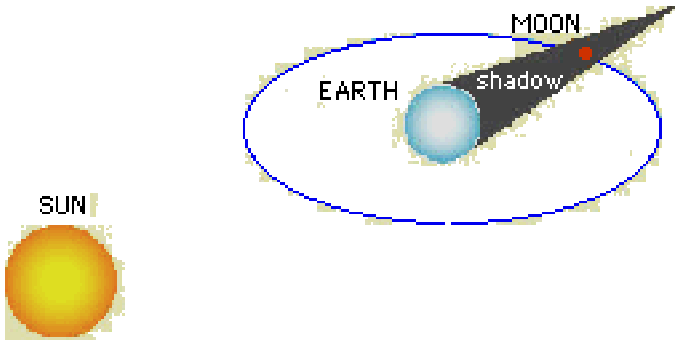
www.netspeed.com.au/minnah/2003/2003-1.html

For an Eclipse Computer that will tell you when (and where in the sky) the eclipse is viewable in your area, go to:

http://aa.usno.navy.mil/data/docs/LunarEclipse.htm

Most everyone has seen a total lunar eclipse at one time or another. They aren't all that rare. But no one has ever experienced such an event from the Moon's surface. What would the experience be like? What would we see in the lunar heavens? How would it transform the appearance of the surrounding moonscape?

For observers on the Moon, what we Earth-dwellers experience as an eclipse of the Moon, will for them, be an eclipse of the Sun, our home star disappearing behind the Earth. So the phenomenon that they would/will experience will bear closer comparison to the one that those fortunate enough to have seen a total solar eclipse on Earth have felt.



Shown: Moon passing thru Shadow Cone (Umbra)

Let's try to visualize and feel the sight and impressions that would-be future Lunan pioneers can anticipate.

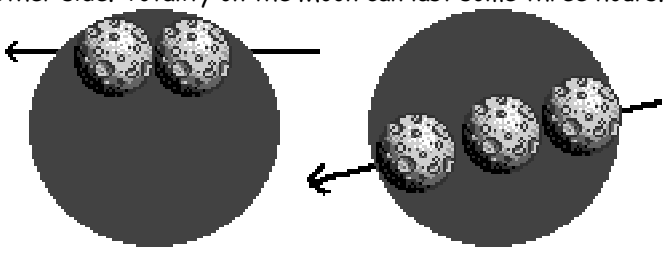
Comparisons

Those of you fortunate enough to have witnessed totality in a total solar eclipse (anything even a tad short of totality counts as zilch - yes, there is that much difference) were probably as little prepared for the overwhelming effect of the experience on oneself as I was, when I saw my first from Minot, North Dakota in February 1978. The sky darkens gradually, suddenly going black, as the Sun disappears and the stars come out, in what should be bright daylight. Where the Sun had been there appears in its place a very black hole in the sky surrounded by a ring of flames, the corona. Meanwhile the air temperature drops some tens of degrees, and and an eerie silence falls. For many first time witnesses, the experience is so unexpectedly transfixing that the goal of seeing yet another total eclipse suddenly soars out of nowhere to somewhere near

the top of one's personal life agenda. For me, that quest next led to Bratsk, Siberia in late August, 1981.

Much of the magic of this experience arises out of an unlikely coincidence. The size and distance of the Moon makes its apparent size vary from just smaller to just a bit larger than the apparent size of the Sun. Total solar eclipses occur in the latter case. Because of the close approximation in apparent size, totality is brief, commonly two minutes give or take, with a maximum of seven.

But from the Moon, Earth's apparent diameter is some three and a half times as great as that of the Sun. When the Sun disappears behind the edge of the Earth, it will take quite a bit longer before it peeks out from the other side. Totality on the Moon can last some three hours.



Short Totality — *Moon just inside Umbra*

Longer Totality — *through center of Umbra*

For us on Earth, during totality, the Sun's flaming corona can be seen surrounding the black hole in the sky that is the Earth. From the Moon, the Sun's corona will also be eclipsed for most of totality. However, the black Earth will sprout its own "coronalet" as sunlight beaming down upon the hemisphere of Earth turned away from the Moon, lights up the dust in the atmosphere. This light is refracted into the shadow cone. Portions of the Moon passing closer to the edge of the Umbra will be brighter, those closest to the mid-umbra darker. Clouds and volcanic dust in Earth's atmosphere will also have an effect so the actual appearance, brightness, colors and color variation will change throughout the event and differ from eclipse to eclipse.

Watchers on the Moon will see an unbroken ring of sunsets and sunrises, much less brilliant than the Sun's corona, but also much larger in diameter, and an awesome sight. Stars hidden by the Sun's glare will reappear in the sky. The glow from this 'coronalet' will repaint the Moon's surface in very unmoonlike hues. For the pioneers, it will be a magical time in which they might imagine themselves transported to deep twilight on Mars! The direction and length of shadows will not change from what they would be if the Earth were not blocking the Sun. But the edges of shadows will be much fuzzier, contrasts less sharp. Familiar moonscapes will reveal themselves in this whole new light. For crews, tourists, and settlers on the Moon's nearside, it will be an unforgettable experience. While for them, this will be a "solar" eclipse, the real show will be on the Moon's surface, with the show in the sky just completing the "Landscape." That's in contrast to the experience of solar eclipses on Earth where the main event is in the sky.

For a treatment of the coloration and brightness-darkness of the Moon during Umbra, see "Danjon Scale:"

http://sunearth.gsfc.nasa.gov/eclipse/OH/Danjon.html

and for the upcoming eclipse: //sunearth.gsfc.nasa.gov/eclipse/OH/OH2003.html#LE2003May16T

Timing and Frequency

How often do these events occur? The Moon's orbit around Earth is tipped some 5 ° to Earth's orbit around the Sun, so the Moon spends most of the time either above or below the plane of Earth's orbit and does not pass through Earth's shadow every orbit. There can be as many as three eclipses a year, as few as zero. Only a third are total. While one seldom sees either lunar or solar eclipses noted on calendars -(just the phases of the Moon), "umbra" dates are likely to be noted on Lunan calendars.

Where on the Moon Eclipses will be visible

The Umbra Experience is only visible on the Earth-facing side of the Moon. That means that the Sky Show of black Earth outlined by the ruddy sunrise-sunset ring of dust-refracted sunlight will be high overhead in the central areas of nearside (the "crooknecks") and at more comfortable elevations above the horizon nearer the limbs (in the "postcardlands"). Some events may be visible in the limb regions, others not, depending on the angle of libration (variance from facing Earth dead-on) at the time.

Both the proposed Angus Bay and North Junction sites will offer comfortable viewing, with Earth some 20-30° above the horizons, with shadows of mid-range length. In contrast, at a site near the center of nearside, not only would the sky show be directly overhead (zenith), but there would be no shadows, it being a high "un-noon" situation. Tourists coming from Earth to experience the umbra will head to areas closer to, or in the limb region.

Umbra will occur early in dayspan for areas east of the Earth-facing meridian, at mid-dayspan along that meridian, and later in dayspan for areas to the west.

Impact on Frontier Culture

The Moon is a world of gray shades, overwhelmingly so. Indeed, Lunans will be challenged to infuse their homes and settlement areas with color to make up for the sensory deprivation that greets them out on the surface. To be able to view familiar out-vac surroundings through the filter of sunlight refracted through Earth's dusty sunrises and sunsets will bring periodic relief and delight. Umbra will also provide the best viewing of the many clusters of city lights on Earth's nightside, framed in the sunrise-sunset ring.

The hours-long event will be occasion enough to let kids out of school, even workers. Umbra could even become a holiday of sorts. For these pioneers, who will have given up much that we take for granted, who can begrudge them this periodic pleasure. Add to that, that each Umbra will be different, and the same event will be experienced differently in various places on the Moon. **<MMM>**

Agriculture on the Moon:

"Seasonal Crops" Year Around

by Peter Kokh

Spring is here in the Northern Hemisphere, and at least in the hearts of some of us with an available plot of land, that leads to garden planning or garden-dreaming at any rate: vegetable gardens, flower beds, landscaping, etc. So let's transpose ourselves to Luna City for a moment.

On the Moon there are no seasons, just the eternal cycling of dayspan and nightspan every 29.53 Earth days. Inside lunar settlements, shielded by layers of regolith against extremes of hot and cold, cosmic rays, solar flares, and micrometeorite rain, we will be able to pick the mini-biosphere climate we want. Perhaps we'll decide to allow the temperatures in common "middoor" spaces of settlement streets and parks to vary naturally from a late dayspan high in the mid 80's (31°C +/-) to a late nightspan low in the low 50's .(12°C +/-). Of course, we could keep it warmer, cooler, or allow an even greater fluctuation.

Our crops can be grown in separate areas with their own temperature and humidity controls. It'll be easy to grow subtropical and tropical plants. But what about plants that seem to require a winter reset, a chilling period, or even a hard frost before they can sprout afresh? Many of us are very attached to such crops, among them most of the berries and other common fruits. We may have to grow them under conditions that provide a simulated winter. Not being tied down to the annual cycles of the solar year, we would want to have as many harvests per year as we could cycle through the necessary stages.

We could experiment, but experimenting takes money. On Earth, experiments get done when the economic circumstances make the potential payoff attractive. And this seems to have been happening on its own the past few years with respect to Raspberry production. The happy result is that we now have the know-how to produce these delicious berries year around in climate-controlled greenhouses: a perfect model for lunar settlement agriculture.

Raspberries will not begin to grow even in warm temperatures until their specific amount of chilling required to terminate rest is satisfied. The chilling required to break rest varies between varieties / growing conditions and isbetween 600 hrs (25 days) and 1500 hurs (63 days) at temperatures below 40 °C (39.2 °F) for maximum bud break and growth. Bud growth will occur when plants are exposed to favorable temperatures after this chilling.[1]

The Economics of Winter Raspberry Greenhouse Crops

Consumers demand a year-round supply of high quality raspberries, as is evidenced by their willingness to pay high prices for fruit imported from Chile and elsewhere during the winter months. Happily, in northern raspberry growing areas such as Washington, Oregon, British Columbia, New York, Ontario, greenhouses are empty during the winter (greenhouse production of edible products has been limited primarily to tomatoes, cucumbers, peppers and lettuce.) Using this available capacity for raspberry production is ideal because only moderate energy inputs are needed, and production is possible under low light and under relatively cool temperatures. Two more plus factors are the commercial availability of bumblebees hives for pollination and the ready availability of the most successful cultivars.

Results to date have been good. Compared to field production, greenhouse-produced berries are larger, firmer, and much less prone to fruit rot. Fruit tends to be slightly less sweet and more acid in the greenhouse, but well within the limits of acceptability. [2] Further, it is proving possible to piggyback other crops on this production: Strawberry plants can share space with the successive raspberry crops, the strawberries in overhead troughs and the raspberries in pots on the ground. [3] Given this happy congress of conditions, it is no surprise that much experimentation has been going on in recent years [4].

Can this success be repeated for other "seasonal" crops? Future Lunans have a stake! Serious greenhouse gardeners can experiment with other fruits and berries (and vegetables, if any) that need a chill reset before the next growing cycle. We can also experiment to see which varieties do better in hydroponic, which in geoponic setups. what's next - other seasonal crops that need chill resets

Such experiments are incomplete, however. We also need to breed varieties ideal for the dayspan/nightspan lighting regimes in lunar outposts, aiming for two dayspan one nightspan (44 day) and three dayspan 2 nightspan crops.(7) with late nightspan germination okay and early nightspan harvest and bed turnaround

Those without green thumbs but with engineering and/or architectural expertise can support this effort by designing greenhouse rack/conveyor systems to stack the plants compactly in chill mode, spread them out for maximum sun in growth mode, etc. Farming equipment designers and manufacturers are very much part of the green revolution on Earth, and will be on the Moon as well! **<MMM>**

Footnotes:

[1] http://foodfarm.wsu.edu/GreenhouseRaspberries.htm

[2] http://www.umass.edu/fruitadvisor/fruitnotes/FNarticle65-05.pdf.

[3] http://www.annexweb.com/greenhousecanada/story2.html

[4] Growing Raspberries in Greenhouses: A One Day Workshop, 27 March 2003, U. of Guelph, Simcoe, Ontatio, CA <adale@uoguelph.ca>

THE SEASONS OF LUNA CITY

by Peter Kokh

Just the Facts – The Moon's axial tilt is a negligible 1+°. So *annual* seasonal effects of this tilt in the amount of insolation, solar heating per unit of surface area, is negligible except at the poles themselves. More significant is the annual variation of the Moon's (and Earth's) distance from the Sun. That distance is least ("perihelion") at the beginning of January, and greatest ("aphelion") about July 1st. The extra thermal buildup in the regolith top layer blanket of moondust lags somewhat and is about 3° C (5° F) higher in March than in September. That will mean that much more of a burden on excess heat radiator systems. If the radiators are not up to the extra load, that might mean slightly warmer interior temperatures in settlement open spaces or Middoors for that period. Not quite what we would dignify as a "seasonal difference."

Such a minimal fluctuation should be easy enough to damp out, or temper, with the shorter 29.53 day long sunthly cycling of exterior dayspan and nightspan having a much greater effect on the climate within the settlement biosphere. Middoor (parks, streets, other common spaces *outside* of residences and offices and work places, but *inside* the settlement "hull" could be allowed to fluctuate naturally in a tempered sunthly pattern from say the mid-80's °F* towards approaching sunset to the mid-50's °F* towards sunrise two weeks later. This is a design question and something the settlement founders and biosphere engineers can decide before hand, in choosing their "climate."

*	**F**	−4	5	14	23	32	41	**50**	**59**	68	77	**86**	95	104
	C	−20	−15	−10	−5	0	5	**10**	**15**	20	25	**30**	35	40

Separate settlements may well choose differing upper and lower temperature limits, and may even choose to impose annual or multi-sunth "seasonal" variations of temperature and humidity in order to accommodate vegetation with seasonal fluctuation requirements for germination and fruiting, etc. Differing choices of climate and degrees of seasonality will lead to a distinctive ambiance for each. The resultant differences in flora (and fauna) may help protect against the spread of plant diseases between settlements. It should also help promote intersettlement tourism and trade in distinctive flora and fauna based products.

Seasons & Urban Wildlife - Some insect, birds and mammals have mating and birth or hatching cycles that are closely coupled to seasonal differences in temperature, lighting conditions, etc. It will be difficult to successfully transplant populations of such species to lunar settlements without reproducing or simulating such climactic clues and sequences. While some species are relatively omnivorous, others demand particular plant species for food, or even the presence of particular animal prey.

We will do well to look for animal species that are not only non-parasitic on the vegetation species we want to support but which are not that particular in their eating habits, and not that restricted in their life cycles by particular climactic and seasonal conditions. In other words, we will want to pick insects (bees, butterflies, etc.), birds, pond and stream fish, and small mammals that adapt well to a great variety of conditions.

Some we will want to complete our ecosystems, others for food production or agricultural needs, others for just plain enjoyment (butterflies, hummingbirds, song birds, goldfish and koi, even squirrels.) One man's pest is another's delight. Which will do best may depend on the type of climate and seasonal variation that is being reproduced or simulated. Thus the "wildlife" in one settlement may well differ from that in another.

Some transplants may be successful from the very start. Others may require a bit of trial and error experimentation.

The basic challenge, however, remains: how do we harmonize any seasonal rhythms desired plants and animals may have with the sunthly climate swings of alternating two week long dayspans and nightspans, sure to be reflected in habitat and farm area temperatures and light levels. We can wait until we get there, or take advantage of whatever opportunities may come our way to experiment here and now with terrestrial market needs subsidizing the cost of the experiments, as in the Raspberry Production story reported above. The lessons learned in that case are a perfect example of serendipity. Now that we see what can happen fortuitously, it behooves us to be on the lookout for more such opportunities for dual purpose research.

We need an experimental agriculture team that would be on the lookout for just such opportunities. **‹MMM›**

Relevant Reading from MMM back Issues

```
#  2 FEB '87 "Moon Garden"
#  8 SEP '87 "Parkway" & "Animal Life"
# 43 MAR '91, pp 4-5, "Dayspan", "Nightspan",
      Sunth"
# 50 NOV '91, p 8, "Trees on the Space Frontier"
# 85 MAY '95, p 7, "Rural Luna Cont: Farm Tarns"
#109 OCT '97, pp 3-11, "Luna City Streets
#148 SEP '01, pp 3-11, "Earthpatch: Anchoring
      Lunan & Martian Homesteads"
#149 OCT '01, pp 5-8, "Homestead Gardens & Early
      Cottage Industry"
```

Online Reading – The LUNAX Experiments

http://www.lunar-reclamation.org/page10.htm

Meandering *through the Universe*

Richard Richardson's column, a regular feature in MMM for four years (since #124, April, 1999) is "on vacation for an undetermined duration.

Luna City Yellow Pages

To all of our MMM Readers

From MMM Editor, Peter Kokh

Many of you are relatively new to MMM, although there are a number who have been with us for all our sixteen plus years. In that span we have covered a lot of topics, many of them illustrating the possibilities for life on the lunar frontier. There are quite a few good past articles still worth reading, and unfortunately, for a number of reasons (all coming down to a lack of time on my part) only some of them are online. Readers with online access are encouraged to browse at:

http://www.asi.org/mmm

It occurred to me that I could reprint some of these articles, But then I decided on another way to recap many of the ideas and possibilities covered in these essays: publishing a column, a page, or pair of pages of the

Luna City Yellow Pages

in each future issue. So we start this issue. Enjoy the ride, or should I say, the "tour?" **<PK/MMM**

Homestead Improvement Contractors

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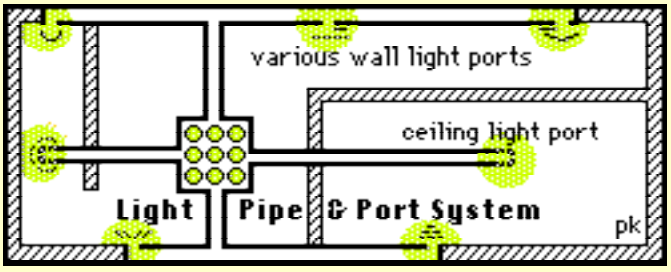
- **Light Pipe Systems:** Light port diffusers, shades, and dimming shutters. Stained glass, ceramic, and alloy. Cove lighting systems with cobalt blue glass diffusers for that sky blue hue on your ceiling vaults to combat those "black sky blues."



- **Fiber Optic Systems** for retrofit application as well as bundles up to 50 centimeters in diameter for incorporation into habitat module ceilings during their manufacture.
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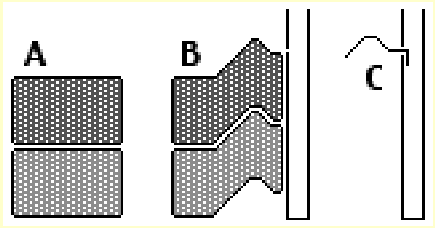
Recreate the rustic look of Old Earth with brick walls without mortar.

Our "bricks" use a unique interlocking shape similar to that of the NovaBrik mortarless brick siding product pioneered on Earth by Amcon Block [www.novabrik.com]

Our bricks have an interlocking shape that holds them securely in place without the use of mortar or adhesives.



KEY: (A) Ordinary Brick Cross section
(B) LunaBrick Cross-section
(C) patented hanger clips into embedded hanger strips every 4th row, secure wall.

LunaBrick comes in two color styles:

New Moon: naturally variegated shades of light to dark gray - the colors of regolith. These moontone bricks are made from compacted mold-sintered regolith from which free iron fines have been removed.

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Purchase this fine product from our Factory Outlet Store in Luna City,
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344-6666 (DIG-MOON) or from
Homestead Depot in Shangri-Luna
and Port Tsiolkofsky

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

Getting Ready for the Total Lunar Eclipse of May 15-16, 2003 A Prime Opportunity for Outreach

by Peter Kokh

Nominally listed for Friday, May 16th when the event actually occurs -- if you are on Universal Time, or living in Europe -- this eclipse begins shortly after moonrise on the evening of Thursday, May 15th for those of us in North America. Below are the times for the four U.S. mainland time zones. PM hours in plain, AM *italic.*

TIME in hh:mm	EDT	CDT	MDT	WDT
enter penumbra	09:05	08:05	07:05	06:05
enter umbra	10:02	09:02	08:02	07:02
Start totality	11:13	10:13	09:13	08:13
Middle eclipse	11:40	10:40	09:40	08:40
End totality	*12:06*	11:06	10:06	09:06
leaves umbra	*01:17*	*12:17*	11:17	10:17
leaves penumbra	*02:14*	*01:14*	*12:14*	11:14

For those on the East Coast, the event starts about an hour after Moon Rise. For those in Central Time, the event starts within minutes of Moon Rise. For those further west, the Moon should rise before the start of totality, so you should not miss the "Main Event." - Weather permitting, of course!

And that is the risk with planning a major public outreach event around such an occasion. But nothing ventured, nothing gained. If you prepare for the event and are clouded or rained out, most of what you have prepared will serve you well for regular Moon observing opportunities.

If you have access to a telescope, even a low power one, or a pair of binoculars, this kind of public outreach event may be ripe for you. On the Space Chapter Hub [httP://nsschapters.org/hub/] you will find suitable Moon-theme flyers in pdf format ready to download and print, as well as suggestions for exhibits. Here the simplest and easiest display would be an Artemis Project™ poster mounted to foam core board with spray adhesive. A 12' Moon Globe would be great if you have one.

Never talked to anyone about the Moon? All of us had to get our feet wet at one time or another. Take the plunge. You may find outreach quite enjoyable. And you just might end up recruiting a new Moon Society member.

Cf. pp. 4-5 for more information on Lunar Eclipses.

How to set up a Sidewalk Astronomy operation:

http://www.moonsociety.org/chapters/milwaukee/msmo_currentproj.htm#sidewalk

or

http://www.sfsidewalkastronomers.org/

Join (renew/rejoin) the Moon Society today!
http://www.moonsociety.org/register

[Browsing Through a Past That Never Was]

The Gemini to the Moon Plan: Forgotten Backup to Apollo

based on "By Gemini to the Moon!"
http://www.astronautix.com/articles/bygemoon.htm

Right up to the end of the Gemini program, the Gemini spacecraft was considered by its contractor and certain factions within NASA as an alternate means of reaching the moon. The Gemini re-entry capsule, smaller and lighter than that of Apollo, would allow direct launch of a mission to the moon using a single rocket. Alternatively, rendezvous and docking of components launched by two small rockets (Titan 3C's or Saturn IB's) would eliminate the need for development of the Saturn V.

There were several proposals for lunar Gemini, right up to the very end of the program:

• **Circumlunar flights by Gemini, boosted by Centaur,** as part of the original Mercury programme plan (August 1961)
astronautix.com/articles/bygemoon.htm#geminicentaur

• **Lunar landing by Gemini, boosted by a Saturn C-3**, in competition with Apollo, as part of the revised original Gemini programme plan (September 1961)
astronautix.com/articles/bygemoon.htm#geminisaturnc3

• **Lunar Logistics and Rescue Vehicle:** Use of Gemini, launched atop a Saturn V, as a (September 1962)
astronautix.com/articles/bygemoon.htm#geminillrv

• **Circumlunar Gemini, launched by Saturn I B**, to replace cancelled Apollo circumlunar flights (March 1964)
astronautix.com/articles/bygemoon.htm#geminisaturn1b

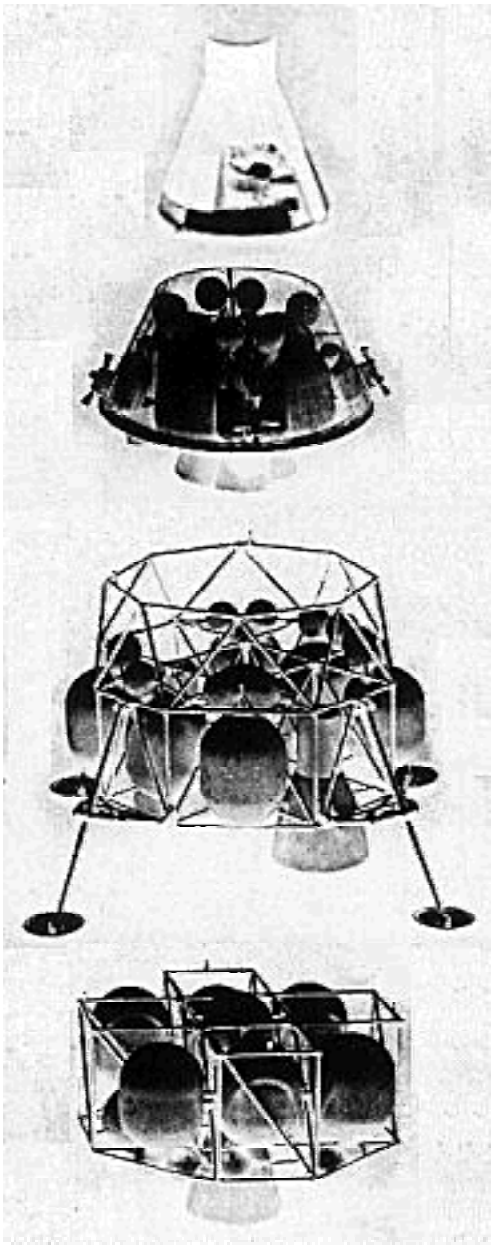
• **Circumlunar Gemini, on Titan 3C-launched double Transtage** (June 1965)
astronautix.com/articles/bygemoon.htm#geminitranstage

• **Universal Lunar Rescue Vehicle** In the wake of the Apollo fire, use of Gemini B, launched atop a Saturn V (April 1967)
astronautix.com/articles/bygemoon.htm#geminiulrv

MSJ EDITOR'S COMMENT: As we consider alternative mission scenarios in continued brainstorming of the Artemis Project™ to put a Commercial Moonbase on the Moon, it may provide some inspiration to look through these alternative mission plans from four decades ago.

It is essential, if we are to succeed, to develop the least expensive options that deliver the goods, and let us attain our goals. The thinking of past mission planners evident in the scenarios above, might stir us to think of options we have not yet considered.

Even if we adopt none of these ideas, considering them will work to mature the plans we do elect to go with. - PK



Gemini Lunar SRS
Exploded view of the Gemini Lunar Surface Rescue Spacecraft. From top to bottom: the Gemini reentry module; the lunar ascent stage; the lunar descent stage; the lunar orbit insertion stage. Credit: McDonnell Douglas

You gotta chase your dream.
It may be gut hard.
But you gotta do it.
Or else you're nothing!

Tori Murden
First woman to row across the Atlantic solo,
Oct-Dec., 2000

Space Resources Roundtable V
Colorado School of Mines
Golden, CO – October 28–30, 2003

www.mines.edu/research/srr

Science Chair: Michael Duke< mikeduke@earthlink.net >

The purpose of the Space Resources Roundtable is to bring together interested space professionals, experi-enced resources personnel from industry, and entre-preneurs who may be considering entering the process of developing and utilizing the resources of space, including the Moon, Mars and asteroids. The goal of the Space Resources Roundtable is to advance the prospects for the commercial develop-ment of space resources through information exchange between personnel in government, commercial, and academic organizations. To that end, the Space Resources Roundtable solicits contributions in the areas of:

- Exploration for resources
- Mining on the Moon, Mars and asteroids
- Resource processing technologies
- Manufacturing with space resources
- Commercial potential of space resources on Earth and in Space
- Space power systems (space power as a resource)
- Planetary surface materials transportation systems
- Space transportation systems utilizing space resources
- Market demand and utilization scenarios for products made from space resources
- Property rights in space

Discussion of technical reports given on aspects of space resource development will take about 70% of the time.

Group discussions of mechanisms to accelerate commer-cial development of space resources will occuppy the rest of the time.

• The resources of space are vast, but widely distributed. Solar energy is abundant, at least out to Mars, and the materials of the Moon, Mars, its moons, and near Earth asteroids include most of the elemental basis for industrial activity in space. Space resource development is competi-tive because of the high cost of transporting materials from Earth into space can be ameliorated if much of the material can be produced in space.

• **Techniques for mining and extracting these resources** have been discussed in the literature, but few have been reduced to practice. Markets for space resources do not currently exist. However, it is clear that space resource development is crucial to the human exploration and development of space.

• **If humans are ever to spend long times on other planets,** they will be sustained by space resources, not supplies brought from Earth. And, as new trade routes are opened in space, space resources, particularly energy and the systems needed to collect and distribute it, will grow in importance as their value and uses begin to be realized. Commercial opportunities can exist within this growing domain; however, the conditions that will enable true commerciali-zation have not yet emerged.

• **Additional exploration missions,** for the Moon and aster-oids, will be needed to identify and characterize potentially valuable resources and to lay the groundwork for techno-logy development. Such missions are relatively low cost missions and missions currently being planned or discussed in various countries (U. S., ESA, Japan, India, and China) can contribute to the goal of space resource characteri-zation and development.

• **Technologies required need to be defined & developed.** The means should be found to link the government and commer-cial sectors into partnerships in these missions and tech-nology development.

On the SRR Website:

NOTE: some of these URLs have spaces in filenames:

The Case for Commercial Lunar Ice Mining
http://www.mines.edu/research/srr/LDEM_Draft4-updated.pdf

Conceptual Design of a Lunar Oxygen Pilot Plant
http://www.mines.edu/research/srr/Reference Library/Conceptual Design of a Lunar Oxygen Pilot Plant.pdf

SRRI 1999: Final Program, links to abstracts & presentations; Roundtable Recommendations
http://www.mines.edu/research/srr/Recommendations1.htm

SRRII 2000: Final Program, links to abstracts, papers and slides submitted by authors)
http://www.mines.edu/research/srr/ssr2_final.htm

SRRIII 2001: Program and Abstracts
http://www.mines.edu/research/srr/2001Program.htm

SRRIV 2002: Program and Abstracts, Links to abstracts
http://www.mines.edu/research/srr/2002 Abstracts/2002 Program and Abstracts.htm

• **To get on the SRR Mailing List:** Send name, title, affiliation, address, and contact information - *by May 15, 2003* - to Space Resources Roundtable V, Office of Special Programs & Continuing Education, Colorado School of Mines, Golden, CO 80401 (phone: 303-273-3321; fax: 303-273-3314; e-mail: space@mines.edu)

St. Louis Chapter S.E.E.D. Project Proposal

S.E.E.D. Space Economy and Energy Development

The objective of SEED research is to determine exactly what and how much of various technologies must be sent to the Moon to plant the seed that grows into the tree of space industry through bootstrapping. Like what does a lunar bulldozer weigh and how many do we need? What can we do with micromachines and such? Do we need to ship a mass driver up there or do we ship the production equipment and build the mass driver with local resources; or do we dispense with the mass driver and just build solar powerplants on the lunar surface as Criswell has proposed? What are the goals of lunar industry? Energy, tourism, staging for flight into the solar system?

Dave Dietzler < Dietz37@msn.com >

Chapters Coordinator's Reply

This sounds like a great focus for a new Moon Society TEAM. Teams can operate at large, composed of members from wherever, combining their ideas and efforts online. Or they can be local, chapter based.

If you have a concrete well-defined project, a local team can work much more efficiently, with live hands-on activities and better coordination and project management. But there is a place, in the project definition stage, where online teams can work well.

I'd suggest listing all the specific project ideas that come to mind within the general area you have outlined above, post that outline on a web page where other potential teams can have a look, and choose one specific idea to turn into a local hands-on, live-coordinated project: e.g. "components of a mass driver that can be manufactured locally on the Moon with startup industries," or to be more ambitious, "designing a mass driver to maximize the mass percentage of components that can be manufactured on location." Or designing a teleoperable drag line to use for placing regolith shielding over the Moonbase." There are many worthy projects, all "orphans" awaiting someone to adopt them and nourish them to fruition.

Teams require leaders. So you need more than a team. You need a team leader. If one of your group has project management experience that would be great. If not, that someone should be a recruitment priority!

Projects are the life of a chapter. Chapters are not long held together with aimless discussions, but with projects that involve them, give them momentum, and a sense of purposefulness. Take the ball and run with it.

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:

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

The Moon Society Chapter Charter Certificate

Whereas _____ (hereafter referred to as the Chapter) has reached the threshold requirement of five members who are current members of the Moon Society, and

Whereas the Chapter has duly elected officers and has formulated bylaws, both in accordance with the Moon Society Chapter Rules, and

Whereas the Chapter has organized to support the goals, creeds, and purposes of The Moon Society, therefore

The Moon Society grants this Charter in recognition of the attainment of full Chapter status.

_____
Date of Issue

_____
President, the Moon Society

_____
Moon Society Chapters Coordinator

Moon Society St. Louis Receives Chapter Charter Certificate

by Chapters Coordinator Peter Kokh

The Moon Society Leaders Council has approved the above language for new Chapter Charter Certificates. To earn a chapter charter, an Outpost must meet the following requirements:

- a minimum of five members who are current members of the Moon Society
- have held elections for officers
- prepare a set of bylaws

You can find the full set of Chapter Rules at:
www.moonsociety.org/chapters/chapterRules.html

Outposts can get assistance and further information on any of the above or any other Outpost/Chapter matter from Chapters Coordinator Peter Kokh

Phone 414-342-0705 -- Email: kokhmmm@aol.com
or chapters-coordinator@moonsociedty.org

WORLD WATCH
AFD News Service

SEATTLE, WA. -- A spokesman for an unnamed software company will sponsor a fifth Mars Analog Research Station that it insists be located in the eastern scablands of Washington State, with the exact location to be picked by Mars Society personnel. "The first three Mars Habs are of the same basic design," she noted, with only one, the forth, to be set in the Australian Outback having a radically different, but older design. The so-called biconic habitat will be the streamlined capsule that brings the crew to Mars. In the newer "double tuna can" design, the habitat is landed separately, in advance of the crew's arrival.

"The Mars Society should test other options," the spokesman noted, particular inflatable designs that could afford more pressurized volume for both living quarters and function space - all without an added weight penalty. NASA's old TransHab design was of the same basic dimensions as the first three M.A.R.S. habs . The Mars Society fought to no avail to reverse Congress' determination to cut the TransHab program in 1999; yet strangely, has not chosen an inflatable design for its simulation testing."

"One of the major purposes of the simulations is to see what equipment works best and which designs would better serve the needs of actual crews on Mars. Not only would the layout of a TransHab type design be different, with its central core, but it *could be much larger*. The 27 ft. girth of TransHab was determined by the volume of the inflatable hull, given the thickness it would have to have to withstand meteorite impacts if it were attached to the space station. But on Mars, impact danger would be greatly lessened by the thin atmosphere, and could be virtually zeroed out by simply covering the inflated habitat with Martian soil. Then the habitat could have a much thinner hull along with a larger hull surface within the overall bulk limits of set by a ride in the Space Shuttle payload bay."

The spokesman continued, that as soon as there was "confidence in the dimensions of such a larger, thinner inflatable," her company would let a contract for its fabrication, after the Mars Society decided its basic outfitting.

"My company has two motives: first, help the Mars Society pin down the best Mars Hab design options, and second, admittedly selfish, to see M.A.R.S. Hab simulation exercises go on in the Pacific Northwest, closer to home," she said. "Actually, there is a lot of preli-minary design work to do, and we fully expect that simulation exercises will send us back to the drawing board several times to redo the interior layout. Outfitting an inflatable is a whole new game if you want the internal structure to unfold automatically as the habitat inflates on location on Mars. We expect to put a million bucks into this," she ended.

SAO JOSE DOS CAMPOS, BRAZIL -- At a news conference at the Brazilian Space Agency HQ [INPE http://www.inpe.br/ - Instituto Nacional de Pesquisas Espacial] it has been announced that Brazilian aircraft manufacturer, Embraer [EMpresa BRasileira de AERonáutica S.A.] will produce the Soyuz TM ferry/lifeboat and Progress freighter under license to RKK Energia here in this city of 600,000 some 55 miles ENE of Sao Paulo. Embraer, whose regional jets (American, Continental, US Air and other airlines) are familiar to many, is the largest aerospace contractor in Latin America.

This will mark a major ramp up in INEP's contribution to the International Space Station program. INEP and Embraer hope not only to augment RKK Energia's presently marginal capacity to supply these spacecraft, but also to produce customer-tailored versions that will give rise to a commercial manned space sector. "Stock" craft could be delivered within six months at order, customized versions taking longer to produce. Embraer's new facility will be able to produce two craft a year at first then expand to four or more as market demand grows.

Brazil, with the eighth largest economy in the world, is already an ISS partner with rights to a locker for ten years, and other privileges, spelled out at: http://www.inpe.br/programas/iss/ingles/use/Default.htm

As part of this program, the first Brazilian astronaut, and a backup, are already in training.

Soyuz-TM Spacecraft can carry 2-3 people and, docked at the station, also serve as a shelter when the main computer system on the station breaks down, depriving the station of power and life support. Its thrusters can help maintain attitude control of the station in such situations.

BEIJING, CHINA -- The rumor mill in China is astir with speculation that CNSA, the Chinese Space Agency, is planning to follow up a first successful manned flight of its Shenzhou capsule, expected as early as October, 2003, with an announcement that manned flight #3, sometime in 2004, may pay a visit to the International Space Station. The Chinese purchased the technology for the universal docking adaptor from the Russians in the mid-nineties.

China had previously turned down overtures from the Clinton Administration to get involved in ISS as one of the International Partners. It appears that now that China seems ready to demonstrate that it can contribute on its own terms and as an equal, that it may be willing to negotiate a major role. But that is just speculation, warn observers, who caution that the West take a "wait and see" attitude. The Chinese call their nation "The Middle Kingdom" and it stands to reason that they are going to want to be in the middle of things, not on the outside looking in.

The Chinese have also showed interest in the Moon.

MMM's 17th annual Happy April Fools Day News

Mail For MMM

L1 to LEO via ion engines

[to MMM Contributor David Dietzler, <dietz37@msn.com>]

I've been enjoying your writing in MMM and MMR... However, I thought in the most recent issue of MMR you made the transfer of materials between L1 and LEO harder than it has to be. The only reason to use chemical rockets (or nuclear steam propulsion) between those two points is if you need high thrust - i.e. to get something there quickly. That would apply to human passengers and crew, but not to inert cargo. If all you're sending is a barrel of lunar oxygen, why not strap on an ion engine and let it take a month to make the transit? Sure you'll end up with more inventory in transit, and maybe that'll be a prohibitive cost of doing business - but using high thrust, low specific impulse methods seems wasteful of propellant mass - and particularly of oxygen mass in the case of chemical rockets or steam - and that's the valuable product you're trying to sell!

The ion-engine approach has been proven on several missions now, and the ESA's "SMART-1" mission to the moon should showcase it again later this year. It really is a better way!

Arthur Smith <apsmith@aps.org>

Dave Dietzler replies

Arthur P. Smith emailed me with a very thought provoking question: Why not use ion drives to ship cargo to and from L1?Darn good question. My reasons: 1) I focused on water for high thrust NTR or LH2/LOX rockets because these will be necessary for rapid transit thru the VABs to minimize radiation exposure to the human crews 2) I wanted to bootstrap a large lunar base as quickly and simply as possible 3) I didn't want to use nuclear power in LEO, and solar power for ion drives is very slow 4) It would only take<STRONG> 3 tons of LH2/LOX or 5 tons of Al/LOX</STRONG> to send a 125 ton cargo carrier (100 tons water+25 tons vehicle, mostly heat shield) from L1 to LEO where it aerobrakes for free. So this is not wasteful.

However, there is a role for SEP (solar electric propulsion) in all of this. The depot at L1 could use ion drives energized by its solar panels (for electrolysis and cryonics) to travel from LEO to L1 where it is permanently stationed. Those ion drives would be used for station keeping after that. We could use SEP to propell the NTR steam rockets, ice mining equipment and initial water stock to L1 (or lunar orbit via WSB trajectories). SEP might also be good for moving reusable water carriers (andAL/LUNOX carriers later on)and their small chemical rocket motors back to L1 after they drop off their heat shield and water payload in LEO. Some carriers will always be in transit with slow SEP, but the mass of those extra carriers will be less than the mass of propellant we'd use over the long run to shuttle them back to L1 with chemical motors even if they are very light after discarding their heat shields. Maybe we could evenuse reusable heat shields on the carriers if we use slow but "fuel efficient" SEP to return them to L1.

Since it would take 21,000 tons of LH2/LOX to ship 20,000 tons of cargo from LEO to L1, we only sacrifice 0.00035% of the ice for this part of the plan. To land 20,000 tons from L1 we'd need no more than 40,000 tons of water/NTR or LH2/LOX, so a total of only 0.001% of the ice is used to move everything from LEO to the lunar surface. To get the 21,000 tons of water to L1 and then to LEO, we'd use roughly 20,000 tons, so the grand total is no more than 0.0015% of the ice.Using SEP would be fuel efficient but time consuming, and time is money especially when stockholders want dividends and banks are charging interest.

I'm glad somebody out there had a question. Questions help clarify things for us all.

Dave Dietzler <Dietz37@msn.com>

After Columbia -- a different path

Reading the February issue of MMM, I read Peter Kokh's editorial on which path we should choose following the Columbia accident. He suggested that we overhaul the remaining shuttles and secure the future of the Space Station. The NSS state-ment on the Columbia Disaster reprinted in the same issue also says, "it is vital that NASA move as quickly as possible to safely resume flying the Space Shuttle fleet to support ISS."

Upon reflection I think this, because of the expense of operating the shuttle fleet and the ISS, will lead to only more of the same pointless space program.

Here is what I think should happen.

1.) As soon as possible the ISS should be moth-balled, the crew removed, and a booster to keep its orbit from decaying should be attached. See 7 below.

2.) The orbiter part of the shuttles should be hauled off to museums where paid admission might recover their cost in 30 years.

3.) The rest of the shuttle stack should be converted to an unmanned heavy lift booster and only used to launch stuff you never expect to return to Earth. If you want to spend the extra money to make the solid rockets able to be flown back, okay.

4.) NASA must be ordered to put the external fuel tank of the shuttle heavy lift booster in to orbit on every launch and to arrange some sort of space tug to keep their orbits from decaying and keep them in a set of orbits that permits flying two or more of them to rendezvous for assembly into a larger unit. They should be sold at cost to a remarketer who will endeavor to sell them to anyone who wants to use them for a space hotel, space manufacturing

facility, space science lab, or weapons platform (well, maybe not just anybody for the last :>).

5.) NASA should develop a crew launch vehicle capable of sending up at least 6 people at a time with minimal cargo. It can be launched on a disposable rocket, but if the flyback booster technology is developed for the heavy lift vehicle it might be incorporated, but I would just order boosters from the Russians, until the Chinese offer them for less. The crew vehicle should be able to fly back (unmanned) and land on a runway.

6.) NASA should develop a space tug (nuclear powered) capable of transiting stuff to/from Earth orbit to lunar orbit or a Lagrange point.

7.) Several of these non-piloted space tugs should be used to move the ISS to either lunar orbit or a Lagrange point where it can serve as safe haven at that end of the journey for human crews.

8.) A habitation module should be developed that can be put into Earth orbit and be combined with other components to make a space station, attached to a space tug and take people to/from a Lagrange point station or lunar orbit, or connected to a lander - engines, tanks, and landing gear including an aeroshell if needed - (launched by the heavy lift vehicle?) for deposit on the moon, Mars, or a Martian moon. In other words, a general purpose habitat module that can be attached to a station, or the appropriate landing system. The living and lab space would be outfitted differently depending upon the mission, but all the life support, power, communication, and interface systems would be standardized and all rated to work in zero, 1/3, or 1/6 G and capable of withstanding the G loads of launch or lunar or Martian landing. No more one offs, we start mass producing house trailers for the solar system.

With this infrastructure and a plan with deadlines we start human settlement of Mars and construction of lunar science bases. NASA should not have a monopoly on any of these systems. All should be made commercially available.

The ISS is like the kid that grows up, goes to college, and then comes home to live, never developing the skills to live out his own. Earth orbit is too close to develop the skills needed for a space faring civilization. The Moon or a Lagrange point may be just far enough away that we can develop the skills. NASA should be made to figure out how to keep people living in space not in orbit.

People won't like this plan because it means not sending people into space for two to three years. So to keep the launch crews from atrophying you would have to maintain some minimum frequency of launch. I would suggest renting KSC and the ISS to the Chinese at cost. Test flights of the new hardware manned and unmanned would pick up the slack before long. The long term benefit of developing a close working relationship with the Chinese may be invaluable.

Right now the space program is on hold, but rather than working on the future while we diagnose the failure, we seem to be waiting to resume the status quo. We need to take this opportunity to say, it is ok if it takes 5 years to figure out what happened with Columbia, but it won't matter to what we are and will be doing. We hit a rock on a heading to a destination we no longer have in mind. We are not going that way again.

Gary Fisher <GCFisheris@aol.com>

SETI@home New Step Sin Search for ET: Revisiting Most Promising Signals

March 10,'03 After nearly four years of searching for extraterrestrial intelligence, the SETI@home project will take a closer look at its most promising candidate radio sources. The "Stellar Countdown" will use Puerto Rico's Arecibo radio telescope March 18-20 to re-observe up to 150 of the most interesting radio sources detected since the distri-buted computing project began in May 1999.

The Planetary Society is the founding / principal sponsor of SETI@home, based at the Univ. of California, Berkeley. SETI@home harnesses the computing power of four million volunteers to analyze data from the Arecibo telescope. Designed as an innovative screensaver program, SETI@home parcels out packets of raw data from Arecibo to be processed in personal computers around the world.

David Anderson, Project Director, said, "After our Stellar Countdown re-observations help us eliminate candidates that are random noise or terrestrial radio interference, we'll be very curious to see what candidates remain."

On-the-spot analysis of data during the Arecibo run will allow us to re-target especially promising signals. A more detailed analysis ofStellar Countdown results will be conducted after the SETI@home team returns to UCB.

Candidate radio sources meet several criteria:

- number of times the radio source was detected ·
- how closely different observations resemble each other
- strength of radio source · proximity to known stars
- type of star (main sequence stars given preference)
- the presence of known planets

Dan Werthimer, Chief Scientist of SETI@home, will lead the team. Researchers will observe the sky eight hours each day, staggering the time of day for each session to cover as much sky as possible. Werthimer said, "I believe that we will likely discover extraterrestrial civilizations in the next hundred years. Even if we don't find a signal from ET this time, I'm optimistic in the long run, since our search capabilities are doubling every year."

SETI@home is the largest computation in human history, logging a staggering 1.3 million years of computer time. The screensaver program runs on computers in homes, offices and schools worldwide, and volunteers range in age from school children to retirees. **<TPS>**

GREAT BROWSING !

Explore a Lavatube Virtually

MMM Rating ★★★★★

http://www.goodearthgraphics.com/virtual_tube/virtube.html

Lavatubes on the Moon and Mars will provide vast and spacious ready-made shelter from the cosmic elements for settlements, industrial parks, agriculture, warehouse and archive repositories and more. We can expect them to be a common feature of the maria, the great lava plains on the Moon, and of the lava flows and shield volcanoes on Mars as well.

In addition to allowing you to get the feeling of what it would be like to explore a lavatube on the Moon, this site explains how lava tubes form, where they are found on Earth, and gives explanations of many terms:

• Aa lava • Aprons (slipbanks) • Backflow • Blades
• Braided Mazes • Breakdown • Cauliflower Aa lava
• Contraction Cracks • Cupolas • Cutbanks
• Drip Stalagmites • Flow Ledges • Glaze • Gutters
• Lava Balls • Lava Falls • Lava Lakes • Lava Roses
• Lava Seal • Levees • Pahoehoe Lava • Roots
• Runners • Settled Crust • Sharktooth Stalactites
• Sinuous Passage • Skylights • Splash Stalactites
• Stretched Lava • Sunken Plunge Pools
• Tube-inTube • Tubular Lava Helictites
• Tubular Lava Stalactites • Upwelled Lava
• Welded Breakdown • Windows

Courageous Solo Adventurers

Gus Mcleod

- www.gusmcleod.com
- google.com search: Gus McLeod

Tori Murden

- google.com search: Tori Murdent

Solar System Ambassadors

www.jpl.nasa.gov/ambassador/index.html

PASA

Michelle Baker - Princeton, NJ/Philadelphia, PA
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CSFS

Bill Higgins - Chicago,IL
higgins@fnal.gov

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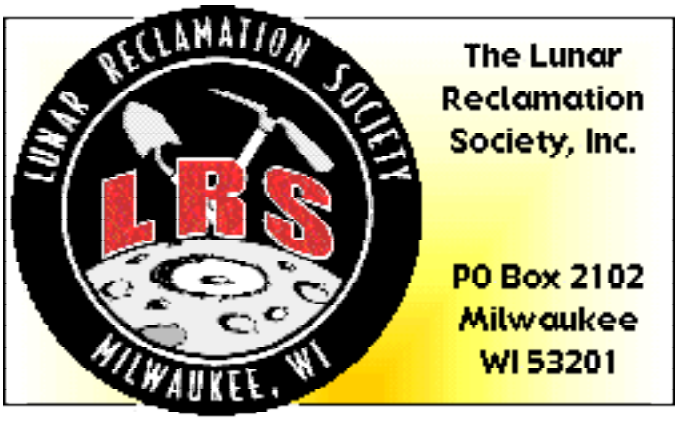
Harald Schenk - Sheboygan, WI
hschenk@excel.net



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

☎ LRS OFFICERS

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

LRS NEWS

• **March 8th Meeting Report:** Peter reported on the agreement reached between LRS & the Moon Society over MMM hardcopy and pdf format pricing for copies to Moon Society Members. He also reported on plans for upcoming outreach event opportunities: (Our "We can fly on Mars" exhibit at Mitchell Field International Airport April 10-11 for Aviation Career Day was cancelled on March 24th because of the Gulf War.) The May 15th total lunar eclipse (possible Wehr sponsored event at Froeming Park on S. 51st Street, south of Puetz Rd in Franklin, and our booth at the annual Rockets for Schools event in Sheboygan, May 17th.

LRS APRIL & MAY Events

Saturday, APR 12th, MAY 10th 1–4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G110** (lower level, NE part of Mall) near the ground-level entrance below Cinema complex. FREE to public as usual.

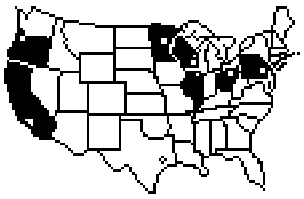
• APRIL AGENDA: ✓ Plans for the total lunar eclipse on Thursday, May 15th, and Rockets for Schools event in Sheboygan on Saturday., May 17th.

✓ The 1991 made for TV movie "**Plymouth**" about a helium-3 mining settlement on the Moon. This is a classic, for which the video has never been released.

✓ For last minute Agenda additions, check online at:

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

U.S. CHAPTERS



NSS Chapter Events

MMM 8 Chapters Strong

Space Chapters HUB Website:

[http://nsschapters.org/hub/]

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: **APR 19th, MAY 17th**

• On **Saturday April 19th** at 10 am Charles F. Radley will be speaking at **Norwescon** on behalf of Transorbital Corp. on the subject of the Trailblazer mission. Norwescon is an annual Science Fiction convention held at the DoubleTree Seattle Airport Hotel, 18740 International Blvd., (SeaTac) in Washington, U.S.A. His presentation will be in the Evergreen-4 room. Norwescon Info: www.norwescon.org/

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

• Feb. 15th Business Meeting Minutes. St. Anthony Park Library, 2245 Como Ave., St. Paul. Attending: D. Buth, Tom Greenwalt, Rich Brown, C. Borchard. S. Shjefte & J. Cran

Treasurer Report: Raise Rates because MMM costs so much now. Yes: Regular $25, Student $20, Family $35, Supporting $50, Corporate $2000

Events

a. Marscon 2003 Party Room Head is C. Borchard and Scheduler too. Buth on Models and layout and Storage. Rich & Ben on Memorial Posters

b. Yuri Night Zoo out, Rostal's or maybe a cafe. Coffman is Open. Buth will check. Have a speaker at party, or Band?

c. MN Zoo Exhibit declined; d. Minicon Scott is liason

e. Astronomy Day May 10

f. May/June R&D meeting Determine date later

g. Convergence Going OK, C. Rostal to do Exoplanet talk

h. Neil's Night Party? 7-20, maybe

Membership: Recruiting ideas? Speaker at Yuri party?

Operations: Server Status growing steadily; Officer's Manuals about 1/2 done

Fund Raising: Employer Contribution Programs; Paypal Account for online donations; Donation jar at events

Projects - Lets get serious about picking something. I'm leaning strongly towards either an asteroid miner or a modular inflatable space station as my personal choices.

Submitted by Dave Buth <dbuth@freemars.org>

• **Bailey Science Night** - Under a light falling of snow 100's of students and parents were amazed and delighted to the wonders of space at "Hands On Science" family event.

The event was held at Bailey Elementary School in Woodbury, MN, Tuesday 3/11/03. MAS and MN SFS were there as we have for many years in the past.

With an opportunity to look thru the new MAS 8" meade scope, sadly only at a basketball net across the grounds, *&@! snow, students and parents still lined up and they were still amazed. They were also invited to attend the various MAS star parties later this year. Also in the MAS display were a laptop slide show of past MAS events and pick up back issues of 'Gemini' newsletter and other MAS handouts. MN SFS offered a chance to try to land the space shuttle and experiment with 'Toys in Space'. See a 1:144 model of International Space station in its current configuration, 3-D star map of 26 nearby stars, and take home their own astronaut photos, including ISS crew 6 and STS-107 and make their own paper cutout shuttles.

Thanks to Jim Cran and Craig Borchard who helped staff MAS/MN SFS displays, NASA Glenn for supplying some of the photos and handouts and Jen Aamodt "Hands on Science" Coordinator for inviting us again.

A few pics: www.freemars.org/mnfan/BESN/2003/

Ben Huset MAS Outreach Chair MN SFS Board

• **Pics from this year's Marscon Science Room.**

www.freemars.org/mnfan/marscon/2003/sci-rm/

✓ Thanks for help: Rich Brown, David Buth, Michael and Donald Jobin, Rick Weller, Lauren Nelson, Joel Swenson, Ron Searby, Craig Borchard, Lynne Heffernan, Jon Huset, Cory Williams, Dave Runkle, Kevin Buth, Tom Greenwalt, Scott Shjefte, Bruce Yoder, Neil Belsky, Star & Ben Huset.

✓ Thanks to MN SFS., MAS, MARCEE, NASA Glenn. **<BH>**

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**

Information: OASIS Hotline, 310/364-2290; website. Microcosm, 401 Coral Circle, El Segundo.

- **April 19**, 3:00 p.m. -- OASIS Monthly Business Meeting, location TBD.

25 Years & Counting!

To mark the **25th Anniversary of OASIS** (25 years of grassroots space education, outreach, and activism), we are having a banquet and party on **July 19,** 2003, from 6-11 p.m. at The Proud Bird Restaurant, 11022 Aviation Blvd in El Segundo. Dr. Richard Van Allen will speak about the Trailblazer mission. Cost is $40 per ticket.

Register at: http://www.oasis-nss.org/index.html

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

☞ **NEXT MEETING DATES:**

- **APR 19th**? SAT afternoon, Great Lakes Science Center

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.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.

NEXT MEETINGS: MAR 15th, APR 19th

Call Earl or Mitch 215-625-0670 to verify all meetings

Meeting Location: Liberty One Food Court as previous, **April: Saturday the 12th; May the 17th (3rd Saturday).**

• **Meeting Notes:** We had a fair turnout due to our treasurer *Jay Haines* coming to discuss financial matters and the Biennial *Space Studies Institute Seminar,* which several members are likely to attend, at Princeton, NJ in May. Check the S.S.I. site (www.ssi.org) for dates and costs. At the least, many of us will try to attend the summary sessions which try to give an overview of the event that lasts a substantial part of a week. Jay has been part of this for some time. He received a number of members renewals, on the spot, at our increased membership rate of $25 a year, payable in quarterly installments (as we had determined was needed previously).

Jay also informed us on several topics: *The S.S.I Research Update for 2002* & was released (see ssi.org site) and includes a *closed ecology life support system project* with Cornell University. He also asked us to consider helping with the **Delaware Valley Science Fair** on Wed. **April 2nd.** The Fair can be reached at: www.dvsf.org & This is the next step up from the **George Washington Carver Science Fair** that we give awards at and contribute volunteer judges to.

He also talked of *Astronomy Day* as discussed un *Sky and Telescope* which gave the date as May 10th, a Saturday. A "how to do this well" handbook as well as posters are available (one book per group). Also material on reducing light pollution. Thanks Jay!

Larry, our Webmaster, reported on the low number of visits our site has and talked of a problem getting "on" a particular browsers links list that has been a problem for some time. However he also told us of being on the **Open Directory Project** organizations listings in the Science

Technology section in the Space Organization and Associations subsection.

Dotti Kurtz reported on several topics: her *Planetary Society Report* included mention of a group of articles that I would consider a kind of indirect tribute to *Dr. Robert Forward* who died several months ago. The topic was *Advanced Propulsion Concepts and Interstellar Flight* and included a tribute to Dr. Forward, and an article by him on *Lightsails and Laser propelled Interstellar Missions,* an article by the brothers Benford (Gregory and James), who had a great report on Microwave Driven "Lightsails" and the materials they are working with in this research: Carbon & Filaments. The details are quite interesting for those considering long term exploration and the techniques to reach far targets. The Benfords, working under contract, tested the concept of microwave driven "**Wisp Sails**" (one of Dr. Forwards descriptions) using the filaments woven into a thin matt & configuration (structure~ 100% filaments) and discovered that much of the propulsive force in the experiments came from gas related to microwave heating forcing Hydrogen out of the material, which had been absorbed during processing. This work was done with collaborators at J.P.L., Univ. of California at Irvine.

There was an interview with *Freeman Dyson* which also discussed advanced propulsion, interstellar flight and Man's place in the Cosmos. And this doesn't exhaust the publication! http://planetary.org *Dotti* also reported on a *Smithsonian Magazine* article on the new **Air and Space Museum extension** near Dulles Airport (opening December), and a travel to the Moon story in *Budget Travel* Magazine January issue. George Smart was the author.

*Hank Smith t*alked about his experience trying to get back from the Boskon Convention, which happened in February during our major snow storm. The location, The Sheraton in the center of Boston, & will also be the site of the 2004 World Science Fiction Convention which he will attend and help out at. *Hank* will travel in May to the **I.S.D.C. 2003 May 22-26** in **California.** Check links to N.S.S. link from our site or directly at nss.org or talk to *Hank,* who has other activities he is associated with, at hankscifi@hotmail.com. *Mitch Gordon* described the new distribution of ***Ad Astra,*** the National Space Societies paper publication of record, which is now Quarterly.

He also discussed the **April 30th** book signing on *Viable Utopian Ideas* and the new Boarders at Broad and Chestnut in Philadelphia. *Earl Bennett* reported on the major event we participated in during March: **The George Washington Carver Science Fair.** *Michelle Baker, Gary Fisher & Mike Fisher* acted as judges for the many wonderful projects at the two levels for the Fair: Elementary and the Mid to Senior Level. Our winners where: *Brian Caputo* for a project on why Venus is hotter than Mercury even though Mercury is closer to the Sun, and our other winner *Lauryn Gray* whose presentation was entitled *"The in situ Phytoextraction of Hexavalent Chromium from surface water using Elodea Canadensis"* or water weed. This project on water remediation is significant to our future human exploration efforts, not because it will be used per se but that the path *Lauryn Gray* and other Earth environment oriented future scientists are working on will lead to results we can use.

We awarded both *Brian Caputo* and *Lauryn Gray* with QX3 Microscopes and autographed copies of *The Case for Mars,* by Robert Zubrin et al, contributed by *Gary Fisher,* President of Independence Mars, a chapter of the Mars Society. Thank you judges!

Pictures at our website when *Larry & Earl* select them. *Earl Bennett* deferred the technical report due to science fair reporting volume and notes that the following are upcoming: **SETICon03** will be **April 25th to 27th** with sessions on technical topics Friday & Saturday. There will be a special Hardware Workshop which will be an extra $150.00. Check "our" (I'm a member of the SETI League) websites, either P.A.S.A.'s or www.setileague.org. I also encouraged talk on the *Planetary Report* material. Member *Simon Koumjian 3rd* also joined us with material his family sent on *Columbia* from there home at Satellite Beach, Florida papers. Mars projects and other activities also.

Business note: *Jay Haines* presented our board of directors with the annual report he files for us with the National Space Society that is our key organizational supporter and covers us with an insurance policy. He also gave us our members list as of January. For those who are renewing; we will contact you next month (April) to remind you, but will carry those members for awhile.

Reported by *Earl Bennett*

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**

APRIL15: Stoelting House, **Kiel**

MAY 20: Foerster Academy of Dance, **Sheboygan**

NAME _____.

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CITY/ST/ZIP _____.

PHONE #S _____.

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- **For members residing in the U.S & Canada:**
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  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,
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Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
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